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This Issue of the Electric Railway Journal

A word of explanation in regard to the mailing place of this issue of the **Electric Railway Journal** is necessary. Although it is the regular weekly number of the paper it is being printed in Denver and will be mailed from that city. As our readers know, we have supplied them during the past four days with four daily issues, which have contained an account of the Denver convention. The compilation of these issues required that practically the entire editorial and business staff should be at the convention. The publication of this issue of the paper in Denver permits us to complete our report of the convention, thus giving this news to our subscribers at the earliest possible time. The issue for Oct. 16 will be printed upon our own presses, and at that time a return will be made to the usual style of type and arrangement of articles followed in the **Electric Railway Journal**.

The Re-Election of President Shaw

The re-election of a president is a complimentary course for the American Street & Interurban Railway Association to follow, and it is one that has a good precedent. Mr. Shaw's re-election, like that of Mr. Ely several years ago, was a recognition of valuable leadership. The policies enforced during the last year will be continued and will be supplemented, if we may pre-judge the course of events, by appropriate action on all new matters that may arise affecting the industry. Mr. Shaw is to be congratulated on the re-election of the four vice-presidents who have served the interests of the association so well. The strength of the

support which the power of these executives assures will be an important factor with the co-operation of all members in making the coming year the most successful and effective in the history of the association.

Variations in Railway Practice

We are all creatures of habit, and this fact stands out as prominently in railway methods as in anything else. We do not refer particularly here to railway practices as instituted by the companies but to those demanded by the public of different countries. In America, where center aisle cars have always been used on the steam railroads, they naturally were adopted by the street railways, but abroad a different condition prevails. There the compartment car, the inheritance from the old traveling coach, is standard on the steam roads, and, while the tramway cars have center aisles, there is a tendency to pattern the longer cars used on the high-speed lines after the compartment model. For the same reason, as the European steam car doors are opened by the passengers, the practice has been continued on the Metropolitan underground railway system in London and in the cars of the Berlin subway, although in this country a platform guard is considered necessary. Again, like their steam contemporaries, both the London and Berlin subway companies permit smoking in a large percentage of the seating capacity in their cars, while in the New York and Boston subways smoking is prohibited and this regulation meets popular approval.

Discussion of Corporation Tax in Denver

It was undoubtedly merely a coincidence that President Taft should have selected as the place for his discussion of the corporation tax on Sept. 21 the Denver Auditorium, where two weeks later the representatives of the street railway companies were to assemble and consider technical and financial matters relating to their properties. The tariff and other national issues were considered at length elsewhere, but he reserved for Denver his explanation of the reasons for the adoption of what is in a sense the most radical departure ever made in the control of State corporations. The income tax on individuals and corporations enforced during the Civil War cannot be considered as a precedent in this respect, because the corporations had not at that time reached the magnitude which they now possess, nor can the regulations of the Interstate Commerce Commission for the steam roads and for the control of industrial corporations through the Sherman and other laws afford a comparison, because all of these companies do an interstate business. But the business of the vast majority of the electric railways is circumscribed within narrow limits by city and State boundaries; they are purely the creation of the individual state and are held by it responsible for the proper performance of their duties.

If the walls of the Denver Auditorium had tongues as well as ears, they could repeat the presidential arguments enun-

ciated here two weeks ago in favor of the corporation tax. These were partly because of the income which the law will produce and partly because of the publicity of the affairs of the corporation which its enforcement will entail. A. L. Linn, Jr., general auditor, New York State Railways, in his paper presented before the American Association, which was published in yesterday's issue, directed attention to the serious accounting errors in the law. The 1 per cent required on net income, as it advocates say, may "hardly affect dividends at all as it would be taken out of the surplus," but in conjunction with State corporation and city taxes, franchises, payments and other assessments made under one guise or another, it presents a very serious aspect when viewed in the light of high operating expenses and decreased fares caused by the compulsory issue of transfers.

Goodby to Denver

It is with no feigned reluctance that every person connected with the 1909 conventions of the American Street & Interurban Railway Association and its affiliated associations, says goodby to Denver. There was some skepticism, some shaking of heads, when it was first announced that the conventions would be held this year 2000 miles west of the Atlantic seaboard. Many thought that the attendance would be comparatively small and that the expense of making an extensive exhibition would be disproportionate to the returns to be expected from it. But the convention has proved that the Denver convention was rightly placed. The Denver people rallied to its support in the most effective and encouraging fashion, and the attendance was surprisingly good from all parts of the country. The reception has been so cordial that the word of farewell to Denver which will arise in the minds of all, will not be goodby, but au revoir!

The close of the convention is a suitable time for a brief summary of some of the features of the convention week which we have not yet had an opportunity of mentioning in previous daily issues of this paper. We have already commented on the excellence of the papers and discussions before the various associations and have also mentioned the exhibit features. A review of the convention would be incomplete, however, without a reference, even if brief, to some of those who have made the Denver convention possible; especially the officers of the Denver City Tramway Company, the Denver Convention League and the vice president in charge of exhibits, the director of exhibits and the entertainment committee of the Manufacturers' Association.

The task set before the Manufacturers' Association in arranging for and conducting an exhibit 2000 miles away from home was enormous and can hardly be realized by those who have not been actively engaged in the work or in touch with what was being done. It included not only engaging the hall and securing additional space by the erection of a temporary structure, but also the decorations of the exhibition premises, the arrangement of a uniform scheme of colors and posts, railings, signs, etc., and provision for the administrative utilities of the convention. At Atlantic City a great deal of the material needed is ready for the use of the numerous conventions that meet on the piers from year to year; at Denver everything had to be created. Not only this, but the manufacturers had to be urged to make exhibits in face of the objections that it was a long distance to transport men and apparatus and the plea that the attendance would be small.

Finally, the entertainments were not only most profuse and liberal, but they were in many respects almost unique. For

instance, there is no other city in the country that could provide such an excursion as that over the Moffat Road to the region of the perpetual snows, crossing the Continental Divide. Where, too, could a wild game barbecue, such as the remarkably successful affair of Wednesday night, be arranged so well as in Denver? Then the numerous side trips through majestic scenery—in what other center outside of Denver could so many be planned? From the brilliant official reception of Monday night to the official excursion over the Continental Divide of Friday, there was a succession of interesting events, including the sight-seeing automobile and trolley rides for the ladies, the excellent vaudeville show of Tuesday evening, the ever memorable barbecue of Wednesday, the ladies' afternoon at the Denver Country Club and the theater party Thursday evening.

We are sure that the convention has proved the wisdom of those who were responsible for the selection of the Metropolis of the Rockies as the meeting place of the 1909 convention.

Studying Economy in Small Power Plants

Engineers who have made a special study of the cost of generating electric power in stations of varying capacities find that the size of the plant by no means is certain to set the limits of production efficiency. The general tendency is for large stations to produce power more cheaply per unit than is feasible in the smaller installations, but so many plants of moderate size have made good records in the line of current cost at the switchboard that no manager of an active property should hesitate to analyze his operations through fear of not being able to improve the figures. As a matter of fact, the smaller power plant usually is better fixed for studies of economy than the larger station, so far as those studies involve temporary changes in practice. It costs a good deal less to operate a small station under revised conditions than to impose similar modifications upon plants of higher capacity.

Often a small station will illustrate in its composition quite a wide range of designs, with practically obsolete methods in daily service, beside the latest equipment and its applications. In one small plant we may find belted units in service at one end of the building and one or more of the most recent steam turbine units in service at the other end; again, part of the plant may be equipped to run condensing with fresh water, and part with salt water; some of the auxiliaries may be steam driven, others motor driven; and further, both natural and forced draft may be in use in the same boiler room, combined with one or more methods of feed water heating. Also, with the recent wide-spread movement for taking advantage of nature's resources and developing power hydraulics, we now find some generating stations with their machines direct-driven or belted to water wheels as well as steam engines and turbines. Not many railway stations have yet been equipped with storage battery plants, except those which also generate current for lighting service and these usually are of relative large capacity.

In stations with mixed apparatus of this sort a great deal can be learned if the records of the plant performance are carefully maintained and examined regularly. In plants of moderate size the loads vary through wide sweeps, and in order to keep up the output, it is often necessary to run the equipment in different combinations. On one day the lighting and the railway service may have to be run upon a single machine or pair; on the next day the plant finds itself short of condensing water of the proper temperature,

and perhaps has to run non-condensing for two or three hours at the peak.

All these changes in load, equipment and weather conditions, the use of water of a certain injection temperature at one time and of a different temperature at another, and in general any marked differences in station conditions, afford valuable service test data from which may be drawn accurate conclusions regarding the value of the practice maintained. If necessary, operation can often be carried on for artificially extended periods, in order to determine the conditions making for the least fuel consumption in proportion to the output, in the small station. The quantities involved are so much smaller than in plants of scores of thousands of kilowatts rating that the actual cost of studying production conditions and changing them within the limits of reliable service becomes very moderate in proportion to the lasting benefits derived. The greater the variety of apparatus in the small station, the better becomes the opportunity to study plant efficiency on an experimental basis closely bound up with the routine service rendered.

Central Power-Station Power for Electric Railways

In the vicinity of large cities blessed with populous suburbs the supply of power to electric railways outside the limits of the urban lines offers an attractive field for central station enterprise. Inside the urban community itself the traction company usually generates its own current, although a notable exception is afforded by the late railway contracts of the Commonwealth Edison Company of Chicago. Beyond the confines of the large city traction system, however, there is usually found a sort of no-man's land of engineering, where the facilities offered to the public have to be worked out on a much smaller scale and generally at a much lower efficiency than is possible on systems of larger resources. If the local central station organization is equipped to transmit power to points from 10 to 20 miles away, it is often possible to arrange to establish substation equipment either at or near the sites of the older and less efficient power stations, and to operate the suburban railway lines with a much better supply of electricity than is ordinarily available on the small rural or semi-rural trolley system.

A conspicuous example of improved power supply through the establishment of central station service is just now afforded by the Boston Suburban Electric Company's system, which has begun to take power from the Edison Electric Illuminating Company of Boston for certain of its lines in the Natick-South Framingham district. The Edison company has for some time operated a distributing substation of its own in the town of Natick, 18 miles west of the city of Boston, and in order to supply the trolley lines in that district it was only necessary to install a transformer and rotary converter equipment, with suitable connections to the trolley feeders. An old non-condensing station with belted equipment was then shut down at South Framingham. The drop in potential common to the service provided by the old station was largely cut out with the establishment of the new power supply; the maintenance of schedules was facilitated, and the inefficient service of the old station displaced by a more economical contract with the larger organization. It is expected that the Homer Street power station of the Suburban companies at Newtonville will shortly be shut down as a generating plant for similar reasons.

Another noteworthy example of widespread distribution

by a single company is the transmission distribution system of the California Gas & Electric Company which has 60,000-volt lines tying together several hydraulic generating stations in California. Current is converted in railway substations owned by the generating company and also is distributed to individuals and municipalities for general services.

Of course, it does not always follow that even the service of a large central station will be more economical or desirable than that which can be produced by a small suburban company in its own plant, but the tendency in the vicinity of large cities will undoubtedly be in the direction of eliminating the less efficient and smaller direct-current self-contained railway plants as their apparatus grows older and then of obtaining power from a centralized station owned either by the company itself or by outsiders.

Oil in Boilers

It is a common experience that a film of oil on a boiler plate will tend to cause overheating of the plate and will raise by many degrees the temperature of the fire-side of a plate. A writer in the Engineer (London) raises the question of molecular continuity, in explanation of this. He illustrates the meaning of this continuity by the case of the hot soldering iron and a strip of thin tin-plate. If the hot iron is simply laid on the strip of plate there is but slow heat transfer between the two pieces of metal. But a simple drop of fluxed solid between the two, metallicly adhered to both, will cause heat to flow with great rapidity. This is due to the establishment of molecular continuity. Heat will not pass a boundary surface with readiness. If clean water be in contact with clean plate a fireside temperature of the plate may be obtained from a fierce fire at 3000 deg. Fahr. that is only 85 deg. Fahr. greater than the water side temperature. The water has thus so full a control of the fire-side temperature of a $\frac{3}{8}$ -in. plate that the temperature difference is not as great as that between a hot and a cold day.

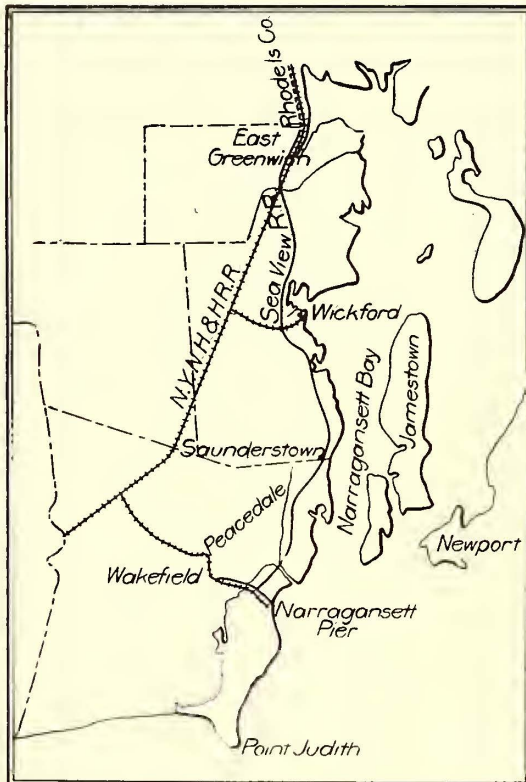
Now this great influence of the water is due to the molecular continuity of water and plate. There is no boundary surface to offer a resistance to the flow of heat between plate and water. But if the plate surface is just greasy, the greasiness having no definite thickness, there will be boundary surfaces to resist flow; there is no longer a molecular continuity. It may even be supposed that there are four bounding surfaces to be crossed by the heat stream.

Assuming the hypothesis to be sound, and there seems good reason to admit its soundness, it is enough to explain many matters which will come up from time to time to be attended to by the steam engineer. It certainly serves to explain the mysterious action of greasiness, and it should help such in the evaluation of different sources of water. It may be that water ought to be tested in the laboratory with a view to showing the degree of molecular continuity that it is possible to set up between it and the plates of a boiler. The effect of salt in solution might be similarly tested, for there are reasons to suppose that some salts do prevent water from touching a plate in the fullest of molecular sense, while again other salts have been supposed to aid considerably in the transmission of heat.

This is a direction in which research has never been directed to any great extent. Only a few experimental results have been made with greasy plates and with water variously treated or mixed with other liquids, jellies or flours, and it might be a good subject for an engineering thesis in a technical school.

OPERATING FEATURES OF THE SEA VIEW RAILROAD COMPANY

The western shores of Narragansett Bay, R. I., border one of the most attractive vacation districts in southern New England, and an important factor in the upbuilding of this territory is the electric railway service provided between the city of Providence and the well-known resort of Narragansett Pier. The lines of the Rhode Island Company extend southward from Providence to East Greenwich, a distance of about 12 miles, and from East Greenwich to Wakefield the service is furnished by the Sea View Railroad Company, whose headquarters are at Wickford. The terminus



Sea View Railroad—Map of Territory Served

of the Sea View Company at Wakefield is about 3 miles west of Narragansett Pier, the latter being the most important station on the southerly end of the road. The total length of the Sea View line is 20 miles and all of the traffic is handled on a single track route. All but 2 miles of the line are located upon a private right-of-way. The car service is conducted by telephone dispatching, and both passenger and express service, with haulage of freight cars, are maintained. Although the greater portion of the travel occurs during the summer months, an all-the-year-around service is maintained by the Sea View Company on lengthened headway.

Schedules and Territory

The service on the passenger car schedules in the summer season is in the main half-hourly, with a few omitted runs during the lighter hours of the morning and evening. The company provides its patrons with time tables in card form, 3½-in. by 4½-in., for pocket use, showing the service between Providence and the Wakefield terminus, and not stopping at the end of its own system. In general the service extends from about 6:30 a. m. to 10:30 p. m. and five cars are sufficient to handle the regular schedule. The running time is 70 minutes from East Greenwich to Wakefield, giving a schedule speed, including stops, of 17.2 m.p.h. The company serves the following communities: East Greenwich, Lafayette, Wickford, Hamilton, Barbers Heights, Saunderson, Narragansett Pier and Wakefield. It supplies electric

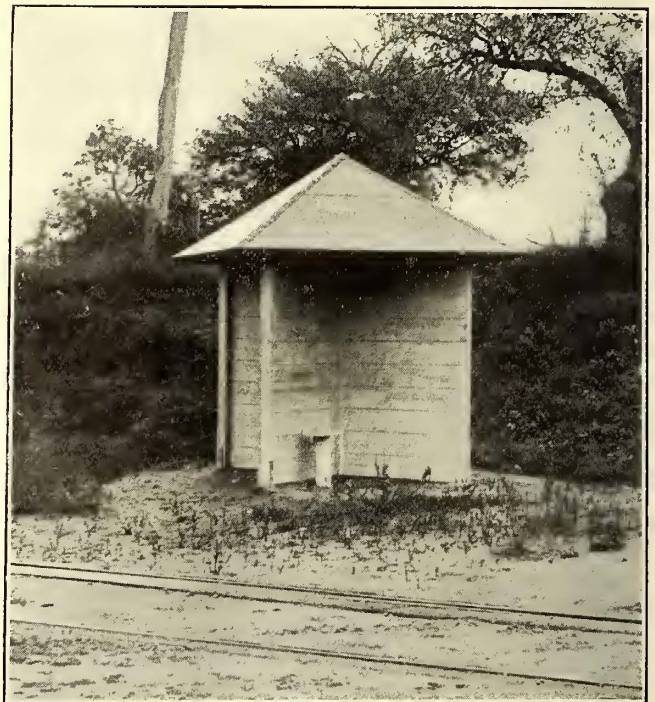
lighting service to all these places except East Greenwich, and in addition it lights Peacedale and Matunuck.

Dispatching

The operating center of the road is at Hamilton, where the power plant and dispatcher's office are located. The repair shops are also situated here. A feature of the car service is the supplying each motorman and conductor with a working time table of the diagrammatic type. The principles of this time table are thoroughly familiar to electric railway operating officers, the plan being to show by appropriate lines the runs of the different regular scheduled cars, with passing, arrival, leaving and meeting times, and the points where turnouts are to be made. The novelty of this application lies in its use by every man in the car service, in place of the more common tabulated runs. The management has found that the men quickly grasp the idea of the diagrammatic time table and utilize it effectively in making their meeting points and generally holding to schedule. Strict control of all movements, of course, is vested in the dispatcher. All train orders are written down and repeated back to the governing authority, who in turn records them with all telephone reports on the daily log sheet of the road.

Fares and Stations

The passenger traffic is handled by both cash fares and tickets. Each conductor is provided with a blue-print table which gives the fare between every station on the road at a glance. In general the fare unit is 5 cents, the average rate per mile being about 2 cents. At a number of points on the road ticket offices are established, and for all cash fares taken on the cars in excess of 5 cents a 5-cent excess

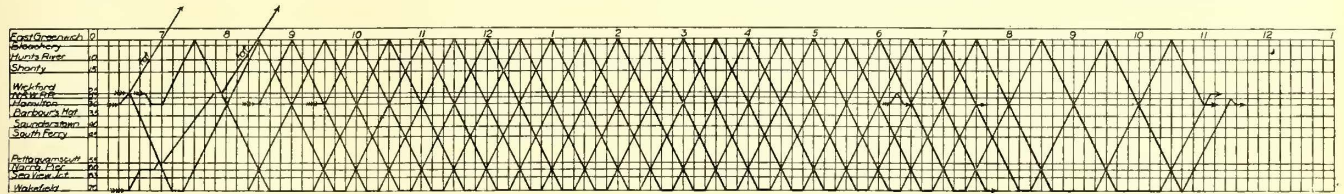


Sea View Railroad—Standard Shelter Shed at Farm Crossing

is collected with the issuance of a rebate slip as in steam railroad practice. The tabulated lists of fares have proved to be of great value in the handling of summer traffic in particular. The company sells through and round trip tickets between points on its lines and Providence, as well as round trip transportation on its own system. At various points on the road old combination open and closed cars have been set down at the side of the track for use as waiting stations, giving the passenger the choice of an

indoor or an outdoor seat irrespective of the weather. A waiting station built in the form of a plus sign is frequently used by the company. The latter stations can be built at nominal cost and enable the passenger to be sheltered in all weathers, regardless of the direction of the wind or the storm. An attractive feature of the combination car

The sills and plates are of hard pine. All framework, including roof purlins, is of white oak. The inside of the car between the bulkheads and the head of the car is used for storing empty milk cans. On the outside of the sheathing and running along the side of the sill are iron plates 8 in. x 1/4 in. bolted on, which prevents any damage to this por-



Sea View Railroad—Dispatcher's Train Record

waiting station is the provision it makes for smokers with no annoyance to other patrons who may be waiting for cars.

Rolling Stock

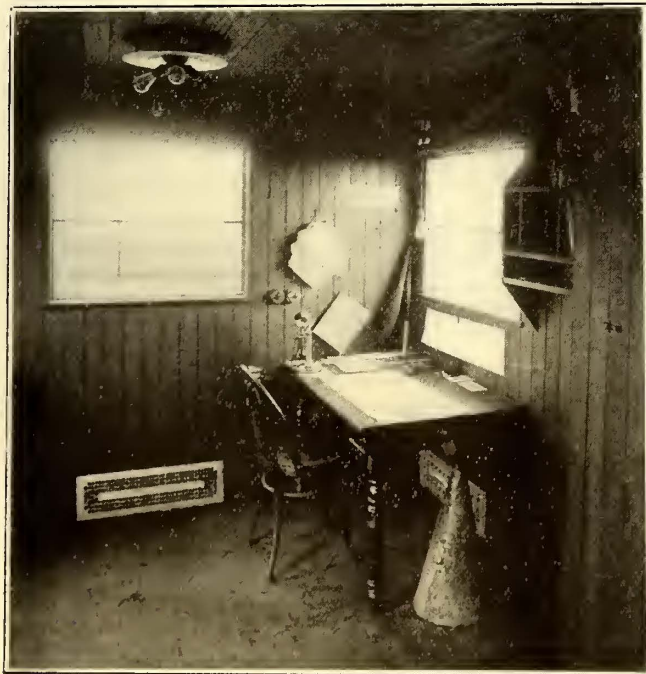
The rolling stock of the company consists of four Brill Narragansett type open cars seating 90 persons each; two trailers of the same type; four 15-bench Newburyport cars; two 15-bench Jackson & Sharp cars; five closed cars, two express cars, two work cars, two plows, one hopper, one flat car and three gondola cars with hopper bottoms. The Narragansett and Newburyport cars are equipped with four Westinghouse 49 motors each; also one of the work cars. The Jackson & Sharp cars are fitted with four GE-67 motors

tion of the car. The car is mounted on McGuire & Cummings trucks and has four Westinghouse 49 motors, K-12 controllers and Janney couplers. The company saved \$1,500 on the purchase price by building this car in its own shops.

The snow plow equipment was built from two combination open and closed cars. The cars were sawed in two and the closed ends bolted together, the windows being boarded up. The plow noses are raised and lowered by compressed air. The whole work was done in the shops of the company at Hamilton. The open ends of the combination cars were put together in the same way and utilized for a work car. This car also is used as a locomotive to haul freight cars over the line from connecting roads and is provided with a full set of line tools. The ends were left open so that the car can carry poles when desired. A useful feature is a folding step ladder attachment to the roof for the quicker and easier handling of line repairs. The car is equipped with Janney couplers.

Express and Freight Service

About one-fifth of the company's revenue in the year 1908

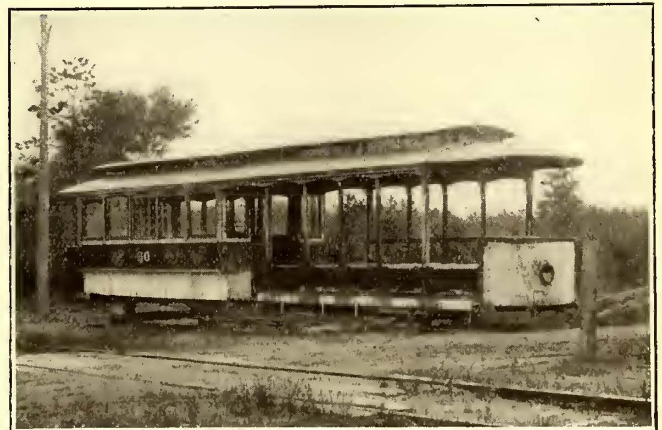


Sea View Railroad—Interior of Dispatcher's Office

each, and the second work car has four Westinghouse 12-A motors. The following data apply to an express car built by the company. A noteworthy feature is the frame, which is of white oak, sawed from native ties:

Express Car Data

Height from sill to rail.....	3-ft.
Length over all.....	43-ft.
Length over sills.....	38-ft.
Width over sills.....	8-ft. 3-in.
Width inside car.....	7-ft. 5-in.
Length inside bulkhead.....	32-ft. 5-in.
Height above rail.....	11-ft. 11-in.
Size of sills.....	6-in.x7 1/2-in.
Bolster.....	9-in.x6-in.
Iron plate each side.....	6-in.x1 1/2-in.



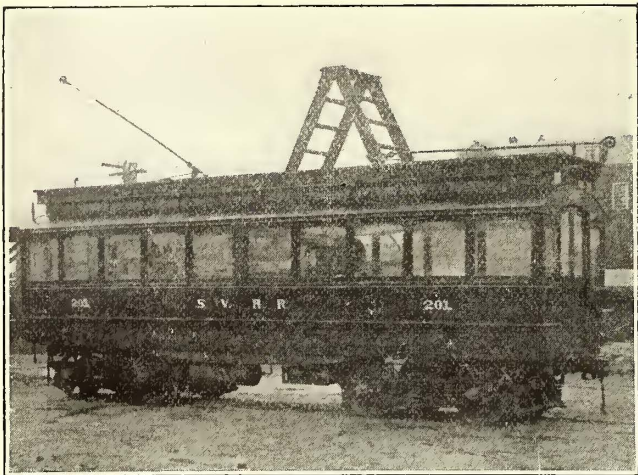
Sea View Railroad—Old Car Used as Shelter Shed at Cross Road

was derived from its freight service. There are two express car movements over the line each day in each direction, and in addition a considerable amount of interchange business with the New York, New Haven & Hartford Railroad and its connections is handled. Coal is hauled in large quantities to the East Greenwich bleachery and also to dealers in Wakefield at the southern end of the road. The road handles all its own coal for the use of the power station at Hamilton via its own lines. The classification of freight charges conforms to that of the New York, New Haven & Hartford Railroad, and through rates are quoted from Providence to Wakefield as well as to all other points on the line. A minimum charge of 25 cents per shipment is in effect. There are six classes of freight or express matter and all trips are made on fast schedules which do not interfere

with the passenger schedules. The express service has proved to be of invaluable utility to the summer population of the Narragansett Bay district. Many of the points along the shore south of Wickford are entirely served by the Sea View line, as no other railroad facilities are available. Between Wickford and Narragansett Pier the entire summer

ple condensing Greene engine; a 300-kw Westinghouse revolving field alternator, wound for 360 volts, direct driven by a cross compound condensing Brown-Corliss engine; and a 500-kw Westinghouse-Parsons 12 stage turbine, three-phase alternating type, wound for 360 volts and making 3600 r.p.m. at normal speed. The trolley service is supplied through the rotary converter at Hamilton and another of the same capacity at Narragansett Pier. Two three-phase 13,200-volt transmission lines connect the Hamilton power station with the substation. In addition to the foregoing machinery the company has in service a storage battery of 248 chloride accumulator cells which floats on the substation bus at the Pier.

The capacity of this battery is 160 amp at the one-hour rate. The railway service requires three 75-kw transformers at Hamilton for the local rotary and a similar bank at the Pier. At Hamilton there are also installed three 100-kw lighting transformers, with a secondary potential of 2300 volts for local lighting and small power distribution. The connections of the transformers provide that any bank can be used at Hamilton for either railway or lighting service, and the rotary converter at Hamilton is operated at times as a generator and at times as a rotary, according to the conditions.

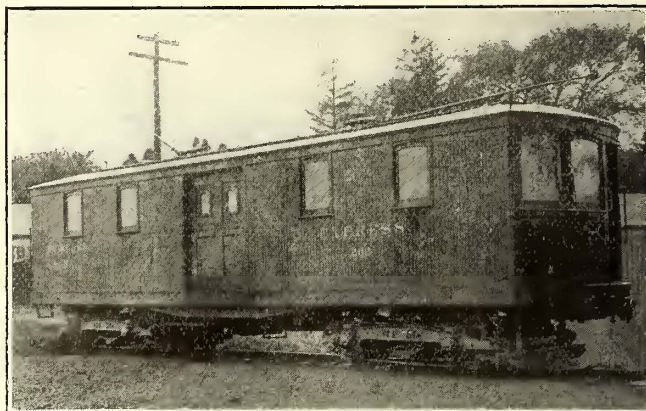


Sea View Railroad—Combination Line and Wrecking Car Built in Company's Shops

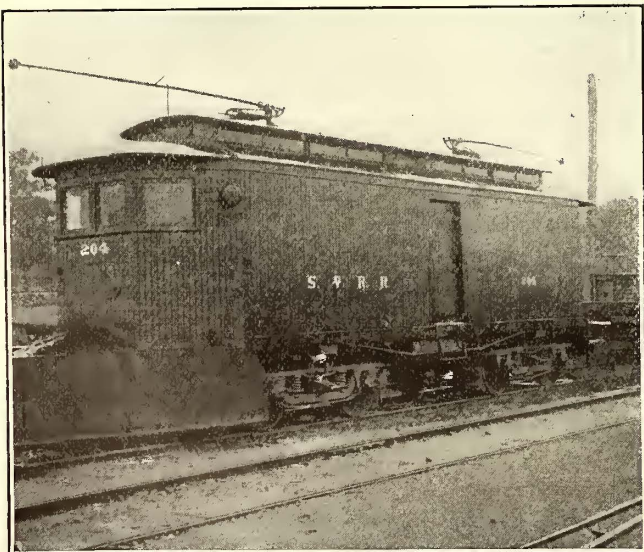
patronage and population of the district are vitally dependent upon the electric railway service.

Power Station

The power station at Hamilton furnishes all the energy needed for the road. It is now being modernized. The machinery at present in this station illustrates the advance in station design from the belted multipolar 500-volt d.c. generator with square frame to the engine-driven direct connected revolving field alternator, the rotary converter and the steam turbine. Steam is supplied by four 925-hp hand-fired Erie boilers. Two iron stacks about 125 ft. high provide natural draft for the furnaces. In a recent storm one of the stacks was bent by the wind to a point where it was



Sea View Railroad—Freight and Express Car Built in Company's Shops



Sea View Railroad—Snow Plow Built in Company's Shops

necessary to remove a part of the pipe, through the use of a gin-pole structure, block and tackles.

The engine room contains a 200-kw 500-volt d.c. generator, belt-driven by a 250-hp Brown-Corliss engine, simple condensing type; a 200-kw Westinghouse rotary converter which may be driven by a belt connection to a 200-hp sim-

When the plant changes are completed, it is expected that in general the turbine unit or the 300-kw alternator at Hamilton will handle both the rotary converters during the day, and with the 200-kw direct current machine at the station will supply the railway and day lighting service. The battery is counted upon for momentary peak and emergency service. Three cars handle the railway schedule after 8 p. m. At night the plan will be to separate the lighting load from the railway service, one being carried on the direct-connected alternator and the other upon the turbine. After midnight the lighting load will probably be handled by the rotary at Hamilton run as a double current generator through the belt connection with the Greene engine, the alternating output being delivered to the transmission lines through the transformers and the surplus direct current being utilized for charging the battery at the Narragansett Pier substation. The rotary will be separately excited when run as a double current generator. Two sets of bus-bars are provided at the Hamilton power house for switching the generators and rotary to one set or the other of the transformer secondaries, and the high tension service from the transformers is assembled on three sets of bus-bars, one set for each transformer bank, with disconnecting knife switches between the different sub sections.

Condensing water for the plant is provided by the Anquatucket River, with a supplementary pipe line serving salt water to the station by a 5-hp motor-driven centrifugal

pump. The river water is ordinarily discharged into a 50,000-gal. pond just outside the station. Just below this pond is a small reservoir of 10,000 gal. capacity. Between the two reservoirs is a movable dam having a height of about 4 in., so that when a sufficient supply of fresh water exists, salt water need not be used for condensing purposes.

There are two condensers in the station, one being a 12-in.x18-in.x18-in. Deane jet condenser, used in reciprocating engine service only, and the other a Westinghouse-Leblanc condenser. The Deane condenser receives its injection water through a 6-in. line and discharges back to the reservoir through a line of the same size. If the supply of fresh water from the river is sufficient, the movable dam between the two reservoirs can be raised or else the stream flow can be utilized to provide fresh injection water for the Leblanc condenser through an 8-in. line, with an 8-in. return to the larger reservoir from the turbine. When salt water is used the dam can be raised between the two reservoirs if desired, and the turbine discharge carried away from the plant and ponds to an outlet having a drop of about 8 ft. below the level of the reservoir. Either fresh or salt water can be used in the Deane condenser at such times, according to the supply. The centrifugal pump serving the station with salt water has a total lift of about 8 ft. at low tide and is located about 175 ft. away from the lower reservoir. When the discharge from the Leblanc condenser is thrown away by the lower pipe the drop secured helps to maintain the vacuum in the turbine and enables the centrifugal pump to handle the service without danger of overload. The salt water is carried about 175 ft. before it enters the lower reservoir, with an 11-ft. lift to the turbine. Suitable valves are provided to permit cutting off different pipe sections as needed.

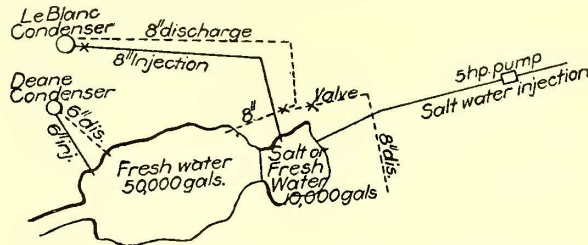
New Type of Condenser

The Leblanc condenser installed is one of the first of its kind to be utilized in railway service in New England. It occupies little space, has no reciprocating or rubbing parts and no valves of any description. Exhaust steam enters the condenser at its top, and cooling water is injected into it at nearly the entrance level, projecting the water and condensed steam downward to a centrifugal discharge pump operating under a head of 2 or 3 ft. which insures positive

pumps are driven by an induction motor manufactured by the Westinghouse company.

Lines

The transmission line is carried upon 35-ft. chestnut poles. The wire is No. 6 copper arranged in two circuits on 18-in. equilateral triangles. Triple petticoated glass insulators are used. The trolley poles are 28 ft. in length. In general the feeder system for the railway 500-volt service consists of a 500,000-circ. mil cable run from Wickford to Wakefield, with a supplementary 300,000-circ. mil feeder over practically the same distance, and a No. 0000 trolley throughout. North of Wickford two No. 0000 feeders run to East Greenwich. The distance from the Hamilton power house to the substation at the Pier is about 9 miles. Throughout the district the local communities are supplied with lighting and small power service from one of the above transmission lines. In general a single transformer is located at the line for the supply of small communities and the street lighting and house



Sea View Railroad—Diagram of Condensing Water Supply and Discharge

service is handled on the three-wire low-tension secondary system of distribution. Usually the limit of this distribution is about 1/2 mile from the transmission line, the company recommending the proper sizes of wire to eliminate excessive voltage drop.

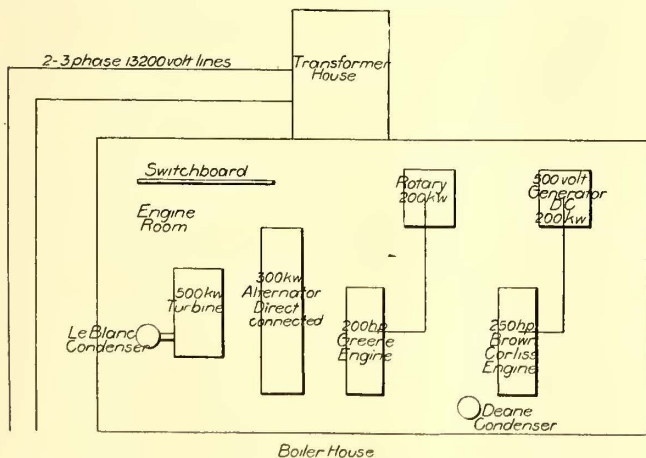
Shops and Track

The shops of the road contain no unusual features. The tools are group-driven by a small motor, and the general plan is followed of carrying on special construction work in the interims between repairs calling for instant attention. The shops contain a well equipped blacksmith division and a convenient carpenter section. A special feature of the car house design was the use of reinforced cement grouting in the roof construction. The roof is V-shaped with a slight pitch and a central supporting wall dividing the car house into two parts. It was built up from below by placing wooden forms at the proper elevation, and then putting on layers of paper, fence wire, cement, tiling, and a final tar and gravel coating. In this work the wire was lapped over the center portion of the building.

The track is built of 60-lb. T-rail, with a No. 0000 concealed bond at each joint. The operation of the road is in charge of W. C. Clarke, general manager, and F. L. Caswell, superintendent, with headquarters at Wickford.

PARK SUGGESTION

A cheap, popular and safe attraction for a summer park would be a safety tight rope upon which ambitious amateurs could try to walk for the edification of the crowd. A rope, 1 1/2 in. or 2 in. in diameter and 15 ft. to 20 ft. long, can be stretched between two platforms 5 ft. above the ground. Eight feet above the tight rope the park manager could stretch a wire cable, to which a safety belt is attached by means of a pulley. The candidate for tight-rope honors would then be prevented from falling to the ground if this harness is strapped about his waist, but it will not prevent his slipping from the rope if he is not expert enough to maintain his balance.



Sea View Railroad—Diagram of Engine Room Arrangement in Power House

filling of the pump. The exhaust steam is drawn downward and condensed by the water spray. The space above the water is occupied by the water vapor plus the air released from the injection water and the exhaust steam. A pipe on the front side of the condenser carries the entrained air to a small pump in the lower part of the casing and the latter is then discharged independently from the water delivered to the apparatus through condensation. The water and air

TESTS OF LINE INSULATORS*

The committee asked a number of manufacturers to furnish for tests samples of line material of the following classes: Wood strains, both 1-in. and 1 1/4-in.; round top bells, West End hangers, and cap and cone hangers. Seven manufacturers furnished samples. These firms are designated by numbers in the test reports. Where more than one type of any class was submitted the letters "a" and "b" were used to distinguish them.

Twenty-four tests were made as outlined. The results of these tests will be found tabulated, together with explanatory notes. The committee desires to express its apprecia-

- 2—Split metal end pieces.
- 3—Broke one eye.
- 4 and 5—Pulled wood body out of end pieces.
- 6 and 7—Split metal end pieces.
- Test No. 3.—Breakdown Voltage; Size 1 1/4-in., Conditions Normal;
- 1, 4, 5, 6 and 7—Did not fail; voltage given was highest attainable.
- 3—Arced over paint.
- Test No. 4.—Breakdown Voltage; Size 1 1/4-in., Conditions Wet;

These insulators were scraped and soaked in water for 18 hours. The excess water on the surface of the insulators was wiped before testing them.

- 1, 3, 4, 5, 6 and 7—Started to burn up and finally voltage jumped between ends.

WOOD STRAINS
Mechanical Tests
Tension

Test No.	Size
1	1 1/4"
2	1"

WOOD STRAINS
Electrical Tests
Breakdown Voltage

Test No.	Size	Conditions
3	1 1/4"	Dry
4	1 1/4"	Wet
5	1"	Dry
6	1"	Wet

ROUND TOP BELLS
Mechanical Tests
Tension

Test No.	Conditions
7	Cold
8	Hot

ROUND TOP BELLS
Mechanical Tests
Side Strain

Test No.	Conditions
9	Cold
10	Hot

ROUND TOP BELLS
Electrical Tests
Breakdown Voltage

Test No.	Conditions
11	Dry
12	Wet

WEST END HANGERS
Mechanical Tests
Tension

Test No.	Conditions
13	Cold
14	Hot

WEST END HANGER
Mechanical Tests
Side Strain

Test No.	Conditions
15	Cold
16	Hot

WEST END HANGER
Electrical Tests
Breakdown Voltage

Test No.	Conditions
17	Dry
18	Wet

CAP & CONE HANGER
Mechanical Tests
Tension

Test No.	Conditions
19	Cold
20	Hot

CAP & CONE HANGER
Mechanical Tests
Side Strain

Test No.	Conditions
21	Cold
22	Hot

CAP & CONE HANGER
Electrical Tests
Breakdown Voltage

Test No.	Conditions
23	Dry
24	Wet

Methods Used in Making Tests of Trolley Wire Insulators.

tion to the following companies for furnishing samples: Albert & J. M. Anderson Manufacturing Company, Electric Service Supplies Company, General Electric Company, H. W. Johns-Manville Company, Ohio Brass Company, Western Electric Company, and Westinghouse Electric & Manufacturing Company.

Notes on Tests of Wood Strains

Test No. 1.—Tensile Strength; Size 1 1/4-in., Conditions normal;

- 1—Split both metal end pieces.
- 3—Broke wood near one end piece.
- 4—Pulled wood body out of end pieces.
- 5—Broke one eye.

Sample From Firm No.	Test No. 1	Test No. 2	Test No. 4	Test No. 4	Test No. 5	Test No. 6
	Tensile Strength	Tensile Strength	Breakdown Voltage	Breakdown Voltage	Breakdown Voltage	Breakdown Voltage
	Size 1 1/4 In.	Size 1 In.	Size 1 1/4 In.	Size 1 1/4 In.	Size 1 In.	Size 1 In.
	Conditions Normal	Conditions Normal	Conditions Normal	Conditions Wet	Conditions Normal	Conditions Wet
	Load in Lbs.	Load in Lbs.	Voltage	Voltage	Voltage	Voltage
1.....	8,260	6,420	48,000	9,000	42,000	9,000
2.....	.....	6,280	.....	.....	42,000	4,000
3.....	10,760	9,440	46,000	5,000	42,000	8,000
4.....	15,640	7,590	48,000	12,000	45,000	11,000
5.....	10,940	8,850	48,000	15,000	45,000	9,000
6.....	8,350	8,000	47,000	11,000	44,000	10,000
7.....	11,020	6,280	47,000	11,000	42,000	7,000

Test No. 2.—Tensile Strength; Size 1-in., Conditions Normal:

- 1—Pulled wood body out of end pieces.
- 6—Split one end piece and started to pull out of the other.
- 7—Pulled wood body out of end pieces.

*Abstract of Appendix F to report of Committee on Power Distribution, American Street & Interurban Railway Engineering Association. Read at Denver, Colo., Oct. 4, 5, 6, 7 and 8, 1909.

Test No. 5.—Breakdown Voltage; Size 1-in., Conditions Normal:

- 1, 2, 3, 4, 5, 6 and 7—Did not fail. Voltage given was highest attainable.

Test No. 6.—Breakdown Voltage; Size 1 1/4-in., Conditions Wet:

These insulators were scraped and soaked in water for 18 hours and the excess water on the surface of the insulators was wiped off before testing.

Sample From Firm No.	Test No. 7	Test No. 8	Test No. 9	Test No. 10	Test No. 11	Test No. 12						
	Tensile Strength	Tensile Strength	Side Strain	Side Strain	Breakdown Voltage	Breakdown Voltage						
	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Wet						
	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Voltage						
	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Voltage						
1.....	3/4	17,700	3/4	13,310	3/4	14,730	3/4	11,950	a-3/4	17,500	3/4	6,000
2.....	a-3/4	15,430	.....	.....	.....	.....	.....	.....	b-3/8	16,000	.....	.....
.....	b-3/8	8,200	.....	.....	.....	.....	.....	.....	.....	7,000	.....	.....
3.....	a-5/8	14,670	a-5/8	13,260	a-5/8	9,310	a-5/8	9,310	a-5/8	20,000	a-5/8	9,000
.....	b-5/8	9,820	b-5/8	9,100	b-5/8	10,250	b-5/8	8,970	b-5/8	8,000	.....	.....
3.....	b-5/8	9,820	b-5/8	9,100	b-5/8	10,250	b-5/8	8,970	b-5/8	20,000	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,000	b-5/8	7,000
4.....	3/4	13,550	3/4	1,390	3/4	12,280	3/4	19,320	3/4	15,000	3/4	7,000
9.....	3/4	9,050	3/4	500	3/4	13,470	3/4	11,600	3/4	14,000	3/4	7,000
6.....	3/4	8,080	3/4	8,340	3/4	9,700	3/4	9,610	3/4	16,000	3/4	5,000
7.....	a-5/8	10,900	a-5/8	2,300	a-5/8	9,000	a-5/8	7,700	a-5/8	16,000	a-5/8	11,000
.....	b-3/4	8,060	b-3/4	1,110	b-3/4	10,300	b-3/4	16,340	b-3/4	16,000	b-3/4	10,000

- 1, 3, 4, 5, 6 and 7—Started to burn up.
- 2—Started to burn up. Carried current at less than 1000 volts.

Notes on Tests of Round Top Bells

Test No. 7.—Tensile Strength; Conditions Normal:

- 1—Broke 3/4-in. bolt; insulation not badly damaged.
- 2—(a-3/4 in.) Pulled body of insulator out of casting.
- 2—(b-5/8 in.) Pulled stud out of insulator.
- 3—(a-5/8 in.) Outriggers turned up; broke one outrigger.

3—(b-5/8 in.) Outriggers turned down; pulled stud loose in insulation.
 4—Pulled stud loose with most of insulation.
 5—Pulled body of insulation loose in casting.
 6—Broke stud inside of insulation.
 7—(a-5/8 in.) Broke one outrigger; insulation slightly cracked.
 7—(b-5/8 in.) Pulled stud loose insulation.
Test No. 8.—Tensile Strength; Conditions, Temperature of 150 deg. F.:
 The insulators used in this test were placed in water which was kept at a temperature of 150 deg. F. for one hour before testing.

1—Pulled insulator loose in casting.
 3—(a-5/8 in.) Outriggers turned up; stud pulled down and thread stripped.
 3—(b-5/8 in.) Outriggers turned down; stud pulled down.
 4 and 5—Stud pulled down.
 6—Broke brass stud casting; insulation only slightly damaged.
 7—(a-5/8 in.) Stud pulled down.
 7—(b-3/4 in.) Stud pulled loose.

Test No. 9.—Side Strain; Conditions Normal:
 1—Crushed insulation under stud; broke 3/4-in. bolt.
 3—(a and b-5/8 in.) Outriggers turned up; crushed insulation under stud; broke 5/8-in. bolt.
 4 and 5—Crushed insulation under stud.
 6—Broke 5/8-in. bolt; cracked insulation slightly.
 7—(a-5/8 in.) Broke 5/8-in. bolt; crushed insulation under stud.
 7—(b-3/4 in.) Bent stud; crushed insulation under stud.

Test No. 10.—Side Strain; Conditions, Temperature of 150 deg. F.:
 The insulators used in this test were placed in water, which was kept at a temperature of 150 deg. F. for one hour before testing.

1—Broke 3/4-in. bolt; crushed insulation slightly.
 3—(a-5/8 in.) Outriggers turned up; forced stud down through insulation until 5/8-in. bolt broke.
 3—(b-5/8 in.) Outriggers turned down; crushed insulation under stud.
 4—Crushed insulation under stud until 3/4-in. bolt broke.
 5—Forced stud down through insulation until 3/4-in. bolt broke.
 6—Broke 5/8-in. bolt; loosened insulation slightly around stud.
 7—(a-5/8 in.) Forced stud down through insulation until 5/8-in. bolt broke.
 7—(b-5/8 in.) Crushed insulation under stud.

Test No. 11.—Breakdown Voltage; Conditions Normal:
 1—Jumped from stud to hanger casting.
 2—(a-3/4 in.) Jumped from stud to hanger casting.
 2—(b-3/8 in.) Spark gap broke down at 20,000 volts. On re-test insulation failed at 7000 volts.
 3—(a-5/8 in.) Outriggers turned up; spark gap broke down at 20,000 volts. On re-test insulation failed at 8,000 volts.
 3—(b-5/8 in.) Outriggers turned down; spark gap broke down at 20,000 volts. On re-test insulation failed at 7000 volts.
 4, 5 and 6—Jumped from stud to hanger casting.
 7—(a-5/8 in.) and 7—(b-3/4 in.) Jumped from stud to hanger casting.

Test No. 12.—Breakdown Voltage; Conditions Wet:
 Insulator was hung at angle of 45 deg. Spray was directed vertically downward on the insulator. No attempt was made to measure precipitation.

1—Jumped from stud to hanger casting.
 3—(a-5/8 in.) Outriggers turned up; jumped from stud to hanger casting.
 3—(b-5/8 in.) Outriggers turned down; jumped from stud to hanger casting.
 4, 5 and 6—Jumped from stud to hanger casting.
 7—(a-5/8 in.) and 7—(b-3/4 in.) Jumped from stud to hanger casting.

Notes on Tests of West End Hangers

Test No. 13.—Tensile Strength; Conditions Normal:
 1—Broke 5/8-in. bolt; cracked outrigger; broke insulation slightly.
 2—(a-3/4 in.) and 2—(b-5/8 in.) Broke insulation away from head of stud.
 3—(a-5/8 in. long stud) Broke insulation away from head of stud.
 3—(b-5/8 in. short stud) Broke outrigger; cracked insulation on head of stud.
 4 and 5—Broke insulation away from head of stud.
 6—Broke outrigger and insulation on head of stud.
 7—Broke outrigger; cracked insulation very slightly.

Test No. 14.—Tensile Strength; Conditions, Temperature of 150 deg. F.

The insulators used in this test were placed in water, which was kept at a temperature of 150 deg. F. for one hour before testing.

3—(a-5/8 in. long stud) and 3—(b-5/8 in. short stud)—Pulled insulation loose from head of stud.
 4—Pulled insulation loose from head of stud; cracked outrigger.
 5 and 6—Pulled insulation loose from head of stud.
 7—Broke outrigger.

Sample From Firm No	Test No. 13		Test No. 14		Test No. 15		Test No. 16		Test No. 17		Test No. 18	
	Tensile Strength		Tensile Strength		Side Strain		Side Strain		Breakdown Voltage		Breakdown Voltage	
	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.
	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Volt age	Size In.	Volt age
1.....	a-5/8	7,910	.....	.....	.....	4,230	.....	.....	.....	13,500	.....	9,000
2.....	b-5/8	3,200	.....	.....	a-3/4	6,230	.....	.....	a-3/4	15,000	a-3/4	8,000
	b-5/8	4,700	.....	.....	b-5/8	4,030	.....	.....	b-5/8	15,000	b-5/8	6,000
3.....	a-5/8	7,100	a-5/8	3,100	a-5/8	3,210	a-5/8	6,570	a-5/8	13,000	a-5/8	5,000
	b-5/8	6,970	b-5/8	4,590	b-5/8	7,700	b-5/8	8,060	b-5/8	13,000	b-5/8	5,000
4.....	3/4	3,810	3/4	4,110	3/4	5,200	3/4	8,760	3/4	13,500	3/4	8,000
5.....	5/8	2,800	5/8	2,000	5/8	6,230	5/8	3,800	5/8	13,000	5/8	5,000
6.....	5/8	11,290	5/8	1,200	5/8	5,950	5/8	5,600	5/8	13,000	5/8	5,000
7.....	5/8	3,940	5/8	2,420	5/8	7,890	5/8	7,730	5/8	13,000	5/8	5,000

Test No. 15.—Side Strain; Conditions Normal:
 1—Broke 5/8-in. bolt; crushed insulator slightly.
 2—(a-3/4 in.) Broke 3/4-in. bolt; cracked insulation.
 2—(b-5/8 in.) Broke 5/8-in bolt; crushed insulator; bent stud.
 3—(a-5/8 in., long stud) Broke 5/8-in. bolt; insulator only slightly damaged.
 3—(b-5/8 in., short stud) Broke 5/8-in. bolt; bent stud; cracked insulator; cracked petticoat of casting.
 4 and 5—Broke 3/4-in. bolt; crushed insulation
 6—Broke 3/4-in. bolt; cracked insulation slightly.
 7—Broke 5/8-in. bolt; bent stud; crushed insulation.

Test No. 16.—Side Strain; Conditions, Temperature 150 deg. F.
 The insulators used in this test were placed in water which was kept at a temperature of 150 deg. F. for one hour before testing.

3—(a-5/8 in., long stud) and 3—(b-5/8 in., short stud) Bent stud until 5/8-in. bolt broke; insulation slightly cracked.
 4—Bent stud until 3/4-in. bolt broke.
 5—Bent stud and crushed insulation.
 6 and 7—Bent stud until 5/8-in. bolt broke.

Test No. 17.—Breakdown Voltage; Conditions Normal:
 1—Jumped from stud to hanger casting.
 2—(a-3/4 in.), 2—(b-5/8 in.) and 3—(a-5/8 in., long stud)—Jumped from stud to hanger casting.
 3—(b-5/8 in., short stud)—Jumped from stud to hanger casting.
 4 and 5—Jumped from stud to hanger casting.
 6—Punctured side of stud about 1 1/4 in. from bottom.
 7—Jumped from stud to hanger casting.

Test No. 18.—Breakdown Voltage; Conditions Wet:
 Insulator was hung at an angle of 45 deg.; spray was

Sample From Firm No	Test No. 19		Test No. 20		Test No. 21		Test No. 22		Test No. 23		Test No. 24	
	Tensile Strength		Tensile Strength		Side Strain		Side Strain		Breakdown Voltage		Breakdown Voltage	
	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.	Conditions Normal	Conditions Temp. 150° Fahr.
	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Load in lbs.	Size In.	Volt age	Size In.	Volt age
1.....	a-5/8	9,500	.....	.....	5/8	5,550	.....	.....	5/8	14,000	5/8	7,000
2.....	b-5/8	6,600	.....	.....	a-5/8	3,500	.....	.....	a-5/8	14,000	a-5/8	6,000
	b-5/8	11,560	.....	.....	b-5/8	4,700	.....	.....	b-5/8	16,000	b-5/8	6,000
3.....	5/8	8,640	5/8	4,400	5/8	7,570	5/8	4,700	5/8	15,000	5/8	7,000
4.....	3/4	11,440	3/4	2,310	3/4	5,820	3/4	7,700	3/4	17,000	3/4	7,000
5.....	5/8	4,900	5/8	1,980	5/8	9,040	5/8	4,900	5/8	18,000	5/8	6,000
6.....	5/8	8,200	5/8	1,000	5/8	6,800	5/8	4,000	5/8	10,000	5/8	8,000
7.....	5/8	9,170	5/8	2,140	5/8	7,200	5/8	.....	5/8	15,000	5/8	6,000

directed vertically downward on the insulator; no attempt was made to measure precipitation.

1, 2—(a-3/4 in.), 2—(b-5/8 in.), 3—a-5/8 in., long stud), 3—(b-5/8 in., short stud), 4, 5, 6 and 7—Jumped from stud to hanger casting.

Notes on Tests of Cap and Cone Hangers

Test No. 19.—Tensile Strength; Conditions Normal:
 1, 2—(a-5/8 in.), 2—(b-5/8 in.), 3, 4, 5, 6 and 7—Broke cap insulation.

Test No. 20.—Tensile Strength; Conditions, Temperature of 150 deg. F.

The insulators used in this test were placed in water which was kept at a temperature of 150 deg. F. for one hour before testing.

3—Broke cap.

4, 5 6 and 7—Pulled stud down in cap.

Test No. 21.—Side Strain; Conditions Normal:

1—Crushed both cap and cone.

2—(a- $\frac{5}{8}$ in., plain) Split both cap and cone.

2—(b- $\frac{5}{8}$ in., galvanized rim) Crushed both cap and cone.

3—Bent stud and crushed cone and cap.

4—Bent stud and crushed cone and split cap.

5—Crushed cone and split cap.

6 and 7—Crushed cone, split cap and bent stud.

Test No. 22.—Side Strain; Conditions, Temperature 150 deg. F.

The insulators used in this test were placed in water, which was kept at a temperature of 150 deg. F. for one hour before testing.

3—Crushed cone and split cap.

4—Crushed cone; forced stud sideways in cap.

5 and 6—Crushed cone and split cap.

Test No. 23.—Breakdown Voltage; Conditions Normal:

1, 2—(a- $\frac{5}{8}$ in.), 2—(b- $\frac{5}{8}$ in.), 3, 4, 5 and 7—Jumped from stud to hanger casting.

6—Jumped from stud to hanger casting, inside of cap, across top surface of cone.

Test No. 24.—Breakdown Voltage; Conditions Wet:

Insular was hung at an angle of 45 deg. Spray was directed vertically downward on the insulator. No attempt was made to measure the precipitation.

1, 2—(a- $\frac{5}{8}$ in.), 2—(b- $\frac{5}{8}$ in.), 3, 4, 5, 6 and 7—Jumped from stud to hanger casting.

THE MOFFAT TRIP

The concluding feature of the Denver convention of the American Street & Interurban Railway Association occurred yesterday when a trip was made to Corona over the "Moffat Road." This is the popular name of the Denver, North-western & Pacific Railway, which is being built between Denver and Salt Lake City and will be much shorter than any of the existing routes. At present the road is open for a distance of 214 miles from Denver, but its highest point is at Corona, 65 miles from that city. Here the road crosses the Continental Divide at an altitude of 11,660 ft., and for this reason is said to be the highest standard gage railroad in the world.

The convention party traveled by special train to Corona and as there were so many who wished to go, a train of two sections, each made up of seven cars, was required. Altogether 721 passengers took the trip.

The start was made from Denver at 9 o'clock and the foot hills were reached about a half an hour later. As the heavily loaded trains, each drawn by two locomotives, slowly ascended the heavy grades and passed through many tunnels and across deep ravines, beautiful vistas were presented to please the eye at almost every turn. To gain the proper altitude the road follows a very sinuous course and the trains often pass the same object several times, each time at a different elevation, as they steadily climb the ascent. Several stops were made on the trip up, so that the tourists could enjoy the views from vantage points. Many carried cameras and used them frequently.

Corona is surrounded by perpetual snow and consists simply of the railroad station and snow shed. Here the party disembarked and a group photograph was taken amid the snow. Several of the more venturesome then climbed the top of a peak near the station and some 300 ft. higher than it. Those who did so were amply repaid by the extensive panorama presented of snow-capped mountains as far as the eye could reach.

The return trip was made in about the same time as the ascent, one section leaving about 1:30 p. m. and the other at about 2 p. m. The trip was carried out under the auspices of the entertainment committee of the Manufacturers' Association.

STORES, ACCOUNTING AND INVENTORY*

By E. S. Pattee, Secretary and Comptroller, Twin City Rapid Transit Company

The intention of the writer is to set forth in a general way the features of stores accounting that require special attention without attempting to cover all the necessary details, these being subject to the decision of the chief accountant, who will, of course, be governed by local conditions.

The results that should be attained by an efficient system of storehouse accounting are twofold: A thorough check on all material received, thereby assuring proper value for all moneys paid out; the correct distribution of material drawn on account of operating and construction expenses.

While the purchasing department is and should be a separate and distinct department, it is so closely connected with stores that a few words are necessary in connection with the receipt of goods.

All purchases should be made by the purchasing agent; all requests for the purchase of material should come from the storekeeper, and all goods so purchased should be consigned to storehouse as far as possible, that the receiving books, from which to check and pass invoices, may be complete.

All invoices of purchases should be received first by the purchasing agent for the checking of prices and by him immediately forwarded to the storekeeper. The purchasing agent should also note on invoice the f.o.b. point, thus informing the storekeeper whether the freight is to be paid by the company or to be charged back to the shipper. All goods should be carefully received by the receiving clerk and entered on his receiving books.

In the regular course, the invoice will be received at the store house and checked against the receiving book by another clerk and any discrepancy noted. If a shortage appears it is reported to the purchasing agent for him to make claim before settlement of invoice. If invoice agrees with actual receipt, as shown in receiving book, the entry is then completed showing the f.o.b. point, deduction of freight (if any), date of passing of invoice, etc.

The above applies only to goods purchased. As some of the companies here represented do more or less manufacturing, we can not well ignore that feature, even though not of particular interest to the majority.

When the storekeeper receives a requisition for goods of this nature he fills out a form of order, requesting the master mechanic to make the articles required. This order is known as a stock order and is numbered. The labor, as well as the material, is charged against the stock order number, and all material left over is credited back. To this total is then added a fixed percentage of the labor charge to care for the non-productive labor and wear and tear of machinery of shops. The unit cost is then obtained and the goods turned back to the storehouse to be charged out as required at this unit cost. A sufficient part of the amount added for non-productive labor, etc., to eliminate the manufacturing feature, should be credited to the shop expense accounts and the balance credited to a shop tools and machinery renewal fund.

The above method would apply to any one or more articles made for a special purpose and not going into stock at all, but charged directly to the account affected. This would not be strictly a stock order, but might be distinguished by calling it a spare work order, with a different series of numbers from the stock orders.

When material is returned to the storehouse as scrap or second-hand for repairs, a practical method of handling it

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is to credit all of such material at a scrap price. Upon investigation, any that can be profitably repaired should be sent to the master mechanic for repairs on stock order. The article itself should be charged against the order at scrap price. To this should be added the cost of new material used and all labor, plus a fixed per cent for non-productive labor and wear and tear of machinery and the order should be credited with all material returned. When returned to storehouse this article then goes on the shelf at the scrap price, plus added labor and material as above.

As there is some material that does not pass through the storehouse a report on a form for this purpose should be filled out at once and sent to storekeeper signed by the head of department who receives it, informing the storekeeper of the receipt of such goods and their condition.

The suggestions made in this paper are based on the assumption that all the employees in any way connected with accounting, including the storekeeper and employees, shop clerks and track timekeepers, are the employees of the chief accountant, whether he be comptroller or auditor.

The storekeeper should keep in close touch with his stock and should be held responsible for having at all times a sufficient stock of all standard material at hand. On the other hand, he should exercise great care not to have an overstock at any time, thus tying up the company's funds. As an aid to this end a system of cards showing the amount of each class ordered and used is suggested, the above to apply to manufactured goods as well.

The method of pricing out goods varies materially. The method the writer would suggest, however, is that all material be charged out at the last purchase or manufactured price and all scrap credited likewise at last selling price.

All material and supplies delivered from the storehouse should be on requisitions which should be approved by one officer, preferably the general manager, the only exception being the material used in shops for maintenance and that used on work covered by a stock order or an approved authorization.

A suggestion for economy and accuracy in handling material drawn on material slips, based on the assumption that the storehouse is as it should be, adjacent to the shops, is as follows:

Install a telephone system connecting each shop with a switchboard in the storehouse, the switchboard to be handled by a storehouse man, who knows material thoroughly, and who is supplied with a list of all order numbers and authorizations. As material is wanted in a shop the shop material man anticipates the demand and telephones the storehouse the order, stating for what the material is to be used. The storehouse man then makes out the material slips in triplicate, taking care that the material on each slip is chargeable to but one account. He retains one and passes two copies to a storehouse employee who fills the order and delivers the goods. The shop material man signs one of the slips, acknowledging receipt of goods, and keeps the other copy. This system saves the time of high-priced mechanics getting their material together and is a check on ordering, as the storehouse man will question closely if, in his judgment, the material requested does not correspond with what the order number calls for.

Here is a suggestion for a correct distribution of time: Before quitting work each day the foreman of the shop informs each man what he will start at in the morning. He also informs the clerk, the clerk then making out a time sheet for each man to cover the work indicated by the foreman. Before leaving at night each man gets his time sheet and when he arrives in the morning proceeds accordingly. When this job is finished he returns the time sheet to the clerk, who stamps the time on it and gives him another sheet filled out for such other work as the foreman has instructed, along with the time of starting. In this way no man is at any time forced to waste a moment's time

between jobs, as his time sheet, showing what he will do next, and the materials to be used in the work, are always waiting for him.

The exchange basis for furnishing supplies for stations is suggested. This method does away with all requisitions from stations except for articles where exchange is not possible, such as stationery, etc. The stores department is thus relieved of back orders and other annoyances connected with a large number of requisitions. Each station is supplied with a small stock of stores, carefully inventoried, of which a record is kept, the station being treated as a sub-storehouse. These supplies are used by repairmen as needed, the old or scrap part being carefully preserved for exchange for a new part. A supply car containing a full assortment of supplies, in charge of a capable storehouse man and clerk, makes a daily trip collecting all scrap and giving a new part in exchange therefor to make good the stock. This new part is charged out on material slips to the proper account by the clerk and the old parts are credited, both charge and credit slips being turned in daily to the storehouse. Of course, this system calls for a careful inventory and a possible adjustment at the close of the year, but this adjustment is a small matter.

With the foregoing suggestions all charges for labor as well as material are absolutely in the hands of the stores accountants, thus insuring a correct distribution. The writer believes this to be a very important point and feels that too much emphasis cannot be put upon the necessity for care in making both material and labor slips, as they are, the basis of the accounting.

Track scales at the storehouse for weighing all material received in carload lots, as well as scrap sold, will be found of immense value. Particularly is this true in the case of fuel, which is often invoiced as of one weight, while the railroad freight bill shows another, thereby causing much correspondence and no end of annoyance before the difference is adjusted. By the use of your own scales you are able to figure accurately your consumption for each month and incidentally may be able to reduce the cost of fuel.

The class of material that perhaps causes the most annoyance, and incidentally may be the large factor in any discrepancy between book balance of stores at the close of the year and actual inventory, is the track material. In the opinion of the writer, correct accounting for this class of material is only obtained where such material is directly under the control of and delivered by the storekeeper under the same conditions as any other class of material.

As it is desirable to take inventory as quickly as possible, it is suggested that a crew of men go through the stock and ascertain the exact quantity of each article on hand, attaching a card with the quantity stated thereon. On this card may be shown the deductions from or additions to for the few days previous to the actual taking of the inventory. When this time arrives a large enough force should be put on to take down the entire stock in one day, this being possible if complete lists of material with prices attached have been made out previously.

After the sheets have been priced, extended and checked and all the adjustments made, the total is checked against the book balance.

The writer, in spite of the most scrupulous care and watchfulness on the part of a trained force of storehouse accountants thoroughly conversant with all material and accounts, invariably finds an average at the close of the year's business, in the adjustment of which the operating and construction accounts receive their proportionate credits.

Some of the properties here represented may be composed of two or more underlying companies whose accounts must be kept separate. This condition would in no wise affect the stores accounting principles. The different accounts of a general nature may be apportioned to each separate company on a mileage or any other acceptable basis.

QUESTION BOX OF THE ENGINEERING ASSOCIATION*

KEY TO ANSWERS TO QUESTIONS

- No. Name.
1. Anderson, Ind., Indiana Union Traction Company.
 2. Anonymous.
 3. Baltimore, Md., United Railways & Electric Company of Baltimore; William A. House, president.
 4. Boston, Mass., Boston & Northern Street Railway Company; G. W. Palmer, Jr., electrical engineer.
 5. Denver, Colo., Denver City Tramway Company; W. H. McAlooney, superintendent rolling stock.
 6. East St. Louis, Ill., East St. Louis & Suburban Railway Company; M. M. Lloyd, master mechanic.
 7. Fort Wayne, Ind., Fort Wayne & Wabash Valley Traction Company; L. W. Jacques, master mechanic.
 8. Fort Worth, Texas, Northern Texas Traction Company; H. T. Edgar, manager.
 9. Kansas, University of; George C. Shaad, professor of electrical engineering.
 10. Kingston, N. Y., Kingston Consolidated Railroad Company; C. Gordon Reil, vice president.
 11. Madison, Wis., Southern Wisconsin Railway Company; Dudley Montgomery, vice president and superintendent.
 12. Mobile, Ala., Mobile Light & Railroad Company; S. M. Coffin, master mechanic.
 13. Mobile, Ala., Mobile Light & Railroad Company; J. H. Wilson, president.
 14. Newark, N. J., Public Service Railway Company; R. E. Danforth, general manager.
 15. Newark, N. J., Public Service Railway Company; E. J. Dunne, superintendent of distribution.
 16. Newark, N. J., Public Service Railway Company; Dudley Farrand, general manager electrical department.
 17. Newark, N. J., Public Service Railway Company; C. Remelius, superintendent rolling equipment.
 18. Newark, N. J., Public Service Railway Company; Martin Schreiber, engineer maintenance of way.
 19. Newark, N. J., Public Service Railway Company; Martin White, superintendent maintenance of way.
 20. Philadelphia, Pa., Philadelphia Rapid Transit Company; James Heywood, superintendent lines and cables.
 21. Pittsburg, Pa., Standard Motor Truck Company; W. G. Price, mechanical engineer.
 22. Schenectady, N. Y., Schenectady Railway Company; B. Penoyer, engineer maintenance of way.
 23. Syracuse, N. Y., Syracuse Rapid Transit Railway Company; E. P. Roundey, engineer maintenance of way.
 24. Utica, N. Y., Utica & Mohawk Valley Railway Company; M. T. French, engineer maintenance of way.
 25. Washington, D. C., Washington Railway & Electric Company; L. E. Sinclair, acting for general manager.

POWER HOUSES

1. What experience has been had in the use of hot water meters in power plants?

Many experiments with hot water meters indicate that there are very few that even approximate accuracy in their indications. Those that test quite close to correct when new rapidly fall off in accuracy and often show erratic results. The Venturi type of meter is undoubtedly the best now on the market for this purpose. (16.)

We have used Venturi meters with indicating manometer very successfully on water up to a temperature of 212 deg. F. The calibration of this meter was checked by means of a weighing hopper and verified to within approximately 150 lb. in 33,000. Thus the Venturi meter is sufficiently accurate for any work in connection with boiler or station tests. (2.)

2. What have been the actual results of purchasing coal under contracts that specify a standard quality and price, with a sliding scale of prices covering variations in quality?

The result has been that the price we pay is commensurate with the quality only, and not quantity; it has also had the effect of keeping the quality nearer to the standard than it would be otherwise. (3.)

We purchase nut and slack coal under a guarantee as regards ash, moisture and sulphur, and B. t. u.'s. During the early part of the contract the contractor was penalized, since then we have got a more uniform and better grade of coal, coming up to guarantee. (2.)

Our contract does not provide for a bonus as the contractor would not guarantee the B. t. u.'s. to run as high as the analysis of his coal, consequently the contractor guaranteed 13,000 B. t. u. with penalty if coal went below that. (13.)

We purchase coal under contract but without any specifications or sliding scale covering variations in quality. (25.)

Our present contract specifies the quality of coal but we have no sliding scale of prices, the purchasing agent merely deducting whatever he thinks right from the bill whenever the coal does not come up to specifications. (2.)

3. Give an exact definition and basis on which power station load factors are worked out, especially in combined railway and lighting stations.

We supply railway current only and base our station load factor on the formula:

$$\text{Load Factor} = \frac{\text{Total daily output}}{\text{Rated capacity of station} \times 24} \quad (3.)$$

The true definition of load factor is the ratio of the average demand made on the station to the maximum normal capacity of the station. A station would have a load factor of unity if it were loaded to its maximum continuous capacity 24 hours each day. On account of the fact that the ratio between the maximum capacity and the maximum load on any station is a changing quantity, it is customary

to calculate the load factor on the basis of maximum demand and not on the basis of maximum capacity. The definition then becomes: the load factor of a station is the ratio of the average load to the maximum demand on the station. This is the definition commonly used in practice. The load factor may be calculated for any period of time, a day, a month, a year. In any case it is the average load for the period divided by the maximum load occurring during that interval of time. In central station practice the load factor for periods of less than one year has little significance. One company, which has the management of several stations that supply a combined load of lighting and railway power, records the load factor for each station at the beginning of every month as calculated for the year just ended. The load factor in this case becomes:

$$\text{Load Factor} = \frac{\text{Output for year just ended, in kw hours}}{\text{Maximum load in kw during year} \times 8760. (9.)}$$

We take the maximum ampere or kw demand for any time during the 24 hours, multiply by 24, and divide this into the daily output for the day, which gives us our load factor for the day (25.)

Load factor means the ratio between maximum load and output and is obtained by dividing output by maximum load, multiplied by time. Thus:

$$\text{Maximum load (in kw)} \times \text{time (in hours)}$$

Total output for same time (expressed in kw hours)

For instance, if the max. load in a station is 1,000 kw and the output for 24 hours is 12,000 kw hours, the load factor is 50 per cent, viz.:

$$\frac{1,000 \times 24}{12,000} = 50$$

This applies equally to any station, whether lighting or railway. In many cases superintendents use the station capacity, or machine rating, instead of actual maximum load, but this method is very misleading and not correct. (16.)

TRACK

4. How does the cost of steel ties in concrete compare with that of wooden ties laid in concrete, and what life is expected for steel ties?

We use steel ties 4 ft. on centers, costing \$1.76 apiece with fastenings; wooden ties 3 ft. apart, costing 76 cents apiece. Steel ties should last 20 years at least and then have a scrap value of almost half of first cost. Scrap value of wooden ties would be from 2 to 10 cents. (2.)

One steel tie (Carnegie, 14½ lb.), costing \$1.77, replaces three 6-in. by 8-in. by 8-ft. wooden ties, spaced 24-in. centers, costing \$2.16. Excavation with steel ties, 4-2 cu. ft. per ft. of track; with wooden ties, 8-5 cu. ft. per ft. of track, an increase of 8 cents per ft. of track when excavation costs 50 cents per cu. yd.; track laying and surfacing with steel ties costs 20 cents compared with 50 cents per ft. with wooden ties on stone ballast, that generally require two and, in places, three tamplings. Assuming top of concrete at base of rail, with steel ties concrete extends only 6 in. below rail, except concrete beam 12 in. wide extends 6 in. under tie. If 6-in. concrete is placed under wooden ties about 2 cu. ft. per ft. of track would be required in excess of concrete for steel ties. At \$4.50 per cu. yd. this amounts to 33 cents per ft. of track. Two spikes per ft. of track, costing 3 cents, are saved. The total saving per ft. of single track with steel ties is thus about \$1.13. Steel ties should last at least as long as the best wooden ties. (24.)

Wooden ties on 2 ft. centers, and steel ties on 5 ft. centers cost about the same. (2.)

5.—(a.) Does the gage line of both rails on straight track wear equally, and if not, what causes one rail to wear more than the other?

(b.) Does such unequal wear occur on high speed lines only?

(c.) On what foundation is the track? (d.) What kind of ballast? (e.) What rail section?

(f.) Are both rails bonded, and if only one is bonded, which rail wears most?

(g.) What kind of trucks?

(a.) Both rails should wear equally on gage lines if rails are surfaced level and motors are suspended alternately on right and left sides. The leading wheel of a car on the gear side generally shows more wear than the other wheels, as driving force is exerted at an oblique angle to the rail, being more noticeable when the gear and pinion become worn. This tends to wear the rail on that side, but suspending motors alternately should prevent unequal rail wear. Heavy wagons wear gage in turning out to the right from double tracks. Passengers are liable to sit on right side of car, thus bringing heavier loads on outside rails of double tracks. (24.)

(a.) Gage line of both rails on straight track usually wears equally if the track is in perfect line and surface. If the track is not in line and surface the tendency is to shift with service from side to side, causing unequal wear to the gage lines of the rails. (25.)

(a.) The difference in the wear of the two rails has been so immaterial as not to engage our serious attention up to this time. (3.)

(a.) City track in pavement; outside rail (double track) shows excess wear over inside rail due to outside rail being surfaced ½ in. low in order to conform to street surface contour. (22.)

(a.) No. Depends on manner trucks are set and the weight distributed. (19.)

(b.) Unequal wear should be more noticeable on heavy city grades where wheels slip and spin. (24.)

(b.) Not necessarily. (25.)

(b.) Low speed (city lines.) (22.)

(b.) No; on both high and low speed lines equally. (19.)

(b.) Not necessarily. (21.)

(c, d, e.) Would apply to track on most any kind of ballast, foundation, or rail section. (25.)

* Presented and discussed by the American Street & Interurban Railway Engineering Association at Denver, Colo., Oct. 4, 5, 6, 7 and 8, 1909.

- (c, d, e.) See answer to Question 5 (a.) (3.)
 (c, d, e.) Track foundation sand, ballast concrete, rail section 7-in. and 9-in. girder. (22.)
 c, d, e.) Not due to kind of track foundation, ballast or rail, but due to reasons outlined in answer to Question 5a. (24.)
 (d, e.) Generally with rock ballast T or girder rail sections. (19.)
 (f.) Both rails bonded. (22, 25, 19, 2.)
 (f.) I do not believe bonding has anything to do with rail wear. (24.)
 (g.) Brill trucks 27-E-1 and 27-E-2, double, and 27-E-1, single. (22.)
 (g.) Believe "maximum traction" trucks damage more than others. (24.)

6. What is the most satisfactory manner of testing for defective bonds in pavements?

Using Roller bond tester, which indicates conductivity of bond as compared with feet of rail. (25.)

Probably by a well equipped car for the purpose, such as the one used by Herrick, or a voltmeter test. (3, 19.)

We have got very satisfactory results from a bond tester purchased from the Western Electric Company. (10.)

Preliminary test, "Tee Pole" testing outfit, check test, milli-voltmeter. (22.)

Herrick test car. (23.)

Testing bonds with special car is most satisfactory. Hand instruments measuring joint resistance in comparative length of abutting rail are fairly satisfactory. (24.)

7. What is the average cost of creosote block pavement, laid on concrete foundation?

\$3.25 per square yard. (25.)

\$3.55 per square yard. (3.)

About \$3.45 per square yard laid on 6 in. of concrete. (24.)

\$2.75 per square yard. (19.)

\$5.50 per square yard paving, with concrete beam under rails and concrete to bottom of ties, \$4.50 per square yard paving, with concrete to bottom of tie under rails and 6 in. of concrete under balance. (2.)

8. What is the average life of creosote block pavement?

None in use longer than four years. This apparently is in as good condition today as when it was laid. (3.)

14 years. (19.)

9. Do physical and chemical tests show any difference between rolled manganese steel rails and cast manganese steel rails? Give details and recommendations?

Yes; but the rolled manganese rail and cast manganese rail could have same chemical test, but show a difference in physical tests. It is more difficult to drill or plane the present cast manganese steel that is in general use for special work than the rolled steel rails that up to this time have been offered to the trade. (18.)

10. Is it practicable and advisable to adopt a standard set of track maintenance rules for city and also for inter-urban lines, including both streets and private right of way?

Yes. (25, 3, 24, 23, 18.)

No. (22.)

11. Have electrically brazed or soldered bonds, placed on outside of rail-head in paved streets, or in streets graded to top of rail, proved satisfactory? Give some figures.

Soldered bonds placed on the outside of rails in streets graded to the top of the ties have proved most unsatisfactory, and have been replaced by the twin plug terminal exposed bond, also fastened to the head of the rail, which has given excellent results. (3.)

Have no brazed bonds. Soldered bonds have proven unsatisfactory in test made with five different makes placed on outside of head of 65 lb. T-rail. Out of a total of 444 bonds, placed in 1907, 83 were off, 64 were loose at one end, and nine had defective strands, in February, 1909. Some of these bonds, among them those giving poorest results, were placed by representatives of the makers. (24.)

No. (19.)

12. What is the life of cast weld joints on new rail laid with good foundation in paved street?

We have some cast weld joints which were placed on new rails laid 10 years ago on slotted track, which is supported on cast-iron yokes, spaced 5 ft. center to center. They will probably last as long as the rail. (25.)

As long as the rail. (3.)

After a four years' service under 12-ton cars, running on a 10-minute schedule, our cast weld joints on 72 lb. 6 in. T-rail are in very good condition. (11.)

It would depend on car movement. Cast welded joints from tee to girder rail sections installed 1904 on 7½-minute lines, estimated life 10 years. (22.)

Satisfactory at end of five years. (2.)

13. How close should ties be spaced on track laid with 6 in. of crushed stone underneath the ties and 4 in. of concrete between the ties; ties 8 in. by 8 ft.?

About 2 ft. 6 in., center to center. (25.)

2 ft. centers. (3, 10, 22, 24, 23.)

15. What is the life of one of the best mechanical joints put on new rail laid with good foundation in paved street?

Our experience with mechanical joints has not been entirely satisfactory, as in almost all instances, in the course of three or four years the paving has had to be opened and the joints tightened. We have adopted electrically welded joints as our standard. (3.)

About six years ago with 12-ton cars running on 10-minute schedule. We expect to cast weld the joints. (11.)

Varies according to car movement; special support joints have failed in from 3 to 5 years. (22.)

"Clark" joints and other good makes of mechanical joints, when properly installed and surrounded by concrete and pavement, should last as long as the rails. (24.)

Less than the life of the rail. (2.)

16. What is the life of electric welded joints put on new rail laid with good foundation?

The same as that of the rail itself. (3.)

Of 1,325 joints welded in September, 1905, about 1 per cent have developed breaks to June, 1909. (22.)

17. How long should concrete be allowed to set, under and between rails, before allowing cars to run over same?

If mixture is strong, and weather favorable, 15 to 20 hours should be sufficient. (25.)

Three to seven days, depending upon the equipment and the traffic conditions. (3.)

With proper precautions it is not necessary to stop cars to allow concrete to set. (10.)

Not less than four days. (22.)

Concrete should set at least one week before car operation begins. (24.)

Ten days at least, and longer, if possible. (23, 2.)

Seven days. (19.)

18. Is the use of soapy water, in place of oil, in general use as a lubricant for drills used in boring holes for copper rail bonding to improve conductivity of contact?

Strictly prohibited on our system. We have used, with good results, a solution of bicarbonate of soda. (3.)

We do our drilling for bonds dry. (11, 23.)

Use oil. (22.)

Clear water is preferable to soapy water. (24.)

CAR HOUSE CONSTRUCTION

19. What percentage of the length of a car storage house (first floor) should be of open pit construction?

About 30 per cent. (25, 3.)

25 per cent. (7.)

About 50 per cent. (11, 2.)

All car house storage tracks should be of pit construction. (8.)

Depends on the number of cars and the equipment; ordinarily about two-thirds. (18.)

For at least 25 per cent and, better, 30 per cent of the total number of cars in the house. (2.)

20. What is the opinion of the Association regarding the necessity of aisle sprinklers when the ceiling sprinklers are not more than 18 ft. above the top of the rail?

If the ceiling sprinklers are located in sufficient numbers, aisle sprinklers should be unnecessary. (3.)

Not necessary. (18.)

Aisle sprinklers in line with car ventilators. (2.)

We believe that regardless of the height of the building, the aisle sprinklers are a needed protection, and should be installed so as to play on one side of every car at least, for if there should be a large amount of draft, the fire would probably spread from car to car without being controlled by the ceiling heads. Furthermore, the aisle sprinklers are generally installed with separate mains from the ceiling sprinklers, thus lessening the possibility of a section being without protection on account of repairs to apparatus. (2.)

LINES—OVERHEAD AND UNDERGROUND.

21. Given a network of street railway lines fed from several 600-volt, d. c. stations and substations: (a) Would you install trunk line feeders to tie the stations together so that they might help each other in case of trouble? (b) Or would you extend and connect the ends of certain feeders so that in addition to feeding a section they might serve as tie lines? (c) What proportion of station or substation capacity would you provide in the capacity of such trunk lines or tie lines?

Where stations are not more than 1½ miles apart, method (a) is preferable. Where more than 1½ miles apart, method (b) should be adopted. (c) Say 25 per cent. (8.)

(b) Connect feeders so that they serve as tie lines. (c) Seventy-five per cent. (22.)

(a) As a general rule, no. In especially indicated circumstances, yes. (b) Yes. (c) This must necessarily depend upon local conditions. In a general way it might be stated that the capacity of each individual trunk line should be such that their joint capacity would be equal to the average demand of the station, less any load that might be taken up by the feeder which might be connected to another station than the one in question. (4.)

(a, b, c) I would extend certain feeders so that in addition to feeding a section they would serve as tie lines, and would also run a number of these feeders between stations so that in case of a trolley break or other accidents which would make it necessary to cut out a section there would be always some feeders available for tie lines between stations. I would supply at least 50 per cent of the capacity of the stations in the tie lines. (3.)

(a) No. (b) Yes. (c) One-third. (15.)

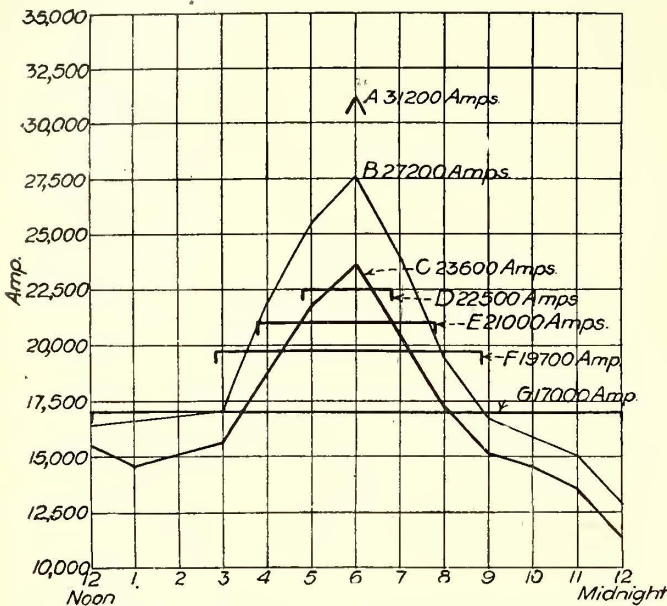
It has been found desirable to operate the stations on flat voltage characteristics, so that any sudden or unexpected demand near any one station will be shared by more distant stations. The feeder copper from the several stations into the tie-sections should be so laid out that the removal from service of one of the largest generating units at any station will not necessitate such lowering of bus-voltage at that station that the schedule speed of the cars will be seriously interfered with. (2.)

(a) No. (b) Yes. (c) One-third. (15.)

It has been found desirable to operate the stations on flat voltage characteristics, so that any sudden or unexpected demand near any one station will be shared by more distant stations. The feeder copper from the several stations into the tie-sections should be so laid out that the removal from service of one of the largest generating units at any station will not necessitate such lowering of bus-voltage at that station that the schedule speed of the cars will be seriously interfered with. (2.)

22. Given a network of street railway lines fed from several 600-volt d. c. stations: If the total system loads are similar to accompanying diagram, and if the morning and afternoon peaks are approximately the same, assuming underground distribution, by using paper insulated copper cables, would you calculate your feeders on the basis of the loads, as per values A, B or C in accompanying diagram, or would you use, say, the 2-hour or 4-hour value D and E and allow the overload capacity of the feeder cables to take care of the system through the peak period?

Would use value D with one spare cable. (3.)
 Calculate value of feeders on basis of value C if only one feeder per section is used. (22.)
 If the distances were short and the controlling feature was the ampere capacity or temperature rise of the cables, should



A—Momentary maximum observed.
 B—Average maximum heaviest month.
 C—Average maximum heaviest 3 months.
 D—2-Hour average of C.
 E—4-Hour average of C.
 F—6-Hour average of C.
 G—12-Hour average of C.

calculate feeders on the basis of the load B; if the lines were long and the line loss was the controlling feature, should calculate feeders on the basis of value D. (4.)

14. What is the best method of getting good fitting combination joint plates, whether from the manufacturers of special work, or made in home shop?

Order from manufacturers, giving rail sections and amount of wear. Then turn over to a blacksmith with a portable forge and upset to exact fit on job. (25.)

From manufacturers of special work. (22, 3, 24, 2, 23.)

I would use the two-hour value and let the cable run overloaded during the peaks. (8.)

Would base our calculations on B. (15.)

We would calculate the feeders for the four months' average one-hour peak, and then the copper would have sufficient overload capacity to take care of the maximum loads that occur. (2.)

23. Can the life of cedar poles be prolonged by treatment? If so, to what extent, and by what method?

Yes, by either brush or tank treatment, but cannot say in the case of cedar poles, what percentage of extra life would be obtained. (4.)

Yes. (15.)

24. What is the best method of testing underground power cables? Interval between inspections and interval between tests?

Insulation test by use of voltmeter in series with conductor made about twice a month; inspections once a month. (3.)

Initial test, high voltage; after that a daily voltmeter test, which will generally detect deterioration before final failure. (20.)

For the insulation test a measurement of the insulation resistance is best. The interval between the inspections and tests will depend upon the importance of the line, possibility of trouble occurring, and the previous condition of the cables as shown by former tests. (4.)

Ordinary voltmeter test daily. (15.)

We have been testing our underground cables regularly for about 14 years. We use for the purpose: D'Arsonal ballistic galvanometer; Ayrton universal shunt box; one-third mfd. mica condenser; 220-volt home-made test tube storage battery, 140 cells; necessary keys, switches, etc. A portable outfit comprising the following pieces of apparatus is used for testing isolated pieces of cable: Special D'Arsonal ballistic galvanometer of Weston v lt-meter type; Ayrton universal shunt box; one-third mfd. paraffin condenser; necessary keys, switches, etc.; line voltage is used for testing purposes. The so-called "Loss of Charge" method of testing for insulation resistance is used with an application that is dictated by our experience. Where earth currents are present this method, which is a ballistic one, is necessary. The more important of our cables we test once a week, others once a month, and still others once in six months or more. Inspection of cables in the manholes is made once in about every three months. (2.)

25. Is the use of galvanized Siemens-Martin steel strand for overhead supports found as satisfactory, both from a lineman's point of view as regards ease of manipulation and from a general manager's point of view as regards reduced maintenance charges, as the use of ordinary galvanized steel cable?

No. (3.)

Use ordinary galvanized steel cable. (22.)

26. Is the San Francisco practice, of putting out fires on wooden poles and crossarms of 13,000-volt a. c. lines by portable extinguishers while the conductors are kept in service, in general use?

We do not use it. (3.)

We have never attempted to put out a fire on the 15,000-volt a. c. wooden pole line until the current was cut out. (8.)

27.—(a.) Is the leasing of the feed-in tap from the underground feeder cable up through the inside of the iron side pole in successful, satisfactory use anywhere in this country? If so, where? (b.) In case this is done, what is the B & S size of the conductor, and what is the preferred insulation of that part of the feed-in tap that passes up the interior of the pole—giving all layers outside of the conductor? (c.) In this particular case is the conductor stranded or solid? (d.) In this same case is a cut-out installed in each feed-in tap, and if so, where is it located?

(a.) Yes, in Philadelphia. (b.) About 300,000 cm. with 6-32 in., 30 per cent rubber insulation, cloth tape, 1/8-in. lead sheath, cotton weatherproof braid outside. (c.) Stranded. (d.) Yes, at the top of the pole. (20.)

Our practice is to bring underground to overhead connections from the main conduit to cut-out boxes on poles through a 3-in. pipe (fiber preferred). Above the cut-out the wires are run open and properly insulated from the pole, using rubber insulated stranded copper wire. From the pole to trolley weatherproof wire is used, of 0000 capacity. (2.)

CAR BODIES

28. Is it better practice to use electric markers in connection with storage batteries on interurban cars than to use regular oil markers?

We consider oil markers preferable. Our system has a metallic circuit, and with electrical markers the battery does not charge properly. (25.)

Electrical markers in connection with storage batteries should not be used on account of danger from fire. We have found that electrical markers wired in connection with trolley circuit in combination with one oil marker on bumpers, using three markers on the rear end are best and safest. (7.) No. (8, 1, 17.)

29. What is the most satisfactory position of the truck centers in relation to the "over all" length of car?

This is somewhat dependent upon conditions, but would say about 1 1/4 ft. to 3 ft. (7.)

Place body bolster as close to end of car as truck clearance on curves will allow. (12, 25, 2.)

Position of truck centers in relation to over all length of car, if possible, should be so there would be a downward stress in center of car. We have found it impossible to get truck centers on city cars far enough apart on account of drop platforms and sills. (12.)

30. Are the ventilating devices on cars more efficient with or without the monitor, or upper deck?

Without upper decks. (1.)

Have no definite knowledge, but think that the possibility of eliminating weight of monitor deck would warrant thorough tests. (5.)

We consider ventilating devices more efficient with monitor decks. (17.)

I believe the monitor type will be replaced with cars so constructed as to eliminate the extra weight necessary for this style of top. It would be better to obtain fresh air from a more indirect source than through any ventilator sash in the side of the monitor. Efforts should be made to ventilate by exhausting the foul air, thus drawing in fresh air. If it is possible to so arrange a device that will cause this suction without moving parts, it would seem that it could best be arranged at the end of a car roof without monitor, better than through the sides of the upper deck. To successfully do this, however, on a surface car with a maximum speed of about 10 to 12 miles an hour is, to my mind, the whole problem. (2.)

31. What is altogether the most satisfactory disinfectant to be regularly used on the interior of closed city cars? Interurban cars?

We use "Chloro Naphtholeum." (25.)

None is thoroughly satisfactory. (7.)

We use with excellent results "Excelsior" disinfectant. (3.)

Kilitol. (1.)

Preparation derived from coal tar more pleasing and lasting in an enclosure than formaldehyde. Spraying each time car is cleaned is sufficient for city cars, and for interurban cars something in cake form to hang in car in addition, may be advisable. (5.)

In our experience, formaldehyde sprayed in all parts of car is best. (17.)

32. In your particular locality, approximately, what actual saving in cost for power can be effected on one car for one year, or for 100 miles run, by reducing the dead weight of an average city car by 100 pounds?

Estimated \$4.00 per 100 pounds per year for city car operating about 40,000 miles. (20.)

Approximately 0.3 kw hour per 100 lb. per 100 miles. (11.)

33. What is the best method of car washing with special reference to the preservation of outside varnish?

We use "Amberzo" to clean cars and then wash off well. Have found this to be very good. (25.)

With clean, cold water. (7.)

For a number of years have used Columbia oil soap, as, with care, this removes the dirt without the least harm to the varnish, and is in turn easily washed off with water. (3.)

Flushing. (11.)

Imperial Car Cleaner. (1.)

Use clear, cold water through brush—hose connected directly to water main. (6.)

We use a linseed oil soap of medium strength and mix half

pound of soap to one gallon of water for a stock solution and dilute to suit work. If cars are kept in good order the stock should be diluted with equal quantity of clear water, but if very dirty, may be used full strength. We use sponge and brush. A very important point is to rinse well with clear water. Natural finish inside should be rubbed dry with chamois skin. (12.)

If dirt is such as can be removed by water alone, good, clean water, free from alkali, no doubt is not injurious to varnish, but we think that car cleaners can be used which, while they may not prolong the life, are not damaging, and with this manner of cleaning, water does not soak into joints. (5.)

Wash car once a month with linseed oil soap, using only clean water in the intervals. (17.)

First remove all dirt and dust by the application of soap and water, the soap containing only sufficient alkali to saponify the oil or grease present. Wash copiously with water and after all grit has been removed an oil cleaner should be applied, of which there are several good ones on the market. We have recently tried a so-called soluble oil which when mixed in the proportion of one part oil to five parts water makes an excellent emulsion. A small quantity of ammonia added to this provides cleansing properties that we have found advantageous. (2.)

35. What is the average life of a closed passenger car, an open car, and a service car?

Fifteen years in each case. However, it has been our experience that cars get out of date and are scrapped or sold before they are worn out. (25.)

Fifteen years, twenty years and ten years, respectively. (7.)

Closed cars used about six months in the year should last at least 30 years with proper care; an open car, under the same conditions, 25 years. (3.)

Twelve years. (11.)

We are still running closed cars purchased in 1893, yet are having to make repairs on modern semi-convertible cars purchased in 1904-5. The first have all been rebuilt once, some twice, and the last will soon have to go through the shop for heavy repairs. Open cars purchased in 1893-4 have all been rebuilt twice and do not make as many miles in the year, so do not see how to arrive at a definite answer. (12.)

Average closed or open car, if exposed to weather when out of service, 16 years; protected under sheds, 20 years. Service cars 10 to 12 years. (17.)

36. What percentage of the original cost each year should be deducted for depreciation?

Twenty per cent, the first year and 10 per cent, from the value of the car each year thereafter. (25.)

Depreciation should be figured at a continually increasing rate. Having agreed upon the ultimate scrapping value of the car, and the probable duration of its usefulness, the rate of depreciation should increase from 0 per cent, to 95 per cent, (if 5 per cent, has been fixed as the scrapping value). In other words, the depreciation can be figured by plotting a logarithmic curve. (3.)

Fifteen per cent. (12.)

Depreciation greatest the first year, but would average from 5 to 6 per cent, on passenger cars and from 8 to 10 per cent, on service cars. (17.)

37. What value is placed on a car after it has outlived its usefulness?

About 20 per cent. (25.)

Of no value whatever. Should be destroyed. (7.)

The average scrap value is about 5 per cent, of the first cost. (3.)

The value of the iron, glass and brass trimmings. (6.)

38. Which is preferable on strap-wound armatures, one or two part coils?

One-part coil for motors of 75 hp or under. (25.)

The two-part coils are giving good satisfaction. (7.)

One-part coils. (1, 3.)

One-part coil is preferable because the trouble at the connection of the parts of the coil overbalances the advantage gained by being able to replace the top half of the coil without disturbing bottom half.

39. From experience of the past year with vacuum process of coil impregnation, is such treatment considered more or less valuable than it was a year ago?

More valuable. (3, 7, 10, 5, 17, 2.)

40. For motors of 50 hp or under, are commutating fields desirable?

Do not think so. (25, 3.)

Yes. (11, 1, 6.)

For motors of 50 hp or under very doubtful. (21.)

41. Does it pay to furnish the depot repairmen small tools, such as hammers, monkey-wrenches, pliers, screw-drivers, etc.?

Yes. Because labor is cheaper when tools are furnished. (25.)

Yes. If the proper check is kept upon them. (7.)

Small tools should be the personal property of each workman. Wrenches of all special kinds necessary for the work should be furnished by the railway company. (3.)

Yes. (11, 6, 12, 5, 2.)

Furnish depot repairmen all small tools except hammers, pliers and screwdrivers. (17.)

42.—What results have been obtained from the use of automatic slack adjusters, and what has been the saving of labor by use of same?

The saving in shoes, wheels, motors, current, renewals of adjusters, labor and accidents should be ample to justify their use. (21.)

With leverage not entirely suitable, we find it necessary to adjust by hand only once during life of shoe, whereas without, adjustment must be made each night. (5.)

Not recommended. (1.)

The brakes are set so tightly by the adjuster when car is heavily loaded that when load is off the brakes are too tight. (6.)

With properly designed trucks and brake rigging, automatic slack adjusters are valuable in maintaining better braking cars and increase the length of periods between inspection and adjustment of brakes. (2.)

43. What is the average life of a car body?

About 15 years. (25, 7.)

Sixteen to 20 years according to care given them. (17.)

44. Average life of equipment?

We replace motors with newer and better equipment, not because the old are worn out, but because it pays from a maintenance standpoint. (25.)

Can be kept in condition indefinitely, modern improvements not considered. (7.)

Six to eight years—see my answer to 35. (12.)

45. Which is the best policy, viz.: to continue using an expensive tin base babbitt metal as used with grease lubrication after your motors are converted to oil lubrication, or to use a cheap lead base metal?

Use tin base babbitt metal. (25, 7, 3, 1, 8, 6, 5, 17, 2.)

Cheap lead base metal. (11.)

Lead base is more economical on low-speed cars. (12.)

46. Do you use either ball-bearing or rolling center plates or side bearings; and, if so, what effect have you noticed on wheel flange wear, power consumption and saving in center plate lubrication?

We are using Baltimore center bearings on our newer cars, and consider that the wheel flange wear is reduced. (25.)

Using them on one car. Note considerable decrease in flange wear, which decreases in power consumption. (7.)

There does not appear to be any special merit in ball or roller center bearings. (3.)

Ball-bearing center plates save wheel flange wear, power and center plate lubrication. (1.)

Effect on flange wear is good. Saving in center plate lubrication about \$1.72 per car per year. (6.)

We have ball and roller bearings in service, giving excellent results in flange wear by overcoming thick and thin flanges, flanges wearing equally. Requires less current, from ordinary observation. Center plate lubrication eliminated entirely. (17.)

47. Have you ever tried the use of a recording meter under the car for car mileage records?

In the cab. (1.)

Yes. (6.)

48. How many motors should one armature winder take care of—average conditions on a road having, say, 25 4-motor equipments and 75 double motors, city and suburban traffic?

About 150 motors, if of a late type. (25.)

With good fields, brush holders set at proper point, correct brush holder spring tension, grooved commutators, motor worked within its capacity and a line voltage for which it was designed, together with proper operation by motor-man, three winders could take care of this work. (3.)

We have 27 4-motor equipments and 78 double equipments, most of which have been in service for six or seven years, and they are taken care of by one armature winder, who spends about half his time on armature work. (8.)

One winder should handle the number indicated with spare armatures amounting to 5 per cent. (5.)

49. What should determine the minimum diameter of a railway motor commutator, that is, when should it be scrapped on account of being too small?

Should be scrapped when commutator segments become narrow enough to cause excessive sparking. (25.)

On Westinghouse No. 49 and No. 56 commutators they should be worn down to 80 per cent, before scrapping. (3.)

Three-sixteenths inch thickness of copper. (11.)

One-fourth inch thick. (1, 6.)

If mica segment shows good, may be worn within 1/8 in. of mica rings at end of bars, but if the built up or micanite is used between bars 3-16 in. to 1/4 in. is close enough. (12.)

50. What has been your experience with motor fields and armature coils wound with asbestos-covered wire? Do you think impregnation of such coils is necessary in addition to being wound with asbestos wire?

We consider the asbestos-covered wire is a moisture absorber and causes almost as much trouble from grounding as it saves by being fire-proof. We have never impregnated asbestos-covered wire. (25.)

Think the motor field wound with cotton-covered wire properly impregnated is as good as when wound with asbestos-covered wire. Do not know as to armature coils. (7.)

Asbestos-covered wire fields that have been impregnated properly will outlast any other field. On account of the frequency of armatures getting upon the poles, it is a matter of conjecture as to whether asbestos-covered wire is more desirable than cotton-covered wire. Impregnation is of immense value to any coil, as it prevents the vibration, increases the insulation and keeps out moisture. (3.)

Wires in fields become loose and chafe one another. Yes. (6.)

Consider satisfactory on field coils but not on armature coils. Think they should be impregnated. (5.)

51. Is not the use of asbestos-covered wire for motor and car wiring sufficiently important to justify the manufacturers of asbestos covered wire to so perfect their product as to enable it to stand the necessary insulation test required of wire used for such purposes?

Yes. (25, 7, 3, 6, 5.)

52. What are the advantages, if any, of asbestos wire-wound field and armature coils over those wound with cotton-covered wire? Do you think there is anything harmful

in such construction due to liability of overloading of motors?

The asbestos wire-wound field withstands a greater temperature with safety. Nothing harmful in such construction provided the motors are used on the same work as formerly. (25.)

Should stand more heat and think they would be overloaded anyway if conditions were such that it became necessary, no matter with what they were wound. (7.)

Asbestos-covered wire should show higher insulation results. (3.)

No advantage. (1.)

The advantages are; the insulation won't carbonize and cause short circuits. No. (6.)

Will evidently stand more heat and do not see that additional harm will result from overload. (5.)

53. What have been the results of using babbitt-lined journal brasses on heavy high-speed interurban equipment?

We have had no trouble. (25.)

Think that there should be a very thin babbitt lining in journal brasses, just enough to form a bearing when starting a new brass. (7.)

Babbitt-lined journal bearings are much superior to unlined bearings. Experience has indicated that the sides of M. C. B. bearings should be carried down a little farther than is now standard to prevent the heavy emergency brake pressure from occasionally pushing the journal partially out of the bearing and causing the bearing to wear to one side. (21.)

Satisfactory. (1.)

Good. Facilitates the seating of the bearing. (6.)

Case harden them. (5.)

54. What is the best brake shoe for steel wheels?

Plain gray iron, medium hardness, with no insert. (7.)

Streeter shoes. (3.)

Steel shoe with inserts reinforced in the back with two steel rods. (8.)

Medium hard cast iron shoe, chilled about 3 in. on each end and steel back. (6.)

Hard iron shoe with chilled ends. (17.)

55. State best method of boring armature bearing true. Give any treatment to increase their life. *

We have rolled the inside surface of our bearings. (25.)

Rolling or compressing of the babbitt in bearings makes metal more homogeneous; consequently longer lived. (7.)

Armature bearings should be bored slightly out of center so as to give increased clearances over the holes at the bottom of the armature. (3.)

One method observed by the writer for increasing the durability of armature bearings is to bore the bearing smaller than the shaft and then press it out to proper size by forcing through it a roller device similar to a boiler tube expander. The roller device is attached to a drill press. This method was developed at the shop of the Allegheny Valley Street Railway Company at Tarentum, Pa. (21.)

Chuck bearing in jig on lathe and bore with expanding bit in tail stock—babbitt to size when possible. (6.)

We have designed a new chuck with which to expand the babbitt on mandrels for the purpose of hardening and tightening the babbitt in the shell. If the bearings are not too large we recommend using a bearing with a tin babbitt lining not more than 1-16 to 1/8 in. thick. (17.)

56. What is considered good mileage for cast iron brake shoes?

About 2,500 miles. (25.)

Five thousand miles with air brakes and 7,000 miles with hand brakes. (7.)

Seven thousand miles on interurban. (1.)

Seventy-six car miles per pound of brake shoe purchased. (11.)

About 310 miles per pound worn off. (6.)

Seven thousand miles, city. (17.)

57. What is considered good mileage for trolley wheels?

About 12,000 miles. (25.)

Four thousand five hundred miles interurban and 7,500 miles street. (7.)

Six thousand miles for 4 in. copper wheel and 15,000 for 6 in. copper wheel. (11.)

Six thousand miles on interurban. (1.)

We get an average of 9,500 miles for trolley wheels in city service and 4,000 miles on interurban service. (8.)

A 6-in. wheel with 1-in. bearing, 7,000 miles. (6.)

Ten thousand miles approximately. (17.)

58. How much of the wear on the truck brake rigging and the resulting brake trouble, and the wear on the wheel flanges when in contact with the shoes is due to the lost end motion of the axles in its M. C. B. bearings?

We have not considered that the shoe wore the wheel flange to any appreciable extent. (25.)

Dependent upon the design of the truck and brake rigging, and also whether the flanged or plain shoe is used. (7.)

The lost end motion of the axles in the M. C. B. bearings does cause much brake trouble, due to the wheels pulling the shoes sidewise, both when the shoes are running loose and when they are applied to the wheels. The rubbing of the side of the wheel flanges against the sides of the flanged cavities in the shoes when the brake is not applied, must cause a considerable loss of current and some additional wear to the wheel flanges. (21.)

59. Will a car ride better if the excessive end-motion of the axle in its M. C. B. bearings is eliminated?

Yes. (25, 7, 21, 6.)

No. (1.)

60. What is the best method of preventing rapid wear on the bolts and other moving parts of the truck brake rigging?

We bush the brake pin holes and then replace the pins when worn. (25.)

The case hardening of the pins and levers will help, but a case hardened pin pressed into the lever is better. (7.)

Suspend the brake rigging properly, oil all parts frequently and use case hardened pins and bushings. (3.)

Put a coil spring on every bolt. This will prevent the bolts and other parts from vibrating. The end motion of the axles in their bearings must also be eliminated. Tests made by the writer show that more than 95 per cent. of the wear on the brake rigging of the trucks, running on surface roads, is due to grit sifting in between moving and rattling parts. Springs keep the parts together and thus keep the grit out; they prevent rattling and moving of one surface upon another, and thus stop the cutting away of the moving parts of the brake rigging. (21.)

Bush pins with case hardened steel and use case hardened steel pins. (6.)

Neat fits and case hardening. (17.)

61. What methods should be used to prevent excessive wear on the ends of M. C. B. journal bearings and the resulting side motion of the truck frame with reference to the axles and wheels?

The truck frame should be kept in square and wheels should be known to be true on the axles and in perfect gage. (7.)

There are two methods of preventing excessive end motion of the axle which the writer can recommend. First, the journal bearing wedge should be made of cast-steel and have a hood cast integral with it, which extends down over the end of the axle, and there should be a bronze bearing plate between this hood and the end of the axle. This device has been much used, but should be improved by making the bearing plate adjustable so that the end motion of the axle can be limited to not over 1/8 in. The second method is to use the motor as a connecting link between the axle and the truck frame to check the motion of the truck from sidewise movement with reference to the axle.

65. In using steel wheels, what mileage should be had between turnings, what wear from service, and how much should be turned off?

About 25,000 miles between turnings, approximately 1/8 in. in diameter of wear. We turn down from 3/8 in. to 1/2 in. in diameter. (25.)

About 45,000 and as little to be turned off as possible to obtain the contour of the flange. (8.)

66. What is considered good mileage for solid steel wheels, steel tired wheels and cast iron wheels, allowing three turnings for steel?

For steel and steel tired wheels, an average of about 90,000 miles; cast iron wheels, about 40,000 miles. (25.)

Two hundred and fifty thousand miles, 220,000 miles and 45,000 miles, respectively. (7.)

Steel wheels should give at least 150,000 miles, and cast iron wheels should give at least 30,000 miles. (3.)

Forty thousand miles for cast iron wheels on 12-ton car. (11.)

Depending upon service conditions—cast iron wheels should average 40,000 miles. (6.)

PURCHASING AGENTS.

67. Should there not be a separate section in the convention for the deliberations and decisions of the purchasing agents of the American Street & Interurban Railway Association?

We do not think a separate section in the convention for the deliberations and decisions of the purchasing agents' division necessary, for the reason that the functions of the purchasing agent are peculiar to him, personality and not system entering greatly into the results he obtains, and though not directly in the operating or engineering branches, his work bears on each, still problems do not confront him as they do the departments named, which would be benefited by a mutual interchange of ideas. Consequently, our opinion is that very little benefit would be derived from making a separate section for the purchasing agents. Instead, it is better for them to affiliate with the engineering section, which is the prevailing arrangement. (3.)

68. Should the storekeeper be under the supervision of, and responsible to, the purchasing agent or engineer?

Preferably to the purchasing agent, where the local conditions will permit. (3.)

Neither. (14.)

69. To avoid the heavy loss by dead stock in storeroom, how often should the purchasing agent and engineer fix arbitrary standards of material?

No given time should be agreed upon for this purpose; instead, it should be taken care of as often as is considered necessary, for otherwise the greatest accumulation of dead material might accrue between the set periods. If the engineer contemplates the change of a standard item, the purchasing agent should be immediately notified to this effect. (3.)

Yearly. (14.)

70. How long should the agreement last?

One year, except in special cases. (14.)

Mr. F. R. Wilhelm has been appointed superintendent of the Monongahela Division, No. 4, of the Pittsburgh (Pa.), Railways in charge of the operation of cars from the Glenwood, McKeesport and Rankin car houses. Mr. Wilhelm started as a conductor with the Birmingham Traction Company, Pittsburgh, Pa., in September, 1891, and remained in that capacity until April, 1898, when he was chosen night dispatcher for the Monongahela Street Railway. When the Monongahela Street Railway was absorbed by the Pittsburgh Railways on Jan. 1, 1902, Mr. Wilhelm was appointed superintendent of the old Monongahela Division, and has since remained in this position.

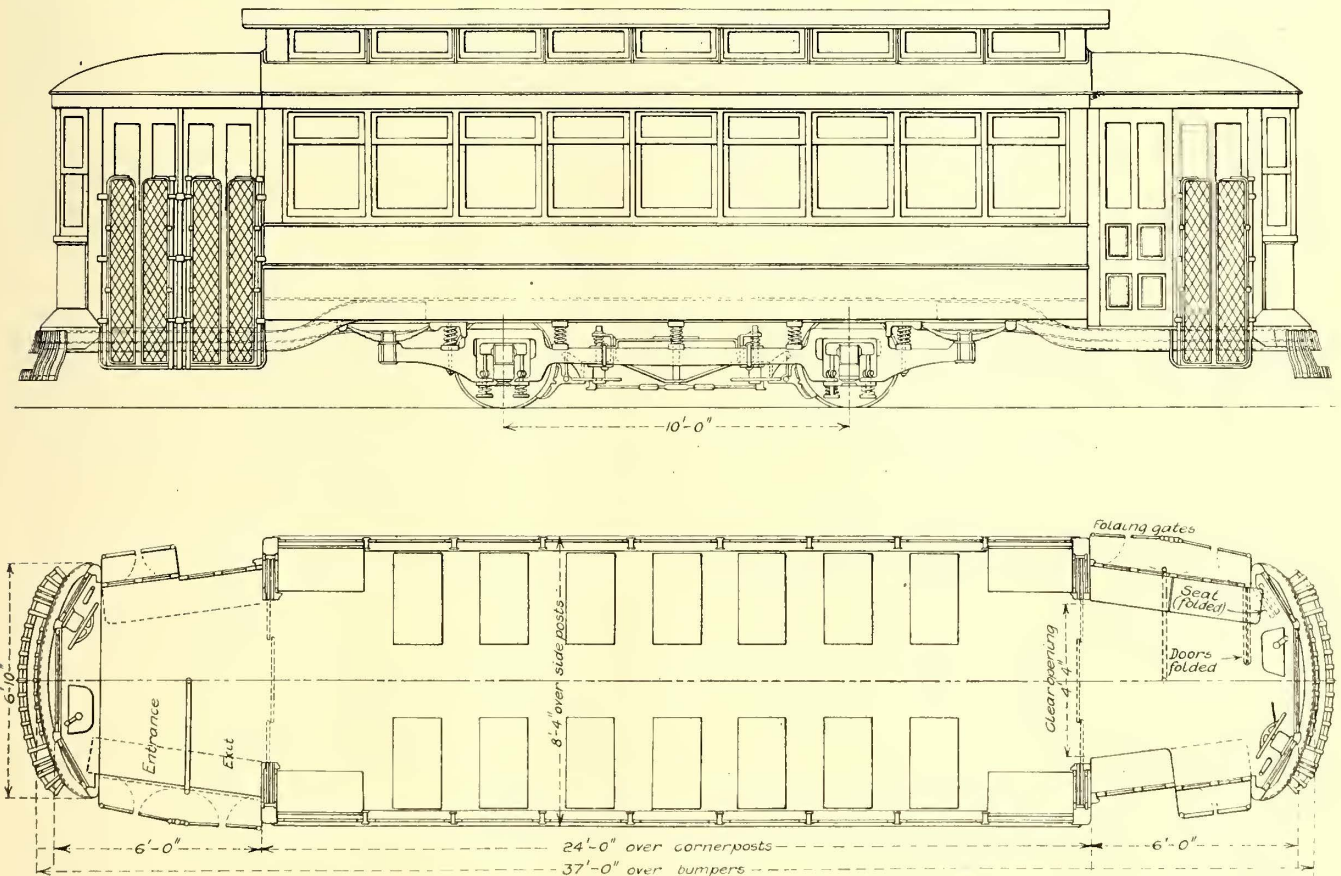
RADIAL AXLE, SINGLE-TRUCK CAR SEATING FORTY-SIX PASSENGERS

The St. Louis Car Company has just completed a single car built for the Birmingham Railway, Light & Power Company, of Birmingham, Ala., which is to be placed in service immediately. The car was designed by Ford, Bacon & Davis, of New York, engineers of the railway company, with a view of its ultimate adoption as the standard type for city service in Birmingham. It includes, so far as practicable, the best features of the principal types of cars previously designed by the engineers for service in other cities, but all of the details, of course, should not be considered as universal in their application, since the conditions of service in Birmingham are quite different in many respects to those existing in other cities.

As will be seen from the accompanying drawings, the car is of the single-truck, semi-convertible type, with long double-end platforms which will enable a prepayment system of fare collection to be used if desired. There are 14 double cross-seats and four double corner seats inside the body and

sible distance from the exit and entrance steps. Passengers thus consume the minimum time in boarding or leaving the car. Both platforms have drop-end sashes and are enclosed on both sides with two-part folding storm-doors folding back against the controller and brake wheel and leaving the main area of the platforms entirely clear. A removable pipe partition railing is used on the rear platform, dividing the wide step into an entrance and exit. This partition extends from the edge of the platform to the center line of the car, leaving ample room on the inside for an entrance aisle. To prevent boarding and alighting accidents a modified form of Minneapolis gate will be used to close the opening above both steps on each platform. The gates are arranged to fold inwardly and will be used whether or not a prepayment system of fare collection is adopted.

The car body is 24 ft. long over corner posts and 8 ft. 6 in. wide over drip rails. It has a monitor deck roof, and below the windows the side panels are slightly undercut. The cross-seats are 32 in. long, giving an aisle 25½ in. wide. A clear opening of 4 ft. 4 in. is provided for the end doors, which are of the double sliding type.



Plan and Side Elevation of Radial Truck Car for Birmingham, Ala.

drop-seats on the front and rear platforms. The front platform will seat six persons, and if the prepayment system of fare collection is not used four persons may be seated on the rear platform. This gives a maximum seating capacity of 46, or two more than can be seated in an ordinary double-truck city car.

The platforms are 6 ft. long and the floors are dropped 10 in. below the floor of the body. The principal reasons for designing the car with drop platforms were: (1) greater safety in entrance and exit, and (2) greater speed in loading. A passenger entering the car can take the last step after the car is started, while if the platform is on a level with the car floor two steps must be taken before it is safe to start the car. The drop platform design utilizes the platform area to the same advantage for seating or standing room as if the floor was level with that of the car body. In addition, the design places all the seats the shortest pos-

sible distance from the exit and entrance steps. Passengers thus consume the minimum time in boarding or leaving the car. Both platforms have drop-end sashes and are enclosed on both sides with two-part folding storm-doors folding back against the controller and brake wheel and leaving the main area of the platforms entirely clear. A removable pipe partition railing is used on the rear platform, dividing the wide step into an entrance and exit. This partition extends from the edge of the platform to the center line of the car, leaving ample room on the inside for an entrance aisle. To prevent boarding and alighting accidents a modified form of Minneapolis gate will be used to close the opening above both steps on each platform. The gates are arranged to fold inwardly and will be used whether or not a prepayment system of fare collection is adopted.

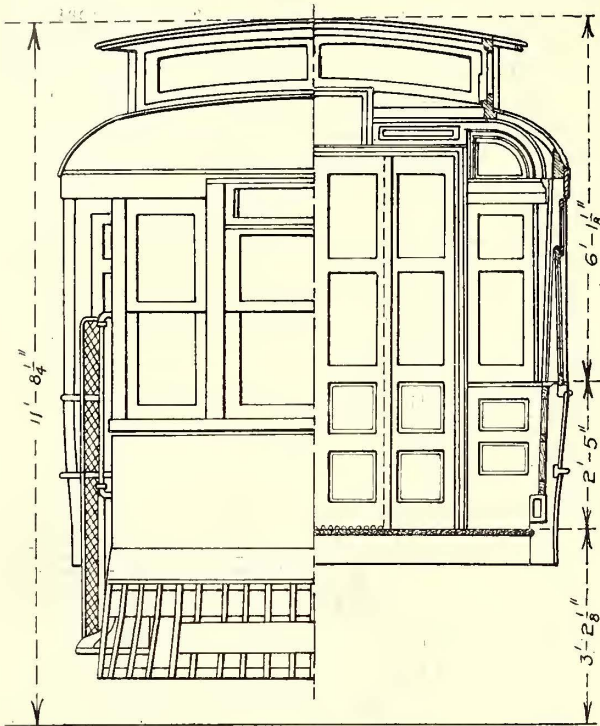
The car body is 24 ft. long over corner posts and 8 ft. 6 in. wide over drip rails. It has a monitor deck roof, and below the windows the side panels are slightly undercut. The cross-seats are 32 in. long, giving an aisle 25½ in. wide. A clear opening of 4 ft. 4 in. is provided for the end doors, which are of the double sliding type.

The great overall length of the car and the minimum center radius of the special work in Birmingham made it essential to use double trucks or a radial-axle type of single truck. After a careful study it was decided to use a single radial-axle truck of the Warner type, built by the St. Louis Car Company. These trucks have had an extended trial in England and are being largely used there, although this is their first application in this country. This truck has a wheel base of 10 ft., which is sufficient for easy riding of a 37-ft. car. The truck can be pushed by hand around a 35-ft. radius track curve. The truck could as well have been designed for a 12-ft. wheel base, which would permit the use of a correspondingly larger body and greater seating capacity. A car seating a maximum of 46 passengers, however, was considered nearly ideal for the conditions as they exist in Birmingham, and the 10-ft. wheel base truck was therefore adopted. The truck carries two motors.

The estimated weights of the car are as follows:
 Body 15,000 lb.
 Truck, including hand brakes..... 7,500 lb.
 Motors 7,000 lb.

Total weight, empty 29,500 lb.
 Weight, per passenger seat..... 641 lb.

The weight of this car is estimated to be about one-half that



Cross Section of Radial Truck Car Designed Especially for Birmingham, Ala.

FUEL OIL BURNING AT THE GEORGETOWN STATION OF THE SEATTLE ELECTRIC COMPANY

The Seattle Electric Company receives power for the operation of its railway from high tension transmission lines and from a large steam relay generating station at Georgetown, a suburb of Seattle. The power station building at Georgetown is a concrete structure which, together with the installation, was designed and erected by the Stone & Webster Engineering Corporation. The structure rests on a concrete monolith supported on piles set on 24-in. centers under the engine room, and in rows of six under the boiler house walls. The general dimensions of the building are: Engine room, 64 ft. 3 in. by 79 ft.; boiler house, 73 ft. by 151 ft. A floor plan of this station showing the arrangement of the turbine room and the boiler house with the firing aisle at right angles to the dividing wall was presented in the *Electric Railway Journal* for March 27, 1909, page 538. The areas per kilowatt of station capacity are, 0.43 sq. ft. for the engine room and 1.01 sq. ft. for the boiler room.

A list of the principal apparatus of this station follows:

One 8000-kw and one 3000-kw 13,800-volt three-phase Curtis vertical steam turbo-generators.

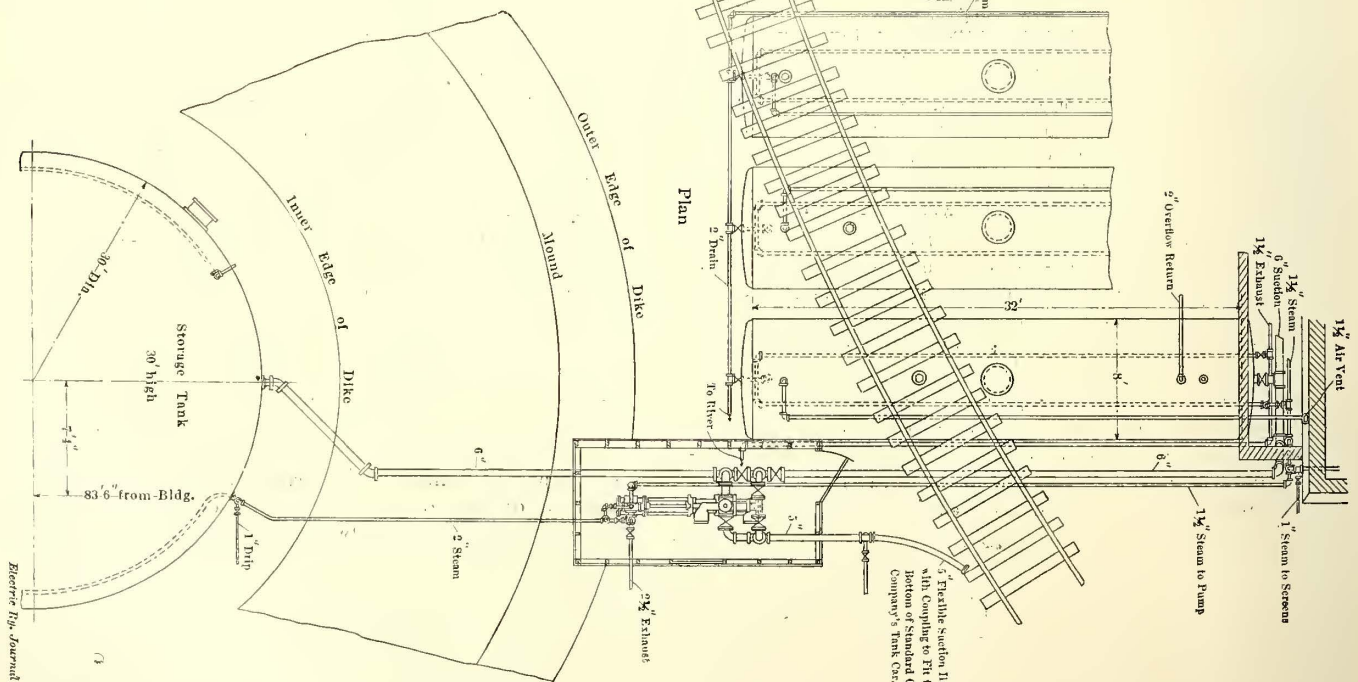
Two 500-kw G.E. synchronous motor-generator sets 13,300 volts, three-phase to 600 volts d.c.

Two 500-kw G.E. transformers 13,200 volts three-phase to 2200 volts two-phase for lighting and two-phase power.

One 30-kw G.E. 6.6-amp tub transformers for street lighting.

Two 100-kw G.E. transformers 13,200 volts three-phase, 2200 volts two-phase; used for station lighting and power.

An interesting feature of this plant is the use of fuel oil for steam making. The boiler equipment comprises 12 Sterling vertical water-tube boilers of 470 hp each. The steam is taken out of the rear upper drum and supply water is fed in through the center upper drum. The blow-off is taken off from the bottom front drum. The boilers are fitted with plain grates and oil burners. Double ash pits are provided under each furnace divided longitudinally into two parts by a wall extending from the grate to the mouth of the the



Seattle Electric Company—Plan of Storage Tank and Fuel Oil Pipe Connections at Georgetown Station

of a double-truck four-motor car of the same seating capacity and equipped with air brakes as used in Birmingham.

Before construction began the design received the careful consideration and approval of A. H. Ford, president, and G. H. Harris, superintendent of the Birmingham Railway, Light & Power Company.

pit, thus reducing by one-half the amount of cold air which would enter the furnace while the ashes were being removed in event of it being necessary to burn coal.

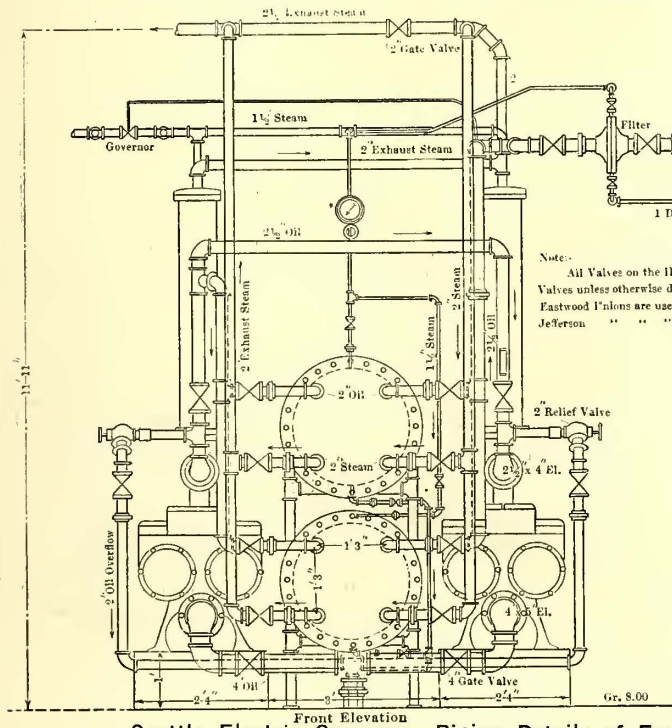
A ground plan presents the arrangement of the oil-tank system for the storage fuel. The main tank, 30 ft. in diameter and 30 ft. high, is located with its center 83 ft. 6 in

from the power station wall. The oil, as received from tank cars on a nearby siding, is forced into the storage tank by a small steam pump. The oil supply comes from California by boat to Seattle, and there it is loaded into tank cars for transfer to the power plant. The oil delivery pipe leading to the boiler house is 6 in. in diameter. The boiler house supply is first led through three auxiliary tanks, each 8 ft. by 32 ft. These tanks are buried underground close to the boiler house wall, so that the oil may be unloaded into them directly from cars standing on a track above. The capacity of these auxiliary tanks is 36,000 gal. and that of the main storage tank 133,000 gal. The oil is forced to the burners by either of two duplex pumps and distributed through oil mains ranging from 2½ in. to 1½ in. in size. These pumps

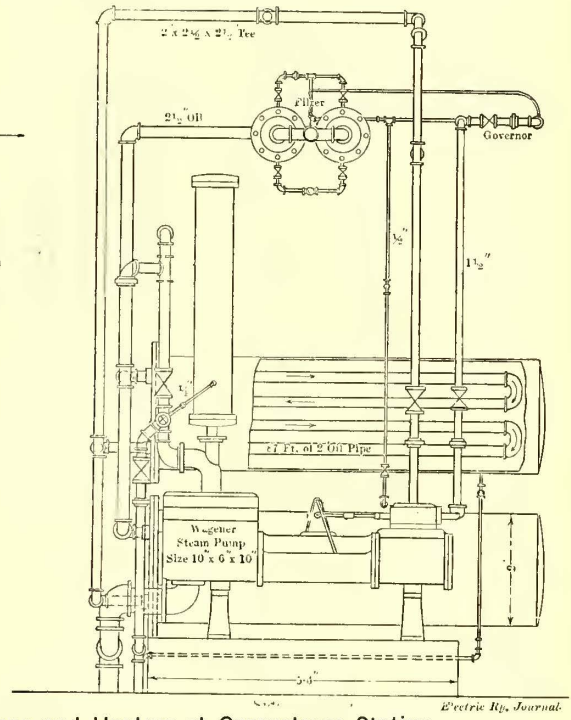
RULING IN ELMIRA, CORNING & WAVERLY RAILWAY FARE CASE

The Public Service Commission of the Second District of New York has announced in an opinion by Commissioner Decker its decision in the case of C. E. Wheaton against the Elmira, Corning & Waverly Railway Company of Waverly, N. Y.:

This company charges a 10-cent fare for about 3 1/7 miles between Holbert's Crossing and Waverly, equal to 3 2/5 cents per mile. It charges the same fare between Waverly and all points west of Wilson's Crossing including Holbert's Crossing. Between Wilson's Crossing and Chemung village (west end) it charges a 5-cent fare for a distance of 2 4/5



Seattle Electric Company—Piping Details of Fuel Oil Pumps and Heaters at Georgetown Station



have cylinders 10 in. by 6 in. by 10 in. The pumps force the oil through steel cylinders through which exhaust steam is piped, and in this way the oil, before being fed to the boilers, is heated to about 180 deg Fahr. When thus warmed it flows and atomizes more easily.

The oil is burned in an external-mixing burner designed by the company engineers and made in its shops. This burner delivers a flat stream of oil, directly under which is a flat stream of steam. The oil and the steam mix before reaching the ignition point and the steam mechanically breaks the oil into small particles, spreading the burning oil into a wide flame. The steam used for this purpose is taken directly from the superheated drum at 180 lb. pressure and 150 deg. of superheat. With this method of burning, which has been evolved after a considerable number of preliminary trials, the boilers show an evaporation of 14½ lb. of water per pound of oil, as fired.

miles and has fixed this fare limit to accommodate travel to and from Chemung. The same reasons that induced the company to put its Chemung 5-cent fare limit at Wilson's exist for placing the limits of its Waverly 5-cent fare at Holbert's.

The opinion states that assuming the 10-cent fare between Waverly and Chemung (west end), 4 2/3 miles, is not unreasonable, it is apparent that a 10-cent fare to or from Waverly becomes too high a short distance east of Chemung. The commission does not disturb the 5-cent fare from Wilson's to Chemung or return, but it does hold that on passenger traffic between Holbert's and Waverly and between points east of Holbert's and Waverly where a 10-cent fare is charged, the fare of 10 cents is unjust and unreasonable and must not during a period of at least one year exceed 5 cents per passenger. The order is limited to one year on account of the company's present poor financial condition, and it has leave to apply and show cause for modification or abrogation of the order at any time before the conclusion of that period.

To reduce the fire hazard in the car house from heaters left in circuit inadvertently, the trolley pole should be pulled down. This, however, interferes with the ready removal of the cars under power in case of fire. To obviate both horns of the dilemma a shield of wood or other insulating material can be slipped between the trolley wheel and wire. This shield could be fitted with a long handle so that it could be easily slipped into place or removed from the floor. It would resemble a hoe in general appearance, but should be of such a shape top and bottom as to retain its position on the wire when under tension.

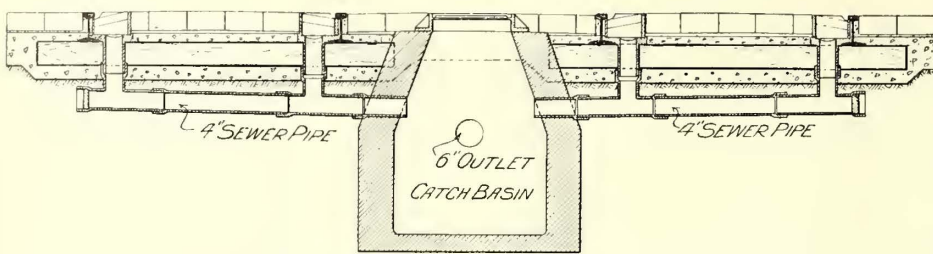
When the company's contemplated extension of service to the center of Waverly shall be effected the question whether the fare limit for Waverly traffic should be brought eastward a short distance may be raised. It appeared in this case that the complainant is trustee of a school district and that he applied originally to the company for a school commutation rate between Waverly and Holbert's Crossing and intermediate points, but his application was refused, and he then brought complaint to the commission against the 10-cent fare applying on all passengers.

TRACK DESIGN OF THE SEATTLE, RENTON & SOUTHERN RAILWAY

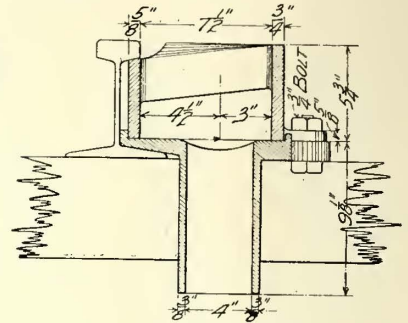
During the past summer the Seattle, Renton & Southern Railway, which operates an interurban line out of Seattle, Wash., has relaid and extended its double-track entrance to the city of Seattle on Fourth Avenue. The design of the track, which has been approved by the board of public works

charging into brick catch-basins built beneath the devil strip. The catch-basins have 6-in. outlets to the city sewer system.

The work of constructing the Fourth Avenue double-track line of the Seattle, Renton & Southern Railway included the design and installation of two double-track narrow-gauge cable-line crossings with the James and Madison Street lines of the Seattle Electric Company. The headway on these



CROSS SECTION SHOWING SUMP AND DRAIN TO CATCH BASIN



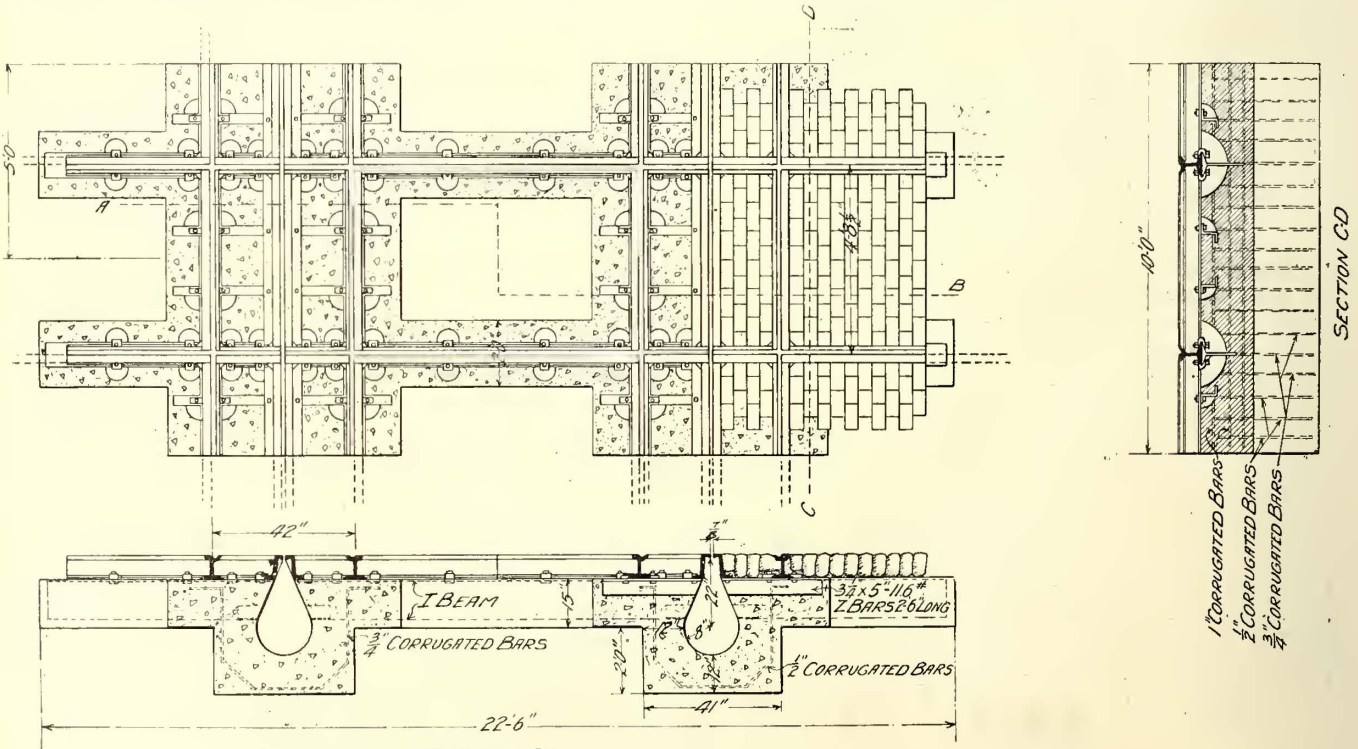
DETAIL OF SUMP

Seattle, Renton & Southern—Design of Drainage for New Track

of Seattle, is illustrated. This track is laid with 7-in. 80-lb. T-rail supported on wood ties enclosed in concrete. Fourth Avenue is within one of the regrade districts of Seattle. Originally the grades on this street were very abrupt, but now the profile is comparatively even although there is a steady grade throughout the length of the street within the business district. Because of this grade it became necessary in designing the track to provide ample means for draining the water which might be brought in by the cross streets and which naturally followed along the flange groove

cable lines approximates 60 seconds and the loads are heavy. Because of this service and for reasons of economy a very complete foundation was designed to carry the track intersections at each of these streets. An accompanying illustration shows the general dimensions and constructional features of one-half of one of these crossings.

The Fourth Avenue line of the Seattle, Renton & Southern is laid with 80-lb. 7-in. T-rail, except at the special work where a 90-lb. 7-in. grooved rail is used. This same rail also is used for the cable tracks. The slot rail is 7 in.



Seattle, Renton & Southern—Design of Cable and Trolley Track Crossing

close to the rails. The connections provided for furnishing this drainage are clearly shown in the illustration.

At each break in grade where water would collect on the track a substantial drainage system has been constructed. Water is led from the flange groove through cast-iron gratings designed to be inserted in the pavement and replace nose bricks. These gratings are 16 in. long and 9 1/8 in. wide installed close against the side of the rail, as illustrated. Each grating is bolted to a cast-iron pipe head which affords a 4-in. connection to lateral sewer-pipes dis-

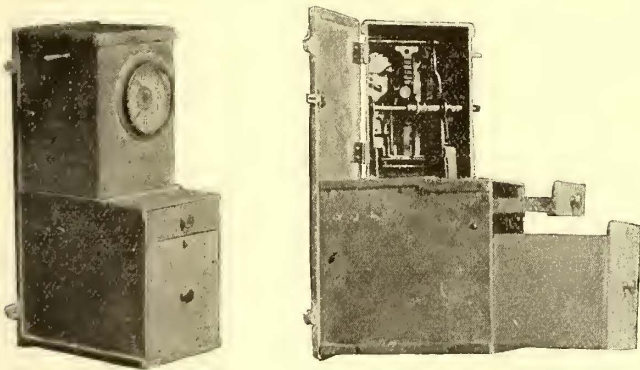
tributing into brick catch-basins built beneath the devil strip. The principal rail-supporting members of this type of cable-track crossing are 24-in. 80-lb. I-beams placed beneath the trolley rails, and Z-bars weighing 11.6 lb. per foot used as ties for the cable rails. Track rails are secured to the ties and steel supports with wedge clips held in place by 1-in. bolts. The clips are 2 in. and 3 in. wide and those at the rail intersections are slotted and provided with taper keys for minor adjustments. The rail structure, with its heavy I-beams and Z-bar ties, is supported on a rein-

forced concrete foundation which also forms the cable conduit. The conduit has a vertical section 22 in. deep and 8 in. wide at the running height of the cable. The heavy concrete foundation is reinforced with 1-in. corrugated bars laid horizontally and ½-in. and ¾-in. corrugated bars placed vertically around the cable conduit. A 1:3:5 mixture of cement, sand and gravel was used for concrete. The street surface above this interesting cable crossing is paved with brick set in cement mortar.

Acknowledgement is made to Messrs. Hanford & Blackwell, consulting engineers, for the material used in this description of the recent track-work features of the Seattle, Renton & Southern Railway Company.

TRANSFER AND TICKET BOX IN LITTLE ROCK

One of the most difficult problems hitherto experienced in connection with transfers has been to prevent their interchange by dishonest conductors. After careful study and trial of different methods of checking and of registering and not registering tickets and transfers, the Little Rock Railway & Electric Company concluded that every paying pas-



Views of Ticket Box Closed and Open

senger should be registered; and furthermore that the tickets and transfers should be taken out of the conductor's hands as speedily as possible and time-registered upon de-

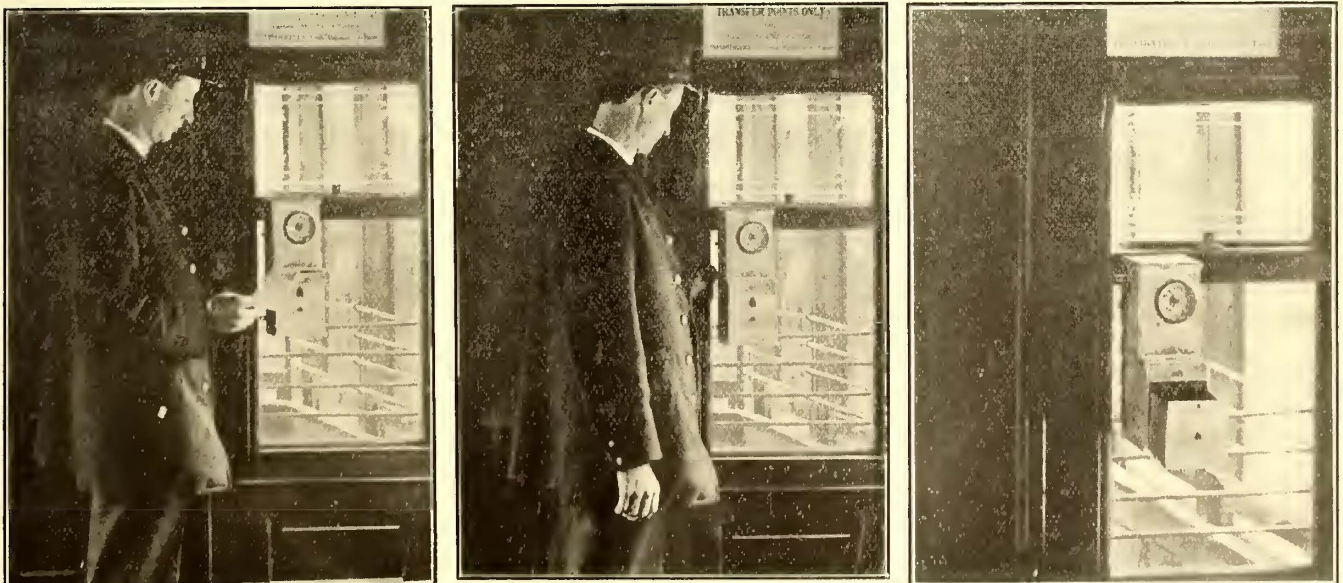
of the envelope, pushes the slide back to its former position and pulls down the lever which stamps the time on the envelope and releases the slide so that it can be pulled out again for another envelope. The front of the slide has a keeper which prevents the withdrawal of the stamped envelopes so that a conductor cannot have an envelope stamped at one time and finally deposited at another time. Once the envelope is stamped it drops to a bottom receptacle which can be unlocked only by the transfer clerk who compares these transfers with the conductors' way-bill and register readings.

This checking system was introduced by D. A. Hegarty, treasurer and general manager of the company, in 1908. It has proved so successful that despite an increase of 2 per cent in cash passengers carried during 1908, there were actually decreases of 8 per cent in transfers issued and 1 per cent in tickets issued during the same period. Comparing the eight months ending Aug. 31, 1909, with the like interval last year, it was found that while the passengers carried increased 8 per cent, the issues of tickets and transfers decreased 9 per cent and 2 per cent respectively. The tickets mentioned are half-fare slips sold to children under 12 years of age.

From his experiences with this system, Mr. Hegarty concludes that the register box has greatly simplified the question of checking conductors' returns. This regulation affords an absolute check on the time of depositing transfers and tickets and so prevents the conductors from meeting to trade these tokens. They cannot keep them in their hands for more than 30 minutes to one hour, according to the length of the round trip. The results obtained far exceeded the expectations of the management and appeared to prove that most railways pay too little attention to the revenue losses due to transfer and ticket manipulation by conductors.

The boxes now being used by the company are of aluminum. The earlier designs had the clock face showing but the later ones do not show the dial.

Otto T. Bannard, who was nominated by the Republicans on Sept. 23, 1909, for the office of mayor of New York City,



Views of Ticket Box on Car, Showing Operations of Inserting and Stamping Trip Envelope

posit. This object has been accomplished by devising the ticket box shown in the accompanying illustrations. The box is operated as follows:

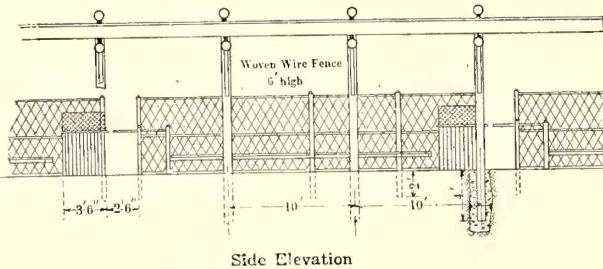
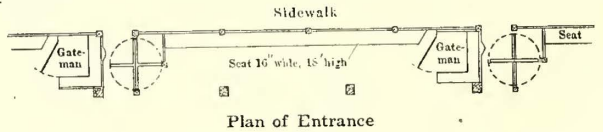
First all tickets and transfers collected on the trip are placed in an envelope. Then at the end of the trip the conductor goes to the box, pulls out the slide for the deposit

is president of the New York Trust Company and is also interested in a number of railway and industrial companies. He is a director of the Mahoning & Shenango Railway & Light Company of New Castle, Pa., the New Hampshire Electric Railways, of Haverhill, Mass., and the Metropolitan Water Company of Kansas City.

HANDLING EXPOSITION CROWDS AT SEATTLE

The Seattle Electric Company has very complete terminal facilities for handling the large crowds which have attended the Alaska-Yukon-Pacific Exposition during the present summer. These facilities include a terminal loading station with change booths and recording turnstiles through which station 44 cars an hour ordinarily are passed over double-track lines branching in three directions. The station is near the front entrance to the exposition grounds. At the south entrance to the grounds the company has a smaller station served by a two-track line and a loading loop.

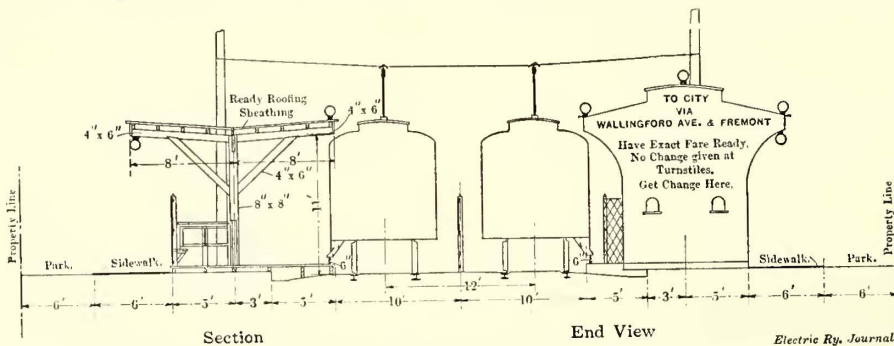
All passengers arriving at the fair grounds are unloaded on the street at the main entrance. Passengers returning to the city can enter only at the terminal station. This station has two loading platforms, each of which will accommodate six cars if



Handling Exposition Traffic at Seattle—Plan of Turnstile Gates

necessary. A plan and section of the platform are shown. Passengers desiring to get on the cars within two blocks of the station must enter the station through one of the 18 turnstile gates, where chop boxes and guards are present to receive the fares. This scheme of concentrating traffic at the terminal where the fares can easily be handled is a most important point in connection with the very complete arrangements made by the Seattle Electric Company for handling the Exposition traffic. About 500 cars were in commission during the height of exposition travel.

Nearly all the cars operated on the lines to and from the exposition grounds are fitted with platform gates operated by the motorman. After the car is loaded these gates are kept closed until the third street outside of the loading platform is reach-

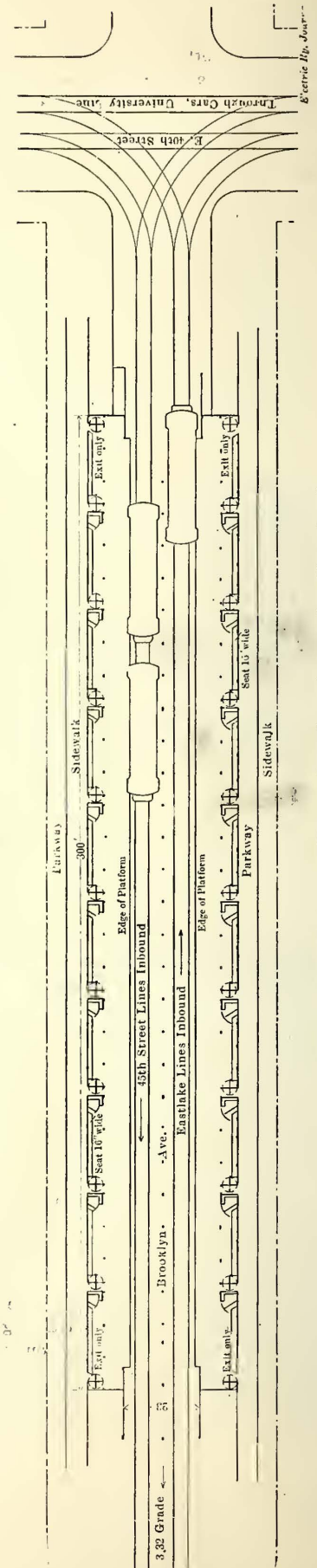


Handling Exposition Traffic at Seattle—Cross-Section of Platforms

ed; hence traffic is concentrated at the place where there are ample facilities and guards to properly collect the fares and to prevent accidents. On those cars which are not fitted with gates, guards ride through the loading station and some distance beyond and serve the same purpose as the gates. Conductors attend simply to the comfort and safety of their passengers in the terminal station area.

On an average about 20,000 passengers per day are loaded in this station. The lowest number, a rainy Monday, was 10,000, and on some days the number has reached 70,000. The regular schedule of cars over the two tracks between the loading platform is 44 per hour, but as many as 100 cars, about evenly divided between the two sides of the platform, have been handled. Track room is available to load six cars at a time in front of either platform, but it is the practice to load only one car at a time on each track so that the traffic can be more closely watched.

On the opening day of the fair a sudden rainstorm came up when over 90,000 people were in the exposition grounds. The terminal equipment was new and untried, and the people came pouring out of the grounds, almost in one mass. But, under these difficult conditions the station proved that it was well adapted for the purpose for which it was designed. Over 60,000 admissions to the station during the day were recorded, and about 40,000 of these came during three hours in the storm.



Handling Exposition Traffic at Seattle—Plan of Loading Station

Entrance to the loading platform on either side may be had through nine turnstiles. Before entering, the passengers get the correct change at change booths, of which there are 10 located at the street ends of the platforms. Four of these booths ordinarily are operated. The girls in charge of the change booth use ready-change-makers, and a supply of change is kept in the station office. Each hour an attendant goes to the change booths to replenish the supply of small change. With the proper change or ticket in hand the passenger drops it in a chop box and is permitted by a guard to pass through the turnstile on to one of the loading platforms. The names of the car lines using the two platforms are indicated on the ends of the structure.

Tickets and transfers are not acceptable at any but one turnstile on either platform. If a passenger gets into the wrong platform enclosure he must go to the "pass gate" where he is given a special transfer which is good at the "pass gate" on the opposite platform. All transfers are issued by the gatemen when fares are paid, and this issuance of transfers and payment of fares before entering the station insures against missed fares and transfer disputes, thus leaving the conductors free to look out for the comfort and safety of their passengers.

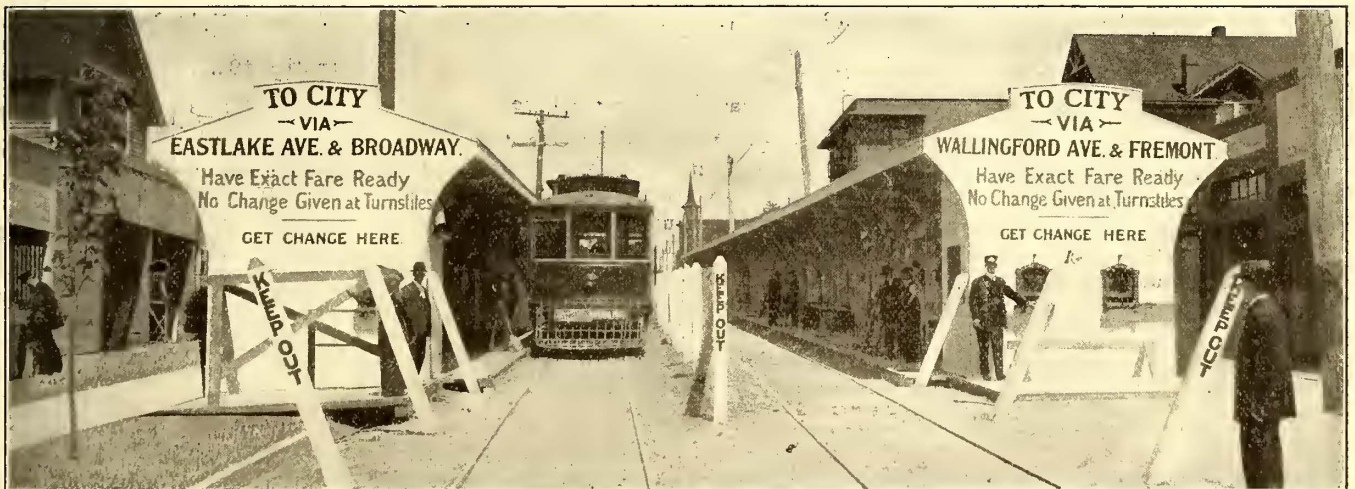
As this station is the terminus of the several lines operat-

TRANSPORTATION & TRAFFIC ASSOCIATION CODE OF RULES FOR CITY OPERATION

At the meetings of the Transportation and Traffic Association on Wednesday and Thursday of this week the proposed standard code of city rules, as revised by the committee on city rules, was fully discussed. A number of amendments to the rules as printed were adopted by the association and the code as a whole was approved for adoption as the standard of the association. The complete text of the rules as amended by the association is reprinted below. Those parts of the rules which were stricken out by amendments are enclosed in brackets. New words or phrases inserted by amendments are printed in heavy-face type.

GENERAL NOTICE

To enter or remain in the service is an assurance of willingness to obey the rules and be loyal to the interests of the company.
 Obedience to the rules is essential to the safety of passengers and employees, and to the protection of property.
 The service demands the faithful, intelligent and courteous discharge of duty.
 To obtain promotion, capacity must be shown for greater responsibility.
 Employees, in accepting employment, assume its risks.
 In all cases of doubt, take the safe side.
 The rules herein set forth are for the government of the employees of the



Handling Exposition Traffic at Seattle—View Between Loading Platforms

ing through it, it is the practice, after a car has started on its return to the city and is about to pass through the exposition station, to make all fare collections for through rides before reaching the loading platform. The station force comprises a station master who has under him 18 gatemen, six guards and three starters, who regulate not only the admission, loading and starting of cars, but also the unloading, which is done at special points outside of the station.

The Chicago transportation committee under the leadership of Alderman Milton J. Foreman has asked the corporation counsel to assist in framing legislation which will prohibit further steam operation by the 26 railroad systems which enter Chicago. It is possible that the proposed ordinance will not directly demand electrification but will call simply for a method of operation which will eliminate the soft-coal nuisance.

As a mark of esteem to the late Governor Johnson of Minnesota, whose body lay in state in the rotunda of the Capitol at St. Paul, Minn., on Sept. 22, the Twin City Rapid Transit Company stopped all its cars in Minneapolis and St. Paul and the Duluth-Superior Traction Company stopped all its cars in Duluth and Superior at 3. p. m. on that day for a period of five minutes.

.....Company, and become effective....., superseding all previous rules and instructions where they conflict with the same.
 Special instructions may be issued from time to time by proper authority.

General Manager.

GENERAL RULES

KNOWLEDGE OF RULES

Knowledge of Rules.

1. All employees whose duties are prescribed by these rules will be furnished with a copy, for which they will sign receipt, and will be required to have the same in their possession at all times while on duty.
 Conductors and motormen are required to be familiar with the rules, and with every special order issued. The bulletin board must be examined daily for special orders. Employment by the company binds the employee to comply with the rules and regulations, and ignorance thereof will not be accepted as an excuse for negligence or omission of duty. If in doubt as to the exact meaning of any rule or special order, application must be made to the proper authority for information and instruction.
 In addition to these rules, special orders will be issued from time to time; such orders, when issued by proper authority, whether in conflict with these rules or not, must be obeyed while in force.

RESPONSIBILITY

Responsibility.

2. (The motorman is held responsible.
 - (a) For the safe running of the car.
 - (b) For the proper operation of the machinery of the car.
 - (c) For running car according to schedule.
 The conductor is in charge of the passengers on the car and is held responsible.
 - (d) For the safety and convenience of the passengers.
 - (e) For the collection and proper accounting of fares.)

2. The conductor is in charge of the car and is held responsible

- (a) For the stopping and starting signals.
 - (b) For the safety and convenience of the passengers.
 - (c) For the collection and proper accounting of fares.
- The motorman is held responsible
- (d) For the safe running of the car.
 - (e) For the proper operation of the car and its machinery.
 - (f) For running the car according to schedule.

Conductors and motormen will see that route and destination signs are properly displayed and will be held jointly responsible therefor.

PERSONAL CONDUCT

Personal Appearance.

3. Conductors and motormen must report for duty clothed in full regulation uniform, and must be clean and neat in appearance.

Politeness.

4. Conductors and motormen must treat all passengers with politeness, avoid difficulty, and exercise patience, forbearance and self-control under all conditions. They must not make threatening gestures or use loud, uncivil, indecent or profane language, even under the greatest provocation. Badge number of conductor and motorman must be given on request of a passenger at any time.

Habits.

5. The following acts are prohibited:

- (a) Drinking intoxicating liquors of any kind while on duty.
- (b) Entering any place where the same is sold as a beverage while in uniform or while on duty, except in case of necessity.
- (c) Constant frequenting of drinking places.
- (d) Carrying intoxicating drinks about the person while on duty.
- (e) Carrying intoxicating drinks on the company's premises at any time.
- (f) Indulging to excess in intoxicating liquors at any time.
- (g) Gambling in any form, including the laying of bets (and playing raffles) while upon the premises of the company.
- (h) Smoking tobacco while on duty.
- (i) Smoking tobacco while off duty in any part of the company's buildings, except in the conductors' or motormen's room.
- (j) Reading books or newspapers while on duty.

Conversation.

6. Motormen, while operating cars, are permitted to answer questions of superior officers, and to give proper instructions to students only. All other conversation with motormen while car is in motion is forbidden.

OPERATING RULES

Run on Time.

7. Cars must never be run ahead of schedule time, but must pass time points and leave terminals promptly on time, unless unavoidably delayed. Should a motorman be unavoidably detained he must not attempt to make up time by reckless running.

Conductors and motormen must carry reliable watches which must show correct time and be compared daily with the standard station clock.

Starting.

8. Motormen must never move car (whether stopped on signal or for any other reason) without signal from conductor, and then only when assured that no one is getting on or off front platform.

Conductor must never give signal to start when passengers are getting on or off.

Conductor must not put his hand on bell cord until passengers have boarded or left car; bell cord must not be touched until it is time to signal motorman to go ahead.

Conductor must never give signal to back a car unless he is on the rear platform and sees that track is clear behind the car.

Starting Cars After Blockade.

9. In the event of a blockade of cars from any cause, the cars in such blockade must not all be started at one time, but singly, and at such intervals as will not burden the feeder line.

Bell Signals.

10. From conductor to motorman, to be given on motorman's signal bell:

1 bell—"Stop at next crossing or station."

2 bells—"Go ahead."

3 bells—"Stop immediately."

4 bells (given when car is standing)—"Back car slowly."

From motorman to conductor, to be given on conductor's signal bell:

1 bell—"Come forward."

2 bells—"Watch the trolley" and danger signal to the conductor.

3 bells—"Set rear brake."

4 bells—Signal to conductor that motorman desires to back the car.

Whenever a car in service is stopped, for any cause except to take on or let off passengers, the motorman will, as soon as he is ready to go forward, give two taps of the gong; after which, if the conductor is ready to proceed, he will give the "Go ahead" signal.

The motorman will answer the signal to stop from conductor by one loud tap of gong; and two loud taps of gong after receiving the signal to go ahead. If unable to proceed immediately upon receipt of signal, motorman will wait for another "Go ahead" signal before starting the car.

When the car is standing, and motorman desires to back, for any reason, he will give the conductor four bells, but must not move the car until the conductor has answered with four bells to signify "All is clear behind." However, when it is necessary to back for any distance, or whenever any danger would be likely to result from backing, motorman must always change ends.

When two or more cars are coupled together, "Go ahead" signal must first be given by conductor of rear car and be repeated by each conductor in succession on his signal bell, when he is ready to start.

Obstructions Near Track.

11. Before passing any vehicle or obstruction close to the track, where passengers or conductor are liable to be injured while standing on the step of an open car, motorman must give two taps on conductor's signal bell as a warning, and must bring his car to a full stop before passing vehicle or obstruction unless he has received GO AHEAD signal from the conductor, indicating that all is clear. Great care must be exercised in passing over all excavations, workmen should be warned of the approach of car by sounding the gong repeatedly, and the car should be kept under full control. Where excavations are near regular stopping place, car should be run clear thereof before stopped.

Danger Signals.

12. Red lights or flags indicate danger, and when placed on the track cars must come to a full stop until such signal is removed.

Reports of Defects.

13. Conductors and motormen will report to superintendent, inspector, starter or foreman any defect in car, track or wire, and fill out blank provided for that purpose.

Disabled Cars.

14. The motorman or conductor of any disabled car, withdrawn from the main track, must remain with the car until relieved by proper authority. When a disabled car is being pushed or pulled, the signal for starting must first be given by conductor on rear car and repeated by conductor on forward car, each conductor being careful not to give the signal when passengers are boarding or leaving car.

Leaving Car.

15. When necessary for the conductor to leave his car he must notify the motorman to protect passengers and car. Should passengers board car during absence of conductor, motorman will notify conductor of the number and location of such passengers upon his return.

Cars in commission must not be left unprotected; either conductor or motorman always remaining in charge.

Responsibility for Damages.

16. Employees will be held responsible for any damages caused by their neglect or carelessness or by disobedience of rules.

Transfer Point Meetings.

17. Motormen and conductors will be held equally responsible for leaving a transfer point so quickly as to prevent the transfer of passengers from an approaching car on a connecting line.

Steam Railroad Crossings.

18. (Car must be brought to a full stop at a safe distance approaching steam railroad crossings at grade, and motorman must not proceed) **When approaching steam railroad or other flag crossings, the motorman must bring his car to a full stop at a distance of (—), and will not proceed until conductor has gone ahead to the center of crossing, looked both ways, and given the COME AHEAD signal.** Before starting, the motorman will look back to see that no passengers are getting on or off; and in no case proceed, even after conductor's signal, until he has also examined the crossing and satisfied himself that steam cars are not approaching.

When there is more than one track the conductor will remain in advance of the car until the last track is reached. After boarding car, conductor will give GO AHEAD signal to notify motorman that he is aboard. Motorman is forbidden to proceed without this signal.

Where crossing is protected by derail, interlocking plant, or flagman (employed by the company) this rule does not apply, special instructions being issued to govern in such cases.

SAFETY OF PASSENGERS

Safety.

19. The safety of passengers is the first consideration. All employees are required to exercise constant care to prevent injury to persons or property, and in all cases of doubt take the safe side.

Warning to Passengers.

20. While persons assuming positions of danger, such as boarding or leaving moving cars, walking behind a moving car when another car is approaching, etc., do so at their own risk, conductors and motormen should call the attention of such persons to the danger of so doing. Conductors on moving cars must give the danger signal [three bells] if an accident appears imminent.

Standing on Steps.

21. (Permit no person to stand on the steps or buffers. Passengers should be fully inside of the car or safely landed on the platform before the signal is given to start.)

(21.) **Permit no person to stand or ride elsewhere than in a safe place upon the car. The standing or riding of passengers upon the buffer, dashers, fenders, roof or outside of a closed vestibule door is prohibited.**

Stealing Rides.

22. Any person caught stealing a ride on a car must never be driven therefrom while it is in motion, but car must be stopped at next street or station and such person put off. [This rule was transferred to the section on ejections.]

ACCIDENTS

Assistance.

23. In case of accident, however slight, to persons or property, in connection with or near any car, the motorman and conductor in charge of the same will render all assistance necessary and practicable. In no case will they leave injured persons without first having seen that they are cared for.

Medical Attendance.

24. Motormen and conductors are directed not to employ medical attendance to injured persons, except for the first visit, in cases of personal injury; nor will they visit such persons at any other time afterward unless specially instructed so to do by an officer of the company.

Fire in Car.

25. When there is evidence of car being on fire, motorman will immediately throw overhead switch to OFF and conductor pull down trolley, both motorman and conductor using every effort to prevent passengers becoming panic-stricken or leaving car before it is brought to a stop.

Written Reports.

26. A full and complete written report of every accident, no matter how trivial, and whether occurring on or near

the car, must be made by the conductor and motorman. Accidents sometimes considered as not worth reporting are often the most serious, troublesome and expensive.

The conductor will obtain the name and residence in full of all witnesses on or near the car when the accident occurred, including badge number of any policeman, fireman, private officer, postman or uniformed employee of the company.

The motorman will assist the conductor in securing the names of witnesses whenever practicable, and will be held responsible for any neglect to render assistance.

In all cases full facts must be obtained and stated in the report, as follows:

The date, exact time, exact place, run and car number, and the direction in which the car was moving, the nature of the accident or collision and the cause of its occurrence.

The full name and address of the person injured, or whose vehicle was in collision (giving the name of both the driver and the owner of the vehicle).

Ascertain the extent of injuries or damage, if any, before leaving the spot.

In case there has been an accident on the car, and the crews change ahead, the conductor taking car on which the accident happened, must secure the names of witnesses as above.

In case a person is struck by a car after passing around the rear of a passing or standing car, the numbers of both cars must be obtained, and both crews must report the accident.

If an accident is caused by any defect or damaged condition of car, conductor must report the same and its cause.

Accidents to employees will be reported the same as accidents to passengers.

Any trouble or disturbance of a boisterous or quarrelsome character which occurs on a car, or the ejection of a person from a car, will be reported as an accident.

Report Accidents to Inspectors.

27. Conductors and motormen will make a verbal report to the first inspector or official of the company they meet of any accident, blockade or mishap of any kind. The depot starter or dispatcher must also be notified.

Information to Proper Persons Only.

28. No employee shall, under any circumstances, give any information whatever concerning any accident, delay, blockade or mishap of any kind to any person, except to a properly authorized representative of the company.

Information by Telephone.

29. In case of accident involving personal injury or serious damage to property, conductor, after attending to the case and getting witnesses, will telephone at once to headquarters, giving notice and particulars of accident.

In case of a blockade, where assistance is needed to get cars moving, conductor of car first in block must summon assistance. Conductor of the second car, however, will also be held responsible for being sure that assistance has been summoned. Expense of telephone message will be refunded upon application at office.

EJECTIONS

Ejections.

30. Ejections shall be made by the conductor, with the assistance of the motorman, after the car has been brought to a stop, using "only such force as is sufficient to expel the offending passenger with a reasonable regard for his personal safety." No passenger shall be forcibly ejected from the car for any cause whatever without order from an inspector, starter or official of the company, unless the conduct of the passenger is dangerous or grossly offensive.

Any person caught stealing a ride on a car must never be driven therefrom while it is in motion, but car must be stopped at next street or station and such person put off.

Where to Eject.

31. Any person ejected from a car must be put off at a regular stopping place.

No passenger will be put off at a point where likely to be exposed to danger.

Particular attention must be paid to this rule during bad and inclement weather, late at night, or when a passenger is intoxicated.

Intoxicated Persons.

32. No passenger will be ejected from a car for mere intoxication unless said passenger becomes dangerous or offensive; such passenger must then be ejected with great care and must be guided until free from probable injury.

CAR-HOUSE RULES

Report for Duty.

33. Regular conductors and motorman must report for duty (ten) - - - - minutes before leaving time for their first trip, or, for any good reason unable to so report, must give notice at least ten minutes before such leaving time.

Extra men must report at such time as ordered, or must give notice at least ten minutes before such time. They must not absent themselves after answering roll-call without permission.

HEARING BY SUPERINTENDENT

Hearing by Superintendent.

34. A hearing will be given by the superintendent to every employe who desires to complain. Reports or suggestions for the betterment of the service will always receive consideration.

RULES FOR CONDUCTORS.

OPERATING RULES

Position on Car.

101. Remain on rear platform or main entrance when not collecting fares, keeping a lookout for persons desiring to board car. Keep careful watch of passengers to observe requests to stop car. When stops are made at principal streets, places of amusement, churches, or at any point where a considerable number of passengers enter or leave car, conductor should be on rear platform until such point is passed. When descending steep grades conductor will remain on rear platform.

Announcements.

102. Announce distinctly the names of streets, public places and transfer points when approaching the same.

Route Signs.

103. Properly display route signs on each half trip.

Trolley.

104. Trolley rope must be held when passing over switches, crossings, or going around curves. Should the trolley leave the wire, the conductor must at once pull down the trolley and signal the motorman to stop. After the car has stopped, replace the trolley on the wire, look around and through the car and see if any persons are boarding or leaving same before giving motorman signal to start. See that passengers keep their hands off the trolley rope. Do not remove trolley from wire at end of run, or elsewhere at night, until passengers have alighted from car.

Gates.

105. Front and rear gates on closed cars on the side between the tracks must always be kept closed and securely fastened. On open cars the guard chains must be kept fastened and guard rail lowered on the side between the tracks. When gates or chains or their fastenings are broken or out of order, prompt report must be made to superintendent, inspector, starter or foreman.

Disabled Motorman.

106. In case motorman is disabled from any cause while car is in motion, conductor must stop the car as promptly as possible.

Inspection of Car.

107. Conductors will see that cars are clean and will carefully inspect floor, windows, grab-handles, steps, signs and all other parts of car which passengers may use, to see that same are in proper condition before car is taken out on the road.

HANDLING PASSENGERS

Moving Forward.

108. On closed cars when standing passengers crowd the rear door, request them to PLEASE STEP FORWARD.

Seating Passengers.

109. Standing passengers should be directed to vacant seats, and an effort made to provide them with seats where possible.

Assisting Passengers.

110. Elderly and feeble persons, women and children should be given assistance getting on and off car when possible. Crippled, blind or badly intoxicated persons should be assisted to sidewalk if necessary.

Information to Passengers.

111. Conductors are expected to be familiar with principal points along their route, so as to be able to give information to passengers about streets, parks, connecting or intersecting railway lines, depots, ferries, public buildings, large stores, hospitals, theaters, etc.

When on the stand at terminals, and when approaching passengers, conductors must announce the route and destination of car.

Spitting on Floor.

112. No passenger will be ejected from a car for spitting on the floor. If a passenger violates the rule or law prohibiting spitting, the conductor will call the attention of the passenger to the law prohibiting such conduct and endeavor to persuade the passenger to desist.

Carrying Packages.

113. Passengers must not be allowed to carry bulky or dangerous packages aboard cars.

Employees must not carry packages, letters or newspapers without an order from the proper authority, and must not assume responsibility for any package which a passenger may bring upon the car, excepting such articles as are to be turned into the Lost Article Department.

They must not hang nor allow articles to be hung on the brake handles.

Lost Articles.

114. Any article left in the car must be turned in promptly at office. Concerning articles found, conductors must not give information to any person, but must refer such person to the proper office. The names and addresses of parties giving lost property to conductors must be obtained.

Dogs in Cars.

(115. Dogs will not be carried on any car.)

FARES AND TRANSFERS

Collection of Fares.

116. Fares must be collected promptly after passenger has boarded car and immediately registered. When more than one person boards car at a time, and one passenger pays the fare for others, the fares must be registered immediately in the presence of the passenger who paid them before any more fares are collected. Fares should be collected separately and not in bunches.

Should a conductor for any reason return a fare to a passenger, or by error register more fares than he collected, he must not attempt to recover same by omitting to register fares subsequently collected, but should make report of such fact.

Change.

117. When necessary to give change, first register fare, and immediately thereafter give change, stating the amount received and amount returned.

Should a conductor have any dispute with a passenger in regard to change, he must make a report in writing to the superintendent.

Conductors will make change for passengers to the amount of (two) - - - - dollars.

Conductors will provide themselves with - - - - dollars, for the purpose of making change, previous to taking charge of the car.

Register Bell.

118. Be careful to see that register rings each fare.

Register Out of Order.

119. In case the register gets out of order, stop using it, make report of fares on back of trip report or on blanks supplied for that purpose, and report the fact to the first inspector, (or) starter or dispatcher met on the road, and subsequently report to superintendent.

Transfers in Blockades.

120. In case any line is blocked it is the desire of the company to carry passengers to their destinations on other

lines. Under such circumstances, conductors of parallel or intersecting lines will accept transfer tickets accordingly and will issue a transfer on a transfer if necessary. They will also accept transfer passengers without tickets on orders from any inspector or authorized representative of the company, making report of same on back of trip report.

Issuance of Transfers.

121. Correctly punched transfers will be issued only on request made at time fare is paid.

Acceptance of Transfers.

122. Transfers will be accepted only when properly punched and offered for ride by persons to whom transfers are issued at designated transfer point within the time limit punched on transfer.

Refusal to Pay Fare—Transfers.

123. When a passenger refuses to pay fare or presents a defective transfer ticket, upon which, in the judgment of the conductor, the passenger is not entitled to ride, the conductor must retain such defective transfer or ticket and secure the names of as many witnesses to the fact as is possible, whereupon the car must be stopped and the passenger requested to leave.

If the passenger fails to comply with such request, the facts of the case must be brought to the attention of the first inspector, starter or official of the company who is met, and the conductor must act according to instructions received from such inspector, starter or official. In all cases the passenger must be given the benefit of any doubt.

When a passenger who refuses to pay fare requests to be allowed to leave the car, the car must be stopped and the person permitted to alight.

RULES FOR MOTORMEN.

HANDLING CARS

Stopping for Passengers.

201. Keep a careful lookout on both sides of the street and bring the car to a full stop for every person who signals, except that when a car has considerable headway, is overcrowded and another car of the same line follows within 500 feet passengers should be requested to take the following car.

Cars will stop on signal only at (farther) designated corners, at car stations, transfer points, and at points as provided in special orders.

Do not stop cars so as to block cross-streets or crosswalks.

Churches, Hospitals and Schools.

202. When passing a church during the hours of service, and at all times when passing a hospital, run quietly and do not ring the gong unless necessary.

Cars must be run slowly and with great care, and gong sounded, in the vicinity of schools when there are children on the street.

Run Slowly.

203. When passing standing or slowly moving cars, gong must be rung and car brought to slow speed.

Run slowly over special work, especially over all facing switch points, and if there is another car moving in the opposite direction on the other track, allow that car to pass before striking the switch point.

Motormen must see that all switches are properly set before passing over them, coming to a full stop if necessary.

Looking Back While Car Is Moving.

204. Motormen must not look back, either through or around car, while it is in motion.

Changing Ends.

(205. When changing ends at terminals motormen must not pass through car.)

Destination Signs.

206. Properly display destination signs on each half trip.

Entering Terminals.

207. Motormen must reduce speed when running into terminals to a rate just sufficient to carry the car into terminal.

Persons Authorized to Run Car.

208. Motormen must not allow any person to run their car except men placed there for instruction or some inspector or duly authorized officer of the company, known to the motorman to be such. Conductors must not be allowed to run cars. A motorman who has a student "breaking in" in his charge must, under no circumstances, allow the student to handle the car unless he (regular motorman) is at his side, ready to take the brake or controller immediately if necessary.

Inspection of Car and Equipment.

209. Motorman must test brakes, switches, controller, lights and other apparatus and examine sand boxes to insure himself that car is in proper running order before taking it out on the road.

Emergency Stop.

210. Motorman must not use the reverse to stop car except to avoid accident or when the brake rigging is disabled.

Do not reverse when the brake is set, but release the brake and throw the reverse handle simultaneously, and, when the reverse handle is thrown in position, apply the current one point at a time; otherwise the fuse will melt or the breaker will release. Sand should be used when making an emergency stop.

Runaway Car.

211. While descending a grade, should it not be possible to stop a car equipped with two motors by means of brake, the motorman must immediately turn off hood switch, reverse and advance controller cylinder to last position. In the event of car being equipped with four motors, simply reverse to stop.

Should a car equipped with two motors start to roll backward while ascending a grade and the brakes be unable to hold it, the hood switch must be immediately turned off and the controller cylinder advanced to last position. Should the car be equipped with four motors, if the reverse is set in forward position the car will stop.

Leaving Car.

212. Never leave platform of car without taking controller and reverse handles, throwing off the overhead switch and applying brake. Always remove reverse handle first.

Before leaving car at any point set hand brake sufficiently to prevent car from drifting.

Overhead Switch.

213. An overhead switch must never be thrown until power is turned entirely off, except in case controller cylinder fails to turn when power is on. It must be thrown by hand only.

Power Off Line.

214. When the power leaves the line the controller must be shut off (the overhead switch thrown and the car brought to a stop); the light switch must then be turned on and the car started only when the lights burn brightly; **but motormen must never allow their cars to coast when power is off the line except to clear crossings or dangerous points.**

Economical Use of Current.

215. In order to effect an economical use of the electric current it is necessary that the continuous movements of starting and increasing speed should be made gradually. In starting a car let it run until the maximum speed of each notch has been attained before moving handle to the next notch.

Rapid feeding of the controller is injurious to the equipment of the car and causes discomfort to passengers. Controller must never be thrown on last point if car does not start from preceding points. The controller must never be thrown from a higher to a lower notch. Controller must not be held for any length of time on any one point except the first and second running positions. If necessary to run slower than the first running position speed, power must be thrown on and off, and not be taken continuously from a lower notch than that of the first running position.

Do not apply brakes when the current is on.

Do not apply current when brakes are applied.

Do not allow the current to remain on when car is going down grade or when passing over section breakers. Endeavor to run car with the least amount of current, allowing the car to drift without the use of current when it can be done without falling behind time.

A great amount of power can be saved by using judgment and discretion in approaching stopping places and switches by shutting off the power, so as to allow the car to drift to the stopping place or switch without a too vigorous use of the brake.

Release of Brakes Before Stop.

216. When brakes are set to make a stop they should always be released or nearly so just before the car comes to a standstill.

Water on Track.

217. When there is water on the track run the car very slowly, drifting without the use of power whenever possible.

Sanded Rails.

218. Never run on freshly sanded rails with brakes full on except to prevent an accident. On cars provided with sand boxes, in case of slippery rails, always sand the track for a short distance before applying the brakes.

Spinning of Wheels.

219. Care must be taken particularly during snowstorms to avoid "spinning" of the wheels with no forward or backward movement of the car.

Slippery Rail.

220. On a slippery rail do not allow the wheels to skid; as soon as wheels commence to skid the brake must be released and reset.

Extreme caution must be used to keep car under full control approaching all intersections, junctions, railroad crossings and prominent driveways, being very careful when approaching wagons and other cars, disregarding schedule if necessary.

Do Not Oil Car.

221. Do not oil or grease any part of a car.

VEHICLES.

Passing Vehicles.

222. Motormen are cautioned to exercise great care when a vehicle is passing alongside of track ahead of car. Ring the gong vigorously to attract the attention of the person driving, as a warning not to pull in ahead of car; and run cautiously until the vehicle is passed in safety.

Fire Apparatus.

223. When any fire department vehicles are observed approaching from any direction, cars must be stopped until such vehicles have passed.

Ambulances, Patrol and Emergency Wagons.

224. Ambulances, police patrol and the emergency wagons of the company must be allowed the right of way, and when approaching or passing, cars must be kept under control to avoid collision.

PEDESTRIANS.

Persons Between Cars.

225. Cars moving in opposite directions must not pass at points where persons are standing between the tracks, but must be operated so, as not to occupy both tracks at such point simultaneously.

Transportation service on the lines of the Omaha & Council Bluffs Street Railway, Omaha, Neb., has been practically normal since Sept. 28. There have been many desertions from the ranks of the strikers. An effort was made on Sept. 29 to declare a truce with subsequent arbitration, but the company refused to entertain the proposal. On Sept. 18 the employees of the Nebraska Traction & Power Company, operating between Omaha, South Omaha, Ralston and Popillion, went on strike because they were required to operate cars of the company from the eastern limits of South Omaha to the business center of Omaha over the tracks of the Omaha & Council Bluffs Street Railway. The Nebraska Traction & Power Company reinstated the men on Oct. 2 as individuals, restoring their seniority rights, the men waiving their objections to operating cars in Omaha.

SERVICE CARD RECORDS AT OAKLAND

The two railway properties at Oakland, Cal., are operated by one staff. Both city and interurban service is given. One property, the Oakland Traction Railway, has an extensive street railway system centering in Oakland and reaching the nearby suburbs; and the second property, the San Francisco, Oakland & San Jose Consolidated Railway, operates

NAME (in full)		BADGE NO.	
PLACE AND DATE OF BIRTH		(Day)	(Month) 19
SERVICE RECORD			
Times Emp'd	DATES OF EMPLOYMENT		REMARKS
	From (Year and Mo.)	To (Year and Mo.)	
1st			
2nd			
3rd			
4th			
5th			
6th			
7th			
8th			
Leave Blank		Mailing License as	
		nationally	
		Citizen	
		over	

Service Card Record at Oakland—Obverse

an interurban train service in connection with its ferry boats running between a pier terminal in Oakland and the principal ferry terminal in San Francisco across the bay. J. Q. Brown, assistant general manager of these two railways, keeps a very complete record of the operation details of the properties. Among the several classes of information filed according to the card index system are service records for all of the company's employees except those working in the gen-

ABSENCE				REMARKS	
Under this heading report all absences of over 30 days without pay since first entering service. If no absences of this length of time have occurred, so state.				Under this heading give any important information or explanation not otherwise provided for.	
NO.	FROM	TO	CAUSE		
1st					
2nd					
3rd					
4th					
5th					
6th					
Leave Blank			DIRECTIONS		
			1st. This Card to be written in ink, and not folded.		
			2nd. Give exact dates near as possible.		
			3rd. Use separate line for each change of occupation.		
			4th. Make entries promptly.		

Service Card Record at Oakland—Reverse

eral offices. Accompanying illustrations show the obverse and reverse sides of one of these service cards and exhibit the headings of the information as recorded. As old men may be re-employed in or transferred to and from the power stations, ferry steamers, shops, line and track departments, these records, when carefully kept, serve as a valuable index of the class and quality of work which any man has done.

The mayor of Springfield, Mass., has written L. S. Storrs, president of the Springfield Street Railway, to ascertain if an agreement could not be reached between the company and the city for re-routing cars. At present 133 cars an hour pass the corner of Main street and Court street. Mr. Storrs replied that he would be glad to meet the mayor at the latter's convenience to discuss transit conditions in Springfield, and at a subsequent meeting on Sept. 24 it was decided that a commission to be composed of representative business men from each section of the city be selected to study transportation matters and make suggestions.

COST OF POWER IN A PLANT WITH A RELATIVELY LARGE RAILWAY LOAD

The return of the Hyde Park (Mass.) Electric Light Company to the Board of Gas and Electric Light Commissioners for the year ending June 30, 1909, illustrates the cost of generating electrical energy in a station of moderate size having a large railway load. Although the Hyde Park Company handles an electric lighting and power business in the suburb of Boston where its plant is established, by far the greater portion of its output is utilized in the operation of trolley lines at the south of Boston. The total normal capacity of the station is 1965 kw, and in the year covered by the return the company generated and delivered at its switchboard 3,990,634 kw-hours. Its total sales were 3,661,372 kw-hours, and of this amount of energy 3,314,076 kw-hours were sold to electric railway lines at a price of practically 2 cents per kw-hour, the exact figure being 1.98 cents, as deduced from the return. Practically 92 per cent of the total generated energy was thus sold—a much higher proportion than is usually encountered in central station work, and due without question in this case to the purchase of the railway power at the direct-current switchboard of the station, with the avoidance by the central station of the usual 15 to 30 per cent distribution losses.

The equipment of the Hyde Park plant, as reported in the return, consists of nine 150-hp Cunningham boilers with Hartford setting, each having a 72-in. shell and 92 3/4-in. tubes; also one 125-hp Dobbins boiler with a Jarvis setting, 72-in. shell and 140 3-in. tubes built for 110-lb. steam pressure. The total rating of the boiler plant is 1475-hp. The engine equipment consists of the following units:

- 1 Corliss compound, 24x48x48 in., 80 r.p.m., 1250 hp.
- 1 Green compound, 24x38x48 in., 100 r.p.m., 800 hp.
- 1 McIntosh-Seymour compound, 13x23x17 in., 200 r.p.m., 200 hp.

Direct connected, respectively to 850, 525 and 100-kw, General Electric, 500-volt, d.c. generators.

- 2 Armington & Sims 18 1/2 x 18 in., 200 r.p.m., 200 hp. belted and one Armington & Sims compound 10 1/2 x 16 1/2 x 12 in., 285 r.p.m., 100 hp, belted, driving 6-arc light dynamos, four alternators of a total capacity of 330 kw and two 500-volt, d.c. generators of 100 kw rating each.

The station was operated by a total force of three engineers, three firemen and two coal-passers. The company burned a mixture of soft coal costing about \$4.21 per ton and buckwheat at \$3.26, the total fuel cost for the year being stated as \$34,471.24. The station wages cost for the year was \$9,621.86. These were the two principal items of cost at the switchboard, the total expense of manufacture being about \$50,000. The principal repairs tabulated were those of the steam equipment, which came to \$2,741.45. The electrical repairs at the station were barely \$1,100. The power production cost was as follows in detail:

Kw-hours delivered at switchboard.....	3,990,634
Cost of manufacture at switchboard as follows:	
Fuel	\$34,471.24
Oil and waste	778.22
Water	273.06
Wages at station	9,621.86
Repairs, station building	90.59
Repairs, steam equipment	2,741.45
Repairs, electrical equipment	1,101.33
Tools and appliances	698.05
Total	\$49,775.80

The cost per kw-hour manufactured in cents was:	
Fuel	0.86
Labor	0.24
Miscellaneous	0.15
Total	1.25

FORCED DRAFT CAR HEATER

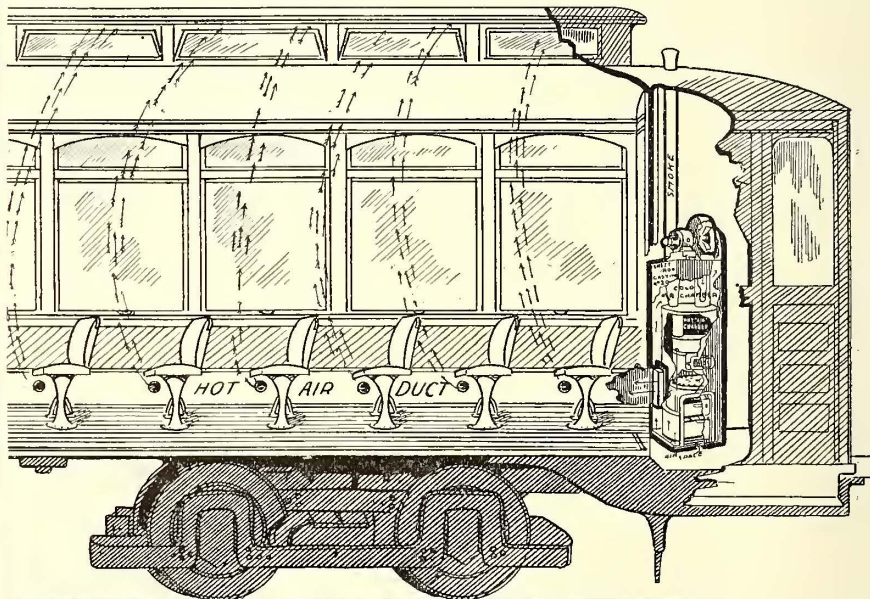
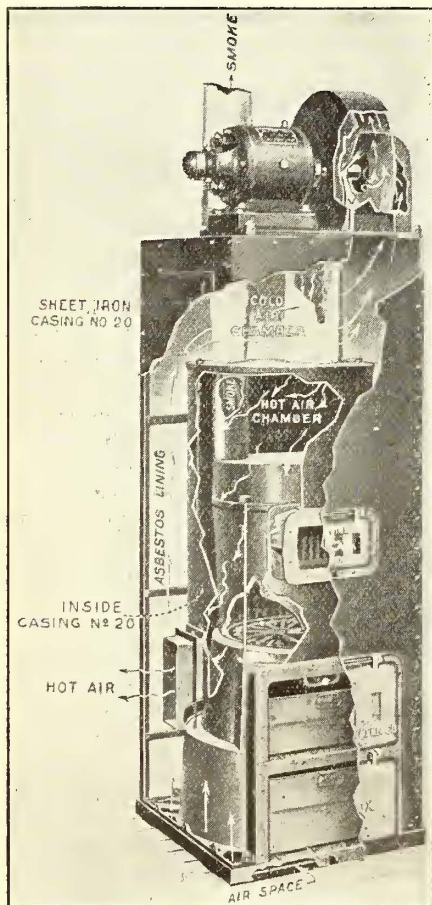
The Peter Smith Heater Company, Detroit, Mich., exhibited this week at the convention a novel forced draft method of heating and ventilating city and interurban cars. The heater for cars up to 35 ft. inside measurement is 21 in. square and 60 in. high and can be placed in the vestibule or body of the car. The stove, which is inside the hot air chamber, is of the ordinary type, but has a corrugated fire pot which is 12 in. in diameter. The grate is of simple design, and is shaken with a side to side movement or rocked and dumped at the will of the operator. The base is a rigid plate casting which serves as a foundation and keeps the different parts permanently in line. The stove has an ash box and coal storage chamber located below the grate.

These chambers have pans which hold sufficient ash and coal to operate for 18 hours. The doors to the fire box, ash pit and coal storage are all hung on gravity hinges

retained and at the same time the heat can be distributed throughout the car in the most efficient manner.

The car in which one of these heaters is now being operated has a distributing pipe or hot air conduit which runs from the front to the rear of the car along the truss plank on the floor. This pipe is rectangular in form, 3 in. by 8 in., and made of light galvanized sheet iron. It lies on edge in a magnesium lined wooden box with square openings under every seat. These openings are cut in the lower portion of the conduit front for all seats forward of the center; for the rear seats the openings are cut in the upper portion of the conduit front. This arrangement permits the hottest air to pass the first openings and be distributed at the back of the car where it is most needed, and also affords a means for an even distribution of warm, fresh air.

The heater has a motor and blower located on the top near its front face. The blower consists of a ¼-hp Brown-ing 500-volt series motor direct connected to an American Blower Company's fan. The fan is designed to handle 200 cu. ft. of air per minute against a pressure of about ½-in. water gage. The speed is 1060 r.p.m. The wheel is 10½ in. in diameter by 2¾ in. wide at the periphery. The inlet is 5¾ in. in diameter, and the outlet is 4½ in. by 4½ in. to 5 in. round. The housing is 14½ in. high and the weight of the base plate is 14 lb., the motor 75 lb., the shell 5 lb.; total weight of heater 500 lb. The equipment can be re-



Part Section of Forced Draft Heater and Sectional View Showing Air Distribution in Car

to make full provision against their being left open.

The hot air chamber is circular and has a 2½-in. air space between the stove and casings. It is made of No. 20 sheet iron. The outer casing is also made of No. 20 sheet iron, built over a square angle iron frame, lined throughout with 3/16-in. asbestos mill board, and has a minimum spacing of 1 in. from the hot air chamber. The framing at the top is reinforced with bar iron under the blower bed plate.

The joints of the stove are air tight to prevent any air from the air chamber getting into the stove and interfering with the draft. The base, as shown in the cut, is perforated in the four corners so that when the fan used with the heater is in operation, air is drawn from under the car through a hole cut in the floor beneath the heater. At the upper end of the cold air chamber existing between the walls of the inner cylindrical hot air box and the square heater jacket, this air, now somewhat heated enters the blower intake pipe. After passing through the blower it is forced downward into the air tight hot air chamber surrounding the stove and from there escapes through the distributing pipe outlet at the bottom into the interior of the car. In this way, the economy of the stove heater is still

moved in summer with no more trouble than is required to take out an ordinary car stove.

The motor is connected to the trolley circuit by a simple snap switch. Actual instrument readings have shown that the blower motor carries far less load than its ¼-hp rating. Under operating conditions the motor takes 0.22 amp at 400 volts. This means an operating cost of 3.5 cents a day of 20 hours, assuming current costs 2 cents a kw-hour. The corresponding cost of operation at 500 volts would be 5.5 cents a day and even at full load capacity the cost would be only 7.4 cents a day. The usual current cost of 5.5 cents added to the cost of 40 lb. of hard coal at \$6 per ton, gives an operating cost of 17.5 cents a day, which is very low for the character of heating.

The operating cost of the same car fitted with electric heaters, assuming cost of current at 2 cents per kw-hour, is given as follows:

First point	5 amp	500 volts	\$1.00
Second point	7 amp	500 volts	\$1.40
Third point	11 amp	500 volts	\$2.20

The assumption of 2 cents per kw-hour may be considered high and unjust to the electric heaters, but even at half that

price for current the forced draft heater would show a maximum operating cost of about one-third that of the electric heaters on the first point. Thus, it is possible to operate a forced draft heater for three days of severe weather for no more expense than is required for one day's electric heater operation in mild weather. The initial cost of this equipment will be somewhat higher than electric heaters, but this is more than counterbalanced by the advantage of relieving the power house of an electric heater load which in severe weather might equal 10 per cent of the total station capacity.

The forced draft heater which the company now has in operation is installed in a pay-as-you-enter car running on the lines of the Municipal Traction Company, Cleveland, Ohio. The inside measurement of this car is 35 ft. 6 in. and its seating capacity is 50 passengers. On the day the tests were made, the outside air was at a temperature of 20 deg. F. There was a moderate fire in the heater, and the following temperatures in degrees F. were taken from

Bell Cord		Seat Back	
Vents Closed	Vents Open	Vents Closed	Vents Open
73 deg.	63 deg.	71 deg.	57 deg.

The car had 14 ventilators 28 in. by 7½ in. in size; 140 sq. in. per vent opening; total outlet of vent air openings, 1960 sq. in.; air volume in car, 1900 cu. ft.

Air from blower per hour, 12,000 cu. ft.

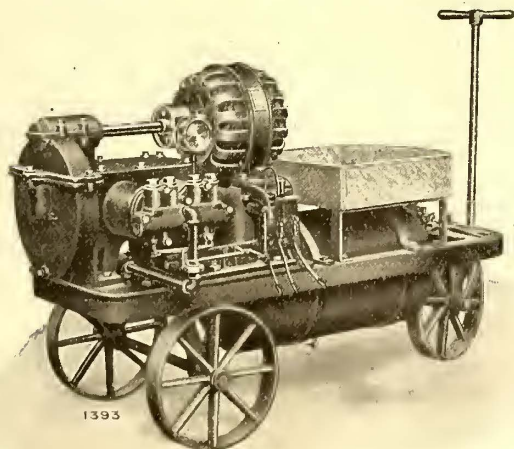
Air changes per hour, 6½.

Minutes required for complete air renewal, 9½.

The average temperature of the air coming out of the openings under the seat was 190 deg. F.

NATIONAL PORTABLE COMPRESSOR OUTFITS

To satisfy the demand for a self-contained, reliable, portable compressor outfit shops, power plants and track work, the National Brake & Electric Company has designed a most durable and convenient outfit consisting of a National type "H" compressor and automatic governor, a combined switch and fuse, air gage, reservoirs and all necessary piping. The entire equipment is mounted on a substantial angle iron frame supported on wheels. These portable outfits are built in two styles with three and four-wheel trucks respectively.

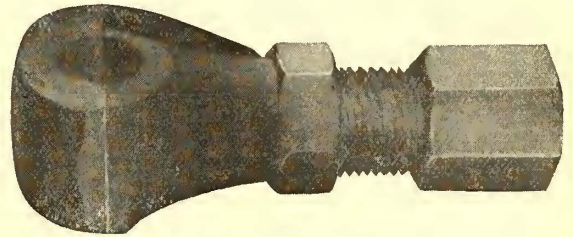


Portable Air Compressor

In the three-wheel type the apparatus is drawn around by means of a wrought iron tongue attached to the pivoted fork in which the front wheel is hung. The four-wheel type is fitted with castors on the two front wheels which permit the truck to be turned and moved about as needed. The small width of these portable outfits allows them to be taken through doors and openings of much smaller breadth than the average. These portable compressors are built in six sizes in capacities of from 11 cu. ft. to 50 cu. ft. free air per minute.

ALUMINUM TO COPPER MECHANICAL CONNECTOR

At the Denver convention Dossert & Company, New York, exhibited a new mechanical connector for use in making tap-offs from aluminum feeder cables to copper branches. As shown in the accompanying illustration the connector is similar to the standard Dossert cable tap with the exception that the hook part of the connector is cast in aluminum while the shank is cast in copper and supplied with copper contact sleeve and compression nut, thus giving contact of



Aluminum to Copper Mechanical Connector

aluminum to aluminum and copper to copper. The two metals are cast together to preclude absolutely the possibility of air or moisture intervening. The connection is so made that it is not necessary to cut the mains in taking off a lead. The hook, with under jaw removed, is placed over the bare cable. The under jaw is then put in place and tight contact obtained by screwing up the jam nut. The shank of the tap is supplied with a compression nut and bushing as previously described by means of which the lead is fastened to the connector. The design has been accepted by the Milwaukee Railway & Light Company which has ordered 1,000 for installation on its new aluminum feeder line.

NEW SHOPS PLANNED BY DENVER CITY TRAMWAY COMPANY

The Denver City Tramway Company is planning the early construction of a general repair and maintenance headquarters on West Forty-eighth Avenue at the terminal of the Moffat Railway. The contemplated plant and adjoining land for extensions, materials and storage will cover about 60 acres. There will be a planing mill, blacksmith shop, paint shop, woodworking shop, foundries and track construction headquarters. These and other facilities will be housed separately. A transfer table 45 ft. wide with a 555-ft. run will separate the woodwork, lumber and paint sections from the general repair shop. Each shop will therefore be equipped with stub tracks in connection with the transfer table. The capacities of the principal sections will be as follows: Paint shop, 33 cars; wood shop, 20 cars; general repair shop, 16 cars. The completed layout will cost about \$200,000 and will represent one of the most extensive railway maintenance plants west of the Mississippi River.

W. R. Garton Company, Chicago, Ill., is meeting with great success in the sale of the Universal safety tread in its territory. It is one of the company's latest lines and promises to be one of its best. The lead tread is especially desirable because of its toughness and non-slipping surface. In this tread, the lead is so applied to a steel base as to afford a constantly-increasing hard surface as the tread wears. Hence the tread improves with use.

M. W. Flanagan has been appointed superintendent of Allegheny Division No. 1 of the Pittsburgh (Pa.) Railways. Mr. Flanagan first entered the employment of the United Traction Company, Pittsburgh in June, 1899, as clerk. Early in 1905 he was chosen superintendent of the West Moreland County Street Railway at Derry, Pa. In 1905 he was appointed superintendent of the Allegheny Division of the Pittsburgh Railways. He has held that position continuously since.

News of Electric Railways

Cleveland Traction Situation

Mayor Tom L. Johnson, through the city council of Cleveland, agreed, on Sept. 29, to the proposition of the Cleveland Railway to submit the questions of valuation of the physical property and of maximum fare to Robert W. Tayler, judge of the United States circuit court, as arbitrator. The rapidity with which the administration acted upon this matter caused considerable astonishment among the people of the city. They expected the old excuse that the duties of the city council must not be taken out of the hands of that body would be pleaded as an excuse, but only one vote was cast in the negative. This member still held to the policy mentioned and would not give in. Dr. Walz did not vote, because he wanted to be free to act when the proposed franchise is brought before the council.

Preceding the council meeting a caucus was held behind closed doors. Mayor Johnson had just returned from an automobile tour which consumed two weeks, but he seemed to have been posted on what was transpiring at home, as he was ready to act at once. The letter containing the Cleveland Railway Company's proposal was delivered just the day before his return, so that everything was in shape to proceed. The city's reply to the letter of the company was as follows:

"Replying to your letter received on Sept. 27, the council committee agrees to refer the questions of valuation and maximum fare to Judge R. W. Tayler.

"You agree to accept and we to pass an ordinance embodying Judge Tayler's findings upon these questions, this to the end that the people of Cleveland at a referendum may pass upon the settlement

"In order that the people may have full information before them, we understand that Judge Tayler's valuation shall be by items, to the extent that either the company or the council shall request, the purpose of this itemization being, of course, to enable the voters to discuss and understand it, for the valuation of the property will be the foundation of the ordinance and of the settlement.

"We are ready then for the immediate submission of these questions to Judge Tayler."

Many persons attributed this move to a desire that the matter should be in better shape before the fall election, as there was every evidence that the people were getting tired of waiting for a decisive move. It was argued that this would put the matter in such a light that the administration could say that it had put a 3-cent fare proposition before the people and they had refused to accept. Since there had been a call for an ordinance on the lines suggested by Judge Tayler, the administration has now apparently made it possible for such a proposition to be placed before the people.

F. H. Goff, formerly arbitrator for the Cleveland Railway, stated that he believed the administration was sincere, but that if an attempt was made to have Judge Tayler fix the value of the property and name the maximum fare, so that the administration might attack the conclusions, he would refuse to have anything to do with the matter. Mr. Goff said, also, that a definite agreement should be reached on all other points before Judge Tayler was asked to take up the subject.

It will be noticed that the administration adheres to the idea that Judge Tayler shall value the property by items, if requests should be made to that effect by either party. The company has opposed any limitations upon Judge Tayler in arriving at the value of the property.

Mayor Johnson, however, is quoted in one of the local papers as saying that he reserved the right to oppose any part of an ordinance based on the Tayler plan that he did not like.

On Oct. 1 the directors of the Cleveland Railway framed a reply to the letter received from the city. While the company does not refuse to have the property valued by items, the assertion is made that Judge Tayler should have his own way in the matter and reply or not, as he sees fit, to any inquiries made either by the company or the city. The letter says in part:

"We understand that it is agreed between us that the questions of valuation and maximum rate of fare shall be arbitrated by Judge Tayler, without restriction or limitation, in ascertaining the valuation of our property.

"While we do not think it necessary that Judge Tayler report the value of the property by items, or his method of arriving at the value, we do not object to his being asked by either the city or the company to itemize the values of

the property. He should be at liberty, however, to comply with such requests or not, as he may deem proper.

"We are ready to unite with you at once in a communication to Judge Tayler requesting him to fix the value of the property and the maximum rate of fare.

"Inasmuch as there are some other provisions of the proposed ordinance upon which we are not agreed, we suggest that they also be submitted to Judge Tayler for arbitration, so that, when the ordinance has been completed, it may be passed in that form by the city council, and submitted to the people, to the end that it may have the approval and support of the city administration and the company in a referendum election."

Mayor Johnson stated that if the ordinance contained objectionable features, he would point them out, and that the degree of his opposition would depend upon the number of such objectionable features. He added that he would not be bound to approve any property valuation or any rate of fare, until he knew what they were.

Accompanying the letter of the Cleveland Railway was a form of submission to Judge Tayler, which is as follows:

"The city administration, the city council and the Cleveland Railway unite in inviting you to value the property of the Cleveland Railway as of Jan. 1, 1908, except that portion acquired from the Forest City Railway, which is to be valued as of March 25, 1908, and also, having reached a conclusion as to the value of the property, to fix the maximum rate of fare which may be charged by the Cleveland Railway within the term of the proposed so-called Tayler plan grant.

"If you decide to accept this public trust, the city administration, the city council and the Cleveland Railway will, as promptly as possible, unite in submitting to you for your decision any other questions upon which they may be unable to agree, to the end that the ordinance, completed by your arbitration upon these disputed matters, may be submitted to the people at a referendum election at as early a date as practicable."

The city council on Oct. 2 drafted a letter to the company in which it proposed that Judge Tayler be bound to make up the value of the property by items to the extent that might be desired by either the city or the company. The form of the letter of submission to Judge Tayler was so amended by the council as to require this. President Horace E. Andrews of the Cleveland Railway stated at the council meeting that the company had no objection to this form of valuation, except that it was not just to place any limitations about Judge Tayler in the work.

The letter of the council indicated that the other matters upon which agreements had not been reached consisted of differences in the form of the language used and that it was not necessary to ask Judge Tayler to pass upon them. One of these is the so-called safety clause, which both parties agreed to submit to a board of which Judge Tayler is a member. Another relates to East Cleveland and the interurban roads. No agreement has ever been reached on these matters.

Two evening papers of Cleveland, in their Saturday issues, stated that the mayor was attempting to put the blame for any further delay in the submission of the matter upon the company.

In a letter to the Cleveland council committee of the whole, delivered on Sept. 27, the Cleveland Railway has expressed its willingness to allow Judge R. W. Tayler to fix the rate of fare, after he has placed a valuation on the property. The administration contended that the fare should not be fixed until after the valuation had been made. The delivery of the letter has been delayed two weeks because of the absence of Mayor Johnson from the city. The letter follows:

"In regard to the value of our property, we believe that the entire subject should be submitted to Judge Tayler, and that neither party should impose upon him any restrictions or limitations.

"As to the maximum rate of fare, we believe that no ordinance fixing a lower maximum rate than 5 cents cash, including a transfer, or seven tickets for 25 cents with one cent for a transfer, as stated in our letter of Sept. 7, should be passed, but we are willing that Judge Tayler shall fix the maximum rate of fare after he shall have determined the valuation.

"The concessions made in our letter of Sept. 7 were made upon the condition that the valuation be determined as herein stated, and that the maximum rate of fare be the rate herein named. We now consent that Judge Tayler may fix

this maximum rate of fare after the determination of the valuation."

At its regular meeting on the evening of Sept. 27 the City Council did not take up the matter. Mayor Johnson was just returned to the city and had not had time to go over any of the matters that have come up during his absence.

The hearing on the claims against the Municipal Traction Company which are opposed by the Cleveland Railway has been postponed by the Federal Court on account of pressure of other business.

Judge Tayler has written a letter to the City Council and the Cleveland Railway, saying, in part:

"I deem it due to myself and to the community to set down the following conditions upon which I can consent to act as an arbitrator on the subject of the valuation of the property of the Cleveland Railway Company and a determination of the maximum rate of fare:

"(1) I cannot consent to enter upon this arduous and responsible work until all other questions are settled. There must not be left anything to debate about or agree upon before I am called upon to leave for an indefinite and considerable time my public duties as judge. The ordinance ought to be completed in every line except the insertion of the valuation and the maximum rate of fare.

"(2) As to itemizing the valuation of the property, I cannot consent to be required to itemize upon any and every part of the property valued which either of the parties may require. But I am not unwilling to value the physical property in one item, the franchise value in another item, and if any allowance is made at all for good will or growing value, to separately itemize that.

"(3) Even these things I hesitate to consent to do, because neither the mayor nor the council agrees to accept my findings, but both reserve the right to attack them at a referendum election."

Judge Tayler says his position will be difficult because he is to act neither as arbitrator nor referee, but simply as adviser in the matter, as the city has not agreed to accept his decision as final. However, he says he is willing to waive that important point and act, from a sense of public duty. On the subject of fares he holds that the maximum should be 7 tickets for 25 cents, with 1 cent for a transfer.

Philadelphia Transit Talks

In Transit Talk No. 19, dated Sept. 21, 1909, the Philadelphia Rapid Transit Company republished a news item from the Philadelphia North American comparing transit conditions in Frankford of 63 years ago and now. The article in the North American was inspired by an old home celebration in Frankford, and said:

"Sixty-three years ago—or, to be exact, on March 4, 1846—there appeared in an issue of the Frankford Herald and Weekly Advertiser the following notice:

"The subscribers respectfully inform their friends and the public generally that they have made arrangements to run coaches every evening between Frankford and Philadelphia. For the better accommodation of those who have business to transact and them that visit the city for pleasure the above line of coaches will leave S. C. Paul's, No. 208 Main Street, every evening at half-past 5 o'clock, commencing on Saturday, Nov. 29, 1846. Returning, will leave Philadelphia from the Sign of the Camel, between Vine and Race, in Second Street, allowing sufficient time to reach Frankford at 12 o'clock. Coaches and horses are good, and no pains will be spared to make this the Accommodation Line."

"W. H. SHALLCROSS & CO."

"What a contrast to the facilities Frankford has to-day in the way of transportation! Not only are there 10 lines of cars reaching the district from various sections, but at Frankford Avenue and Bridge Street is to be found the largest car barn in the world. It is operated by the Rapid Transit Company, which employs 575 men there, and which pays in wages each year at the barn \$301,295."

Transit Talk No. 20, dated Sept. 23, 1909, was the subject, "Wissahickon Rambles." The talk says in part:

Hundreds of inquiries are made at the offices of the Fairmount Park Commissioners about the location of places of interest in the picturesque Wissahickon valley.

Nearly everybody knows of these beautiful spots, but not many people know how to reach them. They are not inaccessible, excepting by long walks, as many suppose.

Our Wayne Avenue line parallels the lower end of the Wissahickon ravine for a considerable distance. Several famous points—Devil's Pool, the Livezey homestead, the old Monastery and Walnut Lane bridge—are within reasonable walking distance of the cars.

We have prepared a map to show the location of these and other points of interest that you may reach by a stroll of a mile from the cars, along romantic lanes and drives.

Transit Talk No. 21, dated Sept. 28, 1909, was on the subject, "Seven 'Dead' Lines," and said:

There are no less than seven lines in this system that are "dead" as money makers, but the accommodation of riders requires that we operate them.

They once were horse-car lines, such as the Catharine and Bainbridge Streets road, but were electrified along with others. Because of increased costs and comparatively insignificant traffic, these roads could not remain in business

today if run separately by the original companies.

But their abandonment would inconvenience thousands of riders. For this reason, and because they are of some service as "feeders" to other lines, we continue to operate them at a loss.

Most of these unprofitable lines run through built-up sections of the city. They have no prospect of becoming profitable.

We have many other lines—extensions that we built after taking over the system—that are not paying, but we do not class them as "dead" ends of the business.

Some day they should make money for us; at present they are helping the city to grow at our expense.

When the average corporation finds that some part of its business is being run at a loss the usual policy is to eliminate the unprofitable department. With a public service corporation it is different.

Transit Affairs in New York

Both the Republicans and the Democrats in New York have selected their candidates for the principal city office to be elected in November, and the municipal campaign has begun. Otto T. Bannard is the choice of the Republicans for mayor and William J. Gaynor the choice of the Democrats. Mr. Bannard is a banker and business man, and Mr. Gaynor is a justice of the State Supreme Court. Mr. Bannard has supplemented the rapid transit plank in the platform of his party with a public expression of his personal opinion, stating:

"All future subways should be owned by the city. They should be built with the city's funds, construction by private capital not being permitted except when it is positively demonstrated that the city is financially unable to keep up with the demands for transit extension, and then only on terms that will preserve strict and effective municipal control.

"The beneficial system of street railway transfers has been practically nullified. We favor such action as will secure as speedily as possible the re-establishment of a universal transfer system.

"A subway built by private capital, to be owned by the city, is a city work. Existing laws prescribe eight hours of labor and the prevailing rate of wages for labor in all city works. No distinction should be made between the city works carried out with the assistance of private capital and those done with city funds. None should be made in contracts for the construction of city's subways. To do so would defeat the intention of existing laws and be unjust.

New Line Opened in Kansas.—The Laurence (Kan.) Street Railway has opened its line in Laurence.

Wire Thieves Arrested in Indianapolis.—Thieves were arrested recently in Indianapolis after having cut down and carried away about \$300 worth of copper wire strung by the Indianapolis, New Castle & Toledo Electric Railway.

Demand for Rental for State Land.—The State of Indiana has made a demand on the Louisville & Southern Indiana Traction Company, New Albany, Ind., for a yearly rental for a right-of-way through land owned by the State. When the road was built the owner of the land was not known.

Malden Aldermen Over-ruled on Speed Question.—The Massachusetts Railroad Commission has issued an order revising a set of speed regulations for electric cars recently put in force by the Malden board of aldermen. The municipal authorities limited the speed at crossings to 10 m.p.h., and at other points to 12 m.p.h. The commission raises these limits to 12 and 20 m.p.h., respectively.

Track Laying at Cleveland, Ohio.—The new track being constructed by Receiver Bicknell of the Municipal Traction Company is being laid with 100-lb. steel grooved rails resting in Carnegie steel ties embedded in concrete. There are 4 in. of concrete between the upper and lower flanges of the ties which rest upon a bed of concrete 10 in. thick. The rails are riveted and welded with thermit at the joints according to the Clark method.

Woburn Grade Crossing Petition Denied.—The Massachusetts Railroad Commission has denied the petition of the Boston & Northern Street Railway for consent to build a line across the Boston & Maine Railroad at grade in the city of Woburn. The board states that no special conditions exist which would justify such construction, and emphasizes the policy of the State as declared in repeated enactments of legislation in aid of abolition.

Cable Road in Brooklyn Converted.—The cable road on Montague Street, Brooklyn, extending from Court and Fulton Streets to the ferry to Wall Street, New York, at the foot of Montague Street has been reconstructed by the Brooklyn Rapid Transit Company for operation as a trolley line. The Montague Street line was the only cable road remaining in Brooklyn, and in rebuilding if the Continental plan was

adopted of suspending the span wires from the houses on either side of the street, the residents objecting to the use of poles. In reconstructing the line the company also arranged for service between Wall Street Ferry and Fulton Ferry.

New Franchise Placard in Kansas City.—The Metropolitan Street Railway, Kansas City, Mo., has posted in its cars a placard referring to the proposed new franchise extension ordinance which reads: "Union Depot ordinance was almost unanimously adopted, vacating 140 streets and alleys for 200 years. Consideration: New depot. The Metropolitan asks a 16 years' extension of franchise. Consideration: Half net earnings (guaranteed never less than 5 per cent gross receipts); children half fare; paving and maintaining one-half double track streets; makes possible immediate opening Twelfth Street Traffic Way, etc. Do your own thinking."

Rumor Regarding Electrification of Branch of Vandalia Railroad.—A number of officers of the Vandalia Railroad, including Benjamin McKeen, general manager of the company, recently made a tour of inspection of the Michigan Division of the railroad, and as a result of this trip, it was reported that the Vandalia Railroad would electrify its line between South Bend and Logansport, Ind., a distance of 67 miles. In reply to a letter regarding this report addressed to him at St. Louis, Mo., recently by this paper, Mr. McKeen replied under date of Sept. 21, as follows: "There is nothing whatever in the rumor that the tour of inspection of our Michigan Division had any connection with the report that the company was considering the electrification of its line between South Bend and Logansport."

Municipal Ownership to Be Recommended in San Francisco.—The public utilities committee of the Board of Supervisors of San Francisco, which has been considering the question of acquiring the Geary Street, Park & Ocean Railroad and equipping it for operation as a municipal line, has decided to submit to the Board of Supervisors of San Francisco a resolution declaring that public interest and necessity require that the road be acquired and operated by the city and requesting that the city engineer be instructed to prepare plans and estimates on the basis of extending the line from the foot of Market Street to Geary Street, thence to Point Lobos Avenue and thence to the Ocean with a connection to Golden Lake Park. The resolution of the public utilities committee to the Board of Supervisors will also contain a provision for holding an election at which the necessary amount of bonds can be voted by the public.

Meeting of Kansas Gas, Water, Electric Light & Street Railway Association.—The twelfth annual meeting of the Kansas Gas, Water, Electric Light & Street Railway Association was held at Wichita on Sept. 23 and 24. In outlining the work of the association W. A. Scothorn stated that during 1907 there were in Kansas 67 private lighting plants and 26 municipal, while at the present time there are 75 private plants and 36 municipal. The relatively larger percentage increase in the municipal plants may be attributed to their being installed as a matter of convenience and local pride in towns that are too small to be attractive to capital. The following officers were elected: M. T. Flynn, Kansas City, president; J. H. Rathert, Junction City, first vice-president; Charles D. Bell, Independence, second vice-president; W. R. Murrow, Independence, third vice-president; J. D. Nicholson, Newton, secretary-treasurer. Executive committee, W. B. Foshay, chairman, Wichita; T. F. Cole, Pittsburg, and B. F. Eyer, Manhattan.

Street Railway Questions in Politics at Toledo.—Frank L. Mulholland, Republican candidate for city solicitor at Toledo, Ohio, published a letter in the Toledo Blade recently in which he set forth the ideas he will favor in the matter of a new franchise for the Toledo Railways & Light Company. Among other things Mr. Mulholland says: "Good service includes up-to-date cars, kept in repair, properly handled by competent, courteous men attentive to the reasonable wants of the passengers in their charge, and cars in such numbers and with seats sufficient to carry all who may wish to ride. Reasonable rates are such as will cover yearly all actual operating expenses, provide for repairs and depreciation of property used by the street car company in thus carrying the public, and also give the company a fair yearly interest on the money actually invested." The details of the franchise proposed by Mr. Mulholland are substantially those suggested in the Taylor plan at Cleveland, including an initial fare of 3 cents, with a provision for regulation according to the surplus or the loss which may result, and interest at the rate of 6 per cent on the money actually invested. Mr. Mulholland says that the renewal franchise should be approved by the voters.

Financial and Corporate

New York Stock and Money Market

Oct. 4, 1909.

The week in Wall Street has been one of continued advance, led by Steel common, which to-day reached the record price of 94%. Marked advances, however, have been recorded only in a few specialties. The advance of call money to 4½ per cent has naturally tended to check the upward movement. It is not so easy to carry stocks with high price money as with low price money. With the exception of Brooklyn Rapid Transit the traction shares have been comparatively inactive and prices have changed slightly. The bond market is not so strong as a few weeks ago since rates for money are higher. Quotations to-day were: Call, 3½ @4½ per cent; 90 days, 4@4¼ per cent.

Other Markets

The features of the Chicago market continue to be the heavy pressure upon Subway stock and the inclination of this issue to decline. During the last week it sold as low as 7 and the quotation was very little better today.

In the Philadelphia market, Rapid Transit and Union Traction continue rather active, but prices remain practically unchanged. There has been some trading during the week in Philadelphia Traction.

In Boston, Massachusetts Electric preferred has been about the only traction issue that has been much fancied. There has been no price change.

In the Baltimore market the bonds of the United Railways are still the important traction issue. Considerable blocks of these were sold during the week.

Among the securities sold at auction last week were: \$5,000 Brooklyn Rapid Transit, 5 per cent bonds at 104; 80 shares South Shore Traction Company, New York, \$100 each, at 41½.

Stock Quotations

Quotations of various traction securities as compared with last week follow:

	Sept. 28.	Oct. 4.
American Railways Company.....	46	a46
Aurora, Elgin & Chicago Railroad (common)...	*50	a48
Aurora, Elgin & Chicago Railroad (preferred)...	*95	a92
Boston Elevated Railway.....	129	124½
Boston & Suburban Electric Companies.....	*17	*15
Boston & Suburban Electric Companies (pref.)...	*74	*72
Boston & Worcester Electric Companies (com.)...	a12	10
Boston & Worcester Electric Companies (pref.)...	a54	a54
Brooklyn Rapid Transit Company.....	80	80¾
Capital Traction Co., 1st pref., conv. 4s.	88½	88½
Chicago City Railway.....	a140	a140
Chicago & Oak Park Elevated Railroad (com.)...	*3	*3
Chicago & Oak Park Elevated Railroad (pref.)...	*10	*10
Chicago Railways, pteptg., ctf. 1.....	108	a110
Chicago Railways, pteptg., ctf. 2.....	36½	a36½
Chicago Railways, pteptg., ctf. 3.....	24	a25
Chicago Railways, pteptg., ctf. 4s.....	9	a10
Cleveland Railways.....	*78	*78
Consolidated Traction of New Jersey.....	76½	77
Consolidated Traction of N. J., 5 per cent bonds.	105½	105½
Detroit United Railway.....	a72	a72
General Electric Company.....	168	167
Georgia Railway & Electric Company (com.)...	94	a97
Georgia Railway & Electric Company (pfd.)...	85	a88½
Interborough-Metropolitan Company (common)...	15	16
Interborough-Metropolitan Company (pfd.)...	48¾	49
Interborough-Metropolitan Company (4½s)...	82¾	84½
Kansas City Railway & Light Company (com)...	a45	a44
Kansas City Railway & Light Company (pfd)...	a81	a83
Manhattan Railway.....	142½	a143
Massachusetts Electric Companies (common)...	16¼	a18½
Massachusetts Electric Companies (preferred)...	79½	a82½
Metropolitan West Side, Chicago (common)...	15	a19
Metropolitan West Side, Chicago (preferred)...	50	a51
Metropolitan Street Railway.....	a22	a24
Milwaukee Electric Railway & Light (pfd)...	*110	*110
North American Company.....	a82½	82
Northwestern Elevated Railroad (common)...	18	a20
Northwestern Elevated Railroad (preferred)...	68	a71
Philadelphia Company, Pittsburg (common)...	48	a48¾
Philadelphia Company, Pittsburg (preferred)...	a44½	a41½
Philadelphia Rapid Transit Company.....	a28¼	a29
Philadelphia Traction Company.....	a90	a91½
Public Service Corporation, 5 per ct. col. notes.	a100¼	100
Public Service Corporation, ctf. s.....	a95½	94½
Seattle Electric Company (common).....	114	114
Seattle Electric Company (preferred).....	105	105
South Side Elevated Railroad (Chicago).....	a55	52½
Toledo Railways & Light Company.....	a10	09¾
Third Avenue Railroad, New York.....	22	21¾
Twin City Rapid Transit, Minneapolis (com)...	110½	110¾
Union Traction Company, Philadelphia.....	53¼	a54¾
United Rys. & Electric Company, Baltimore...	13¾	a14¾
United Rys. Inv. Co., San Francisco (com)...	45¾	43¾
United Rys. Inv. Co., San Francisco (pfd)...	76	74¾
Washington Ry. & Electric Company (com)...	a47¾	a47¾
Washington Ry. & Electric Company (pfd)...	a84¾	a93½
West End Street Railway, Boston (common)...	a96	94
West End Street Railway, Boston (preferred)...	107¼	a106
Westinghouse Elec. & Mfg. Company.....	88½	87¾
Westinghouse Elec. & Mfg. Company (1st pref)...	130	144

*Asked.
*Last sale.

Hearing at Boston on Proposed Expansion of Boston Elevated System

The Massachusetts Railroad Commission and the Boston Transit Commission, sitting as a joint board by order of the Massachusetts Legislature continued the hearing in Boston on Sept. 28 on the proposed acquisition by the Boston Elevated Railway of the stock of other electric railways in Massachusetts, notably the Boston & Northern Street Railway and Old Colony Street Railway, the Blue Hill Street Railway, Lexington & Boston Street Railway, Middlesex & Boston Street Railway and the Boston & Worcester Street Railway. Secretary Joseph B. Eastman and Robert B. Luce of the Boston Public Franchise League were heard in opposition, after which Counsel Frederic E. Snow responded for the company.

Mr. Snow said that the Boston Elevated Railway appreciates that its first duty is to provide for transportation in its present territory; that the purchase of the stock of these other companies would benefit the Boston Elevated Railway through the increased earnings, better service and operating economies which would result, and that the plan is to keep each of these companies legally independent, building it up to be both locally prosperous and beneficial to the Boston Elevated Railway. Actual consolidation would not be practicable even if the 5-cent fare restriction upon the Boston Elevated Railway in Section 10 of Chapter 500 of the Acts of 1897 were removed. Administrative and operating economies, with improved service, were sought by the plan. It was not the power to hold the stock of another company but its abuse which was objectionable. Mr. Snow said that a bill which provided all necessary safeguards had been drawn to meet the objections advanced by the Public Franchise League. By the terms of this bill the amount of securities issued for acquiring any stock of other companies would be subject to the approval of the Railroad Commission, and the Boston Elevated Railway would be obliged to secure the board's consent before selling any securities so acquired. Another provision would require the company on securing a controlling interest to offer to purchase all remaining shares at the average price per share paid for the majority of stock acquired.

Mr. Snow cited the purchase of the controlling interest in the Chelsea, East Boston and Quincy gas companies by the Boston Consolidated Gas Company to show how the service had been improved and rates lowered by the association of these properties with the skilfully managed Boston organization. He further cited the value to the Seattle district of the construction of the Puget Sound Electric Railway by a corporation separate from the Seattle Electric Company, the latter having been held back from such a task by a charter restriction.

Effect of Rehabilitation on Earnings in Chicago

The Chicago (Ill.) Railways has issued the following statement showing the effect of rehabilitation and the installation of new cars upon passenger earnings:

	Earnings 1908	Earnings 1907	Increase	Pct. Inc.
December	\$ 949,260	\$ 833,719	\$ 115,541	14
January	\$ 917,357	\$ 794,388	\$ 122,969	15
February	859,200	716,023	134,177	19
March	963,655	840,743	122,912	15
April	975,440	847,220	128,220	15
May	1,032,511	884,775	147,736	17
June	1,021,582	913,594	107,988	12
July	1,049,277	939,943	109,334	12
August	1,061,364	959,167	102,197	11
September	1,033,961	939,048	94,913	10
Total	\$9,854,607	\$8,668,620	\$1,185,987	14

Boston Suburban Electric Companies, Boston, Mass.—The stockholders of the Boston Suburban Electric Companies voted on Sept. 30 to reduce the capital stock of the company by retiring 4694 shares of preferred stock and 1173 shares of common stock originally issued for the purchase of the property of the Waltham Gas & Electric Company which was recently sold to retire additional common and preferred shares for which tenders are asked at the Boston Safe Deposit & Trust Company. Not more than \$600,000 in cash is to be used and not more than \$2,000,000 of 4 per cent 10-year notes. Mention of the plan of the company to reduce its capital was made in the issue of Sept. 25, 1909, page 482.

Consolidated Traction Company, Chicago, Ill.—Various interests in the Consolidated Traction Company are understood to have agreed on the main outline of the plan of the reorganization committee of the company to be placed before the City Council for ratification. For more than two

months suits for foreclosure had been pending for most of the underlying companies. The default on bond interest was made more than a year ago for the majority of these companies. Several bondholders' committees were appointed, but the committee representing the largest interest was composed of Messrs. Hoover, Cook and Ford of the Harris Trust & Savings Bank, Chicago, and E. K. Boisot of the First Trust Company, Chicago. This committee has acted for the North Chicago Electric Railway, the Chicago Electric Transit Company and the North Chicago Electric Company. About 98 per cent of the bonds of these companies has been deposited with the Harris Trust & Savings Bank. Of the \$6,750,000 of general mortgage 4½ per cent bonds, \$4,200,000 are owned by the Yerkes Estate. The committee representing these bonds consist of Charles G. Dawes, Chicago; James N. Wallace, president of the Central Trust Company, New York; Hans Winterfeldt of Speyer & Company, New York; Fred W. Upham, Chicago, and E. W. Harden, New York. The Payne committee represents the minority interest in the general mortgage bonds.

Chattanooga Railway & Light Company, Chattanooga, Tenn.—The Chattanooga Railway & Light Company, which is a consolidation of the Chattanooga Railways and the Chattanooga Electric Company, paid its first dividend on the preferred stock on Oct. 1. The payment was 1¼ per cent for the quarter. Hodenpyl, Walbridge & Company, New York, N. Y., offer for subscription at 96½ and interest, \$1,600,000 of the first and refunding mortgage 5 per cent gold bonds of the company dated Aug. 1, 1909, and due on May 1, 1956, but subject to redemption after May 1, 1916, at 105 and interest. The first coupon is payable on Nov. 1, 1909, for the period from Aug. 1; thereafter interest will be paid semi-annually in May and November at New York or Philadelphia. The Fidelity Trust Company, Philadelphia, Pa., is trustee.

Columbus, Delaware & Marion Railway, Marion, Ohio.—Eli M. West has been appointed sole receiver of the property of this company by Judge Kinkead of Columbus. Originally George Whysall and Mr. West were appointed co-receivers; the former was appointed by Judge Young of Marion and the latter by Judge Kinkead.

Columbus, Magnetic Springs & Northern Railway Company.—The following officers and directors have been elected by the stockholders: President, W. L. Galbreath, Pittsburgh; vice-president and treasurer, Christopher Magie, Jr.; secretary, H. E. Beck; manager, C. J. Fifer; auditor, B. W. Loveless; directors, W. M. Galbreath, Christopher Magie, J. L. Hord, B. Cahill and W. F. Dodge.

Indianapolis, Crawfordsville & Western Traction Company, Indianapolis, Ind.—Harry J. Milligan, receiver for the Indianapolis, Crawfordsville & Western Traction Company has filed his first report with the United States Court at Indianapolis. The report is for July and August. The earnings for July were \$12,809; operating expenses were \$9,642, leaving net earnings of \$3,167. For August the report shows total earnings of \$18,910 and expenses of \$12,731 with net earnings of \$6,119.

Metropolitan Street Railway, New York, N. Y.—Argument was heard on Sept. 24 by Judge Lacombe, in the United States Circuit Court, on the motion of counsel for the directors of the Forty-Second Street & Grand Street Ferry Railroad to recover from the receiver of the Metropolitan Street Railway \$200,000 for the payment of franchise taxes and other expenses. The Forty-second Street & Grand Street Ferry Railroad is operated by the Metropolitan Street Railway and the directors seek to recover the money for the payment of rent and franchise taxes for the past two or three years. Judge Lacombe reserved decision.

Northern Ohio Traction & Light Company, Akron, Ohio.—The Northern Ohio Traction & Light Company will expend \$225,000 for improvements in 1910. Fifteen new cars will be purchased at a cost of \$100,000. Six of these will be for limited service and will cost in the neighborhood of \$10,000 each. The remaining \$125,000 will be expended for various betterments. It is stated that the company has power capacity sufficient for the next two or three years, and that nothing will be done toward enlargement of the power stations at present.

Oregon Electric Railway, Portland, Ore.—Perry, Coffin & Burr, Boston, Mass.; N. W. Harris & Company, New York, N. Y., and the Harris Trust & Savings Bank, Chicago, Ill. are offering for subscription \$2,000,000 of first mortgage 5 per cent bonds of the Oregon Electric Railway at 96½ and interest. The bonds are dated May 1, 1908, and are due May 1, 1933, but are subject to call on and after Nov. 1, 1910, at 107 and interest. Principal and interest are pay-

able at the office of the trustee, the Columbia Trust Company, New York, N. Y., the interest payments falling due on May 1 and Nov. 1. The circular announcing the issue contains an estimate of the earnings of the company for the year ending June 30, 1910, made by G. W. Talbot, vice president of the company. This estimate follows: Gross earnings, \$435,000; operating expenses and taxes, \$234,900; net earnings, \$200,100; bond interest, \$100,000; surplus, \$100,000.

Philadelphia, Bristol & Trenton Street Railway, Philadelphia, Pa.—John Redwood and Carl N. Martin, who purchased the property of the Philadelphia, Bristol & Trenton Street Railway under foreclosure on Aug. 2, 1909, for \$380,000 for a committee representing the bondholders, have transferred the property of the Philadelphia, Bristol & Trenton Street Railway to the Trenton, Bristol & Philadelphia Street Railway. The consideration was \$325,000 in the capital stock of the Trenton, Bristol & Philadelphia Street Railway and an obligation of \$350,000, which, it is understood, will probably be converted into an issue of bonds.

Public Service Corporation of New Jersey, Newark, N. J.—The stockholders of the Public Service Corporation at a meeting on Sept. 27 approved the proposal to turn the gas properties of the company over to the Public Service Gas Company, as outlined in the *Electric Railway Journal* of Sept. 11, 1909, page 415. They also authorized the execution of a new mortgage for \$50,000,000 to secure an issue of bonds of like amount which will be issued from time to time as deemed necessary. This proposed issue of new securities was mentioned in the *Electric Railway Journal* of Sept. 25, 1909, page 483.

Scioto Valley Traction Company, Columbus, Ohio.—The annual meeting of stockholders of the Scioto Valley Traction Company was held on Sept. 28. The only change in the board of directors was the election of I. B. Cameron, president of the Columbus Savings & Trust Company, to succeed J. C. Hooven of Cincinnati.

Second Avenue Railroad, New York, N. Y.—Justice Blanchard, of the State Supreme Court, has authorized George W. Lynch, receiver of the Second Avenue Railroad, to accept the offer of the Guaranty Trust Company, New York, for the purchase of receivers' certificates for \$500,000 to be used for improvements. The certificates are to draw interest at the rate of 6 per cent and are to mature in one year. It is announced that formal notice has been issued by the Second Avenue Railroad to the holders of the general consolidated mortgage bonds maturing on Nov. 1, asking them to extend the life of the bonds to Nov. 1, 1910. Bondholders not willing to extend the date of maturity of their holdings will be paid on and after Nov. 1 upon surrender of their bonds at the office of the Guaranty Trust Company, New York.

Southwestern Traction Company, London, Ont.—The property of the Southwestern Traction Company will be offered for sale at auction in the offices of the London & Western Trust Company, London, Ont., on Oct. 20. The road extends from London, Ont., to Port Stanley, passing through St. Thomas, a distance of 28 miles. Thomson, Tilley & Johnson, 59 Yonge street, Toronto, Ont., are the attorneys.

Toledo & Findlay Railway Company, Toledo, Ohio.—This is a company incorporated for the reported purpose of uniting the Toledo Urban & Interurban and the Toledo, Bowling Green & Southern roads. The incorporators are B. L. Kilgour, Anthony B. Dunlap, Morris McGrew and Frank H. Simpson. The property of the Toledo Urban & Interurban road was purchased at receiver's sale recently, presumably for the owners of the Toledo, Bowling Green & Southern Traction Company.

Waynesboro & Monongahela Street Railway, Waynesboro, Pa.—A mortgage for \$1,500,000 in favor of the Carnegie Trust Company, New York, N. Y., has been filed by the Waynesboro & Monongahela Street Railway to cover the property which the company has recently acquired in Greene County.

A large balloon sent up from the Indianapolis speedway park on Oct. 1 descended so near the earth that its anchor struck the high-tension wires of the Indianapolis, Columbus & Southern Traction Company at a point near Columbus, Ind.

The Columbus, Delaware & Marion Railway, Columbus, Ohio, has decided to attach freight and express cars heretofore operated separately over its lines to its regular passenger cars.

Traffic and Transportation

Decision Favorable to Company in New Bedford Fare Case

The Massachusetts Railroad Commission has issued an order dismissing the petition of citizens and taxpayers of New Bedford relative to street railway fares within that city. The board states:

"The city of New Bedford is principally served by the Union Street Railway Company. The Old Colony Street Railway Company operates a line from a connection with the Union Street Railway from Lund's Corner, so-called, to the Freetown boundary. The petitioners request a 5-cent fare to and from all points served by these street railways within the city of New Bedford. It is obvious that if the petition were granted it would cause a reduction in many instances in the cost of a single ride and in a return of less than 5 cents to one or both of the companies. Indeed, an equal division between the companies would mean a gross return to each of 2½ cents per passenger.

"The board is of the opinion that there is no present occasion for a recommendation that the companies reduce the unit of fare, in view of the limited amount of travel on the Old Colony Street Railway and the maximum distance of a single ride on the two lines of railway.

"At the hearing complaint was made of the service between the city proper and the Freetown boundary over the lines of both companies. The board has made an investigation of the riding between Lund's Corner and the city proper, on the Union Street Railway, and between Lund's Corner and the Freetown line on the Old Colony Street Railway, and is in receipt of returns for the weeks ending Dec. 19, 1908, March 13 and July 13, 1909, respectively, together with a statement showing the time cars were due according to the schedule and the time they arrived at and left Lund's Corner for the six days ending September 19, 1909, with reasons for delays. These disclose no occasion for any recommendation with respect to service. The managements of both companies, in our opinion, are fairly meeting the present demands of the traveling public, and while delays necessarily incident to the operation of street railways occur here as elsewhere, the service as a whole is reasonably satisfactory. The petition must therefore be dismissed.

Subsequently to the hearing counsel for the Old Colony Street Railway Company filed with the board a statement of all trips on the Old Colony Street Railway between Lund's Corner, New Bedford, and Freetown, showing the number of inward and outward passengers for three selected weeks, in December, 1908, March and July, 1909, as mentioned in the order of the commission; a similar statement covering the same periods, of the total number of passengers on each trip on each of the cars of the Old Colony Street Railway Company while on the tracks of the Union Street Railway Company between Lund's Corner and the center of New Bedford; and a statement showing the time when cars were due at Lund's corner for all trips during the six days ending Sept. 19, 1909, with the time of their actual arrival and departure from that point. In transmitting these statements, Counsel Bentley W. Warren stated that there are few places in the State of Massachusetts in which more than the seating capacity of the cars is so seldom occupied.

A review of the statements filed shows that during the week ending Dec. 19, 1908, on the Old Colony line between Lund's Corner and the city line (Freetown), 136 inward and outward trips were made, upon 6 of which the normal seating capacity of the cars (40 passengers each) was equaled or exceeded. During the week ending March 13, 1909, there were a total of 241 inward and outward trips, and in 6 cases was the seating capacity attained or surpassed. During the week ending July 23, 1909, a period of heavy traffic, representative of the company's maximum business in the summer season, there were 247 regular total round trips, inward and outward, and on 35 trips the normal seating capacity was reached. During this week, however, 70 extra trips were made, and on these, in 24 cases, the seating capacity was attained or exceeded. On the line of the Union Street Railway Company, between Lund's Corner and New Bedford, with substantially the same number of regular trips in each direction as between Lund's Corner and the city line, the week ending Dec. 19, 1909, showed 23 trips on which the seating capacity was filled or exceeded. The week ending March 13 showed 14 such trips, and the week ending July 24, 1909, showed an equal absence of overcrowding, the schedule not permitting the classification of car types, but indicating in general ample facilities. Regarding the alleged lack of punctuality at Lund's Corner, the records for the week ending Sept. 19,

1909, showed that out of 130 arrivals, 29 were 5 minutes late or over, waits for connections being indicated as a common cause for delays.

Prevention of Accidents to Children in Boston

The Boston Elevated Railway advertises a letter which it has sent to the school committees of Boston and surrounding communities in relation to the prevention of accidents to children. The company states:

"Action has been, or is about to be, taken by all of them in co-operation with the company. The company desires, also, the co-operation of parents and others having charge of children. It is believed that much injury may be avoided by such action."

The letter of the company to the school committee is as follows:

"The Boston Elevated Railway Company wishes to call your attention to its desire to prevent as far as possible injuries to children resulting from the operation of its cars in and around.....and if possible to enlist your active co-operation to this end. In spite of every reasonable precaution taken by the company and the generally careful operation of the cars by its employes, distressing accidents happen more often than we believe they would, if the children were carefully instructed by those in authority concerning the danger of careless playing in the streets and of stealing rides on the cars.

"The fact that thus far in the experience of the company the courts have not in a single instance held the motorman responsible for the death of a child, would seem to justify one in assuming that greater care on the part of the injured would result in lessening the number of such accidents.

"The company, therefore, respectfully suggests and believes that such warning to the children attending the schools of.....as you may see fit to have given will tend to diminish these accidents and the sufferings and grief resulting therefrom.

"If agreeable to you will you kindly have the matter brought before the teachers and scholars in such form as you deem best?"

Influence of Interurban Lines on Business in Indianapolis

During the last few years many inquiries have been addressed to the Commercial Club of Indianapolis regarding the interurban electric railways operating out of that city and the effect of travel over these lines of the business of the merchants and trades people in Indianapolis. So numerous did the requests finally become that the Commercial Club placed the matter of studying the subject in the hands of R. G. McClure, its secretary, and instructed him to formulate as far as he could a reply which would cover the requests for information contained in most of the letters received. In his study Mr. McClure was assisted by the companies themselves and by the merchants who estimated for him as nearly as possible the effect of the interurban lines on their business. As a result he has formulated a report from which he draws at length in answering inquiries from outside sources about Indianapolis and its interurban lines. Following is the substance of the typical reply by Mr. McClure to an inquiry for information concerning the interurban roads:

"Referring to your personal inquiry on the subject of the advantages of the interurban railways to Indianapolis, beg to advise that on account of the variety of industries it would be very difficult to secure figures showing the actual increase in business to our retail, wholesale, manufacturing and professional interests.

"Such figures as were obtainable however show that during the first six years interurban roads were operated into Indianapolis the average rate of increase from year to year to the retail business was 40 per cent—the lowest increase was 15 per cent and the highest 77 per cent. These figures prove to me conclusively that, allowing for a natural increase of, say, 10 per cent, we can safely place the increase due to the interurban railways at 40 per cent.

"In investigating the wholesale business we secured various figures from leading houses. A conservative estimate of the increase in this business on account of interurban railways is 15 per cent to 25 per cent. The manufacturing business shows a healthy growth, but figures are not obtainable to show the extent of the increase. Manufacturers, however, freely say that the interurban railways are largely responsible for the increase in their business and that they have greatly improved the facilities for transporting the products of their factories.

"The educational and professional life of Indianapolis re-

ceives probably more benefit than is shown by the business interests, but it would be extremely difficult to ascertain and define this benefit. It is easy to note, however, that physicians, dentists, attorneys, and professional men prosper by the millions of people who come into the city from the rural districts yearly who would probably not come only for the convenient transportation of the interurban systems.

"The State now has more than 1500 miles of interurban electric railways, two-thirds of which are in direct connection with Indianapolis. Hourly service in both directions is given on all these lines in modern cars, roomy, comfortable and operated on fast time. Passengers on the interurban railways are conveyed to a commodious terminal station within a square of the business center of the city. This terminal also combines a large freight station which is used by the 12 lines which carry freight and express matter thus facilitating shipments in either direction

"Territory within a radius of 150 miles comes under the influence of the interurban railways and in some instances patronage has been traced to neighboring states. For a number of years the merchants rebated the interurban fares of patrons who came to Indianapolis to trade, but the tax grew to such proportions that it had to be abandoned."

Mr. McClure also cites the effect of the interurban railways upon the immediate vicinity of Indianapolis in the increase in suburban residences.

Articles That May Be Carried on Cars in Cleveland

Brief mention was made in the *Electric Railway Journal* of Sept. 25, 1909, page 485, of the new order of the Municipal Traction Company, Cleveland, Ohio, to its conductors specifying the articles passengers are to be permitted to carry on cars. The complete order follows:

"Passengers must not be allowed to carry dangerous or bulky packages aboard cars. The following are excepted:

"Washerwomen's baskets.
 "Carpenter's small tool boxes. (12 in. x 12 in. x 36 in. maximum.)
 "Surveyor's instruments.
 "Small tools which can be conveniently carried in the hand.

"Suit cases and valises.
 "Two market baskets to each person paying fare.
 "Folded go-carts.

"Harps, bass drums and bass viols will only be carried when persons accompanying them are provided with permits.

"No article which is too long to stand under rear hood will be allowed on car.

"Employees must not carry packages, letters or newspapers without an order from proper authority, and must not assume responsibility for any package that a passenger may bring upon the car except such articles as are turned into the Lost Article Department.

"They must not hang nor allow articles to be hung on the brake handles."

In addition the company issues permits to florists, milliners, and musical houses, specifying the size and type of packages they may carry under the permit, and also issues permits for dogs, but does not allow dogs from different kennels on the same car.

Freight Franchise Granted in Easthampton.—The selectmen of Easthampton, Mass., have granted the Northampton (Mass.) Street Railway a 25-year franchise to carry freight in Easthampton.

Agreement for Freight Station in Dayton, Ohio.—An agreement has been reached between the city of Dayton, Ohio, and the Ohio Electric Railway and the People's Railway Company of Dayton, the result of which will be the construction of a freight station.

Milwaukee Western Electric Railway, Milwaukee, Wis.—This company has secured 80 per cent of the right-of-way for its interurban railway, which is to extend 60 miles west from Milwaukee to Beaver Dam via Hartland. J. W. Barber, 914 Majestic Building, Milwaukee, secretary.

Conductor Sentenced for Theft of Car Fares.—John J. Sweeney, formerly a conductor of the Boston (Mass.) Elevated Railway has been sentenced to serve 90 days in the House of Correction by Judge Fallon of the South Boston District Court for the larceny of car fares.

Fairmont & Northern Traction Company, Fairmont, W. Va.—This company announced that bids would be received by the company until Oct. 8 for the construction of 5 miles of electric railway on the proposed route from Fairmont to Fairview. Construction is to be started on the Fairview end not later than Oct. 10.

Thermopolis & Hot Springs Street Railway, Thermopolis, Wyo.—The project of building an electric railway from Thermopolis to Hot Springs has been taken up by George D. Miklejohn, Omaha, Nebr., who will investigate and report on the proposition to the interests he represents. Col. S. A. Broadwell, Thermopolis, president. [E. R. J., Dec. 19, '08.]

Private Car Converted Into Touring Car.—Warren Bicknell, receiver of the Municipal Traction Company, Cleveland, Ohio, has placed in service Parlor Car 99, which was formerly Senator Hanna's private car, seating about 35 persons. This car is finely upholstered, has rattan chairs and is heated by electricity. Besides making the regular "Seeing Cleveland" trips, it will be held for evening charters.

Resolutions Against Car Gates Introduced in Birmingham Council.—A resolution introduced into the City Council of Birmingham, Ala., instructing the Birmingham Railway, Light & Power Company to discontinue the use of gates on its cars, has been referred to the railway committee of the Council. The resolution describes the gates as "dangerous and a nuisance because they delay the getting on and off of cars."

Petition to Compel Full Vestibules in New York.—The Public Service Commission of the First District of New York has ordered a hearing for Oct. 12 upon the complaint of the Congress of Knights of Labor, at Albany, against the street railways operating in Brooklyn and Queens, to determine whether the companies should be required completely to enclose the vestibules of their cars. The vestibules now in use are not enclosed at the sides.

Traffic in New York.—During the week from Sept. 25 to Oct. 1, inclusive, when the Hudson-Fulton celebration took place, the Interborough Rapid Transit Company of New York reports that it carried 12,964,716 passengers on its subway and elevated lines. This number does not include last Saturday's record. In recognition of the strenuous work of the gatemen and ticket choppers, the company has ordered that a bonus of \$25,000 be distributed among the men actually concerned in handling the crowds.

International Railway Given Permission to Appeal Fare Case.—The Court of Appeals at Niagara Falls, Ont., has granted leave of appeal to the International Railway, Buffalo, N. Y., from the order of the Ontario Railway & Municipal Board fixing the fare on cars between Bridge Street, Niagara Falls, Ont., and the upper steel-arch bridge at 5 cents. The ruling by the Ontario Railway & Municipal Board followed a protest by the Board of Trade of Niagara Falls, Ont., against the 10-cent fare.

New Bulletin Boards in Philadelphia.—The Philadelphia (Pa.) Rapid Transit Company has recently placed in each of its barns a bulletin board of special design for use in connection with the work of its accident bureau. Upon these boards are posted every 10 days notices dealing with some feature of accident work. Employees of the company have been requested to look the bulletins over from time to time and to make any suggestions which they think might be used to advantage in connection with the notices.

Tum Tum Mountain Railway, Vancouver, Wash.—A. Arntson writes that this company has made surveys of its electric railway which is to connect Ridgefield, La Center, View, Amboy and Tum Tum, a distance of about 32 miles, and will start construction about Jan. 1, 1910. The company's power station will be located at the base of Tum Tum Mountain, and it is its intention to furnish power. Capital stock, \$250,000. Officers: E. M. Meach, Vancouver, president; A. Arntson, Ridgefield, vice-president and general manager; F. R. Whelan, Vancouver, secretary, and T. O. Hilstrom, Vancouver, treasurer. [E. R. J., Sept. 18, '09.]

Hearing on Fares on Westchester Electric Railroad.—A hearing has been ordered for Oct. 11 before the Public Service Commission of the First District of New York upon the complaint of the Tax & Rent Payers' Organization of Wakefield against the Westchester Electric Railroad, Mt. Vernon, N. Y. In the complaint it is alleged that the company charges a 10-cent fare from the subway station at 177th Street, New York, to Larchmont, and the complainant wants the fare reduced to 5 cents, at least to the city limits. The company admits that it is collecting two fares and that the second fare is collected at 233d Street, New York, or 19th Avenue, Williamsbridge. From this point there is a stretch of about one mile of track which is within the city limits, and on this ground it is maintained that the company is violating the law by charging a double fare within the city limits.

Storm Damages Mississippi Line.—The storm which swept over New Orleans and gulf cities recently did considerable

damage to electric light and railway properties. One of the companies which suffered was the Gulfport & Mississippi Coast Traction Company, Gulfport, Miss. About 10 miles of the roadbed of the company was washed away, but the company lost no rails or ties. More than 550 poles were down, and the transmission line was so tangled in wreckage that the company was able to recover only about two-thirds of the insulators and cross-arms. According to an estimate furnished by the company, it will cost \$50,000 to repair the line and the revenue from traffic will be lost for about 40 days.

Chicago & Milwaukee Electric Railroad Menu.—The Chicago & Milwaukee Electric Railroad, Highwood, Ill., has printed the menu of its Chicago & Milwaukee limited service in the shape of a four-page folder. The cover contains a reproduction in colors of the interior of one of the company's dining cars with the insignia of the company in red and white in the upper left hand corner. The back of the menu contains the schedule of the eight limited trains which are run daily between Milwaukee and Chicago. The second page of the folder contains the a la carte list and the third page the wine list. Liquors are sold only in bottles. Playing cards cost 15 cents and 25 cents. An extra charge is made for single orders served for two. All orders must be written out by guests. A copy of the menu has been received from E. H. Vivian, traffic agent.

Through Service Established by Hudson & Manhattan Railroad.—The Hudson & Manhattan Railroad established through service between the Pennsylvania Railroad station in Jersey City and Twenty-third Street and Sixth Avenue, New York, on Sept. 20. Connection is also made with the Erie station at Jersey City and the Hudson Terminal Building, at Church and Cortlandt Streets, New York. Trains are run at intervals of five minutes, the running time between Twenty-third Street and Sixth Avenue and the Pennsylvania Railroad station being 13 minutes. It requires only 16 minutes to go from Twenty-third Street and Sixth Avenue, New York, to the Hudson Terminal Building. The company announces that work has been started on the extension of its lines in Jersey City to connect with the Pennsylvania Railroad, so that through trains can be operated between Newark and the Hudson & Manhattan Railroad's terminal at Church and Cortlandt Streets, New York.

Public Service Commissions Exhibit at New York Fair.—In the Electric Railway Journal of Sept. 18, 1909, page 443, mention was made of the exhibit of the Public Service Commission of the First District of New York at the State Fair at Syracuse, which opened on Sept. 13. The exhibit received considerable attention from visitors to the fair who studied the charts and maps carefully. Commenting on the interest thus displayed in the exhibit, James Blaine Walker, second assistant secretary of the commission, said upon his return to New York: "The charts and statistics shown were such as to emphasize the greatness of New York City, especially in the number of passengers carried on its transit lines and the amount of gas and electric current produced annually. Photographs of the subway during construction and in its completed state were eagerly scanned by thousands, many of whom had never been in New York City. Perhaps the feature which attracted most attention was the profile chart of Manhattan and the Bronx showing the largest ticket sales in one hour at the different stations on the subway and elevated lines as well as at the Brooklyn and Williamsburg bridges and the East River ferries. Profile blocks whose height indicated the number of tickets sold were attached to the map at each station and the block representing the Manhattan terminal of the Brooklyn bridge, with its record of 29,411 tickets sold in one hour, caused many an exclamation of amazement at the gigantic total. Next in interest were the photographs showing the results of fender and wheelguard tests held by the commission last Fall in Schenectady and Pittsburg. Charts showing the tide of travel in New York City towards work for the 24 hours and towards home for an equal period also commanded great attention, as illustrating the great fluctuations in the amount of traffic between the rush hours and the non-rush hours. The pride of Americans in their greatest city was repeatedly shown by many who took the time to read the comparative statistics showing that the transportation lines of New York City carry more persons in one year than those of any other large city in the world. These statistics showed that the roads in London, with a population of more than 7,000,000 in the year 1907, carried only about 800,000,000 passengers as against 1,300,000,000 in New York City with a population of a little more than 4,000,000."

Personal Mention

Mr. John De Lowry has been appointed superintendent of the Birmingham Division, No. 3, of the Pittsburgh (Pa.) Railways in charge of the operation of cars from the Tunnel, Thirtieth Street and Suburban car houses. Mr. De Lowry entered electric railway work as a conductor on the Consolidated Traction division of the Pittsburgh Railways and was promoted to dispatcher and inspector. In 1907 he was appointed acting superintendent at the Highland car house and in 1908 became superintendent of the Ardmore Street Railway. When the Ardmore Street Railway was absorbed by the Pittsburgh Railways Mr. De Lowry was appointed superintendent of the Highland Division and in May, 1909, he was transferred to the Birmingham Division with jurisdiction to Washington Junction.

Mr. E. C. Fitch has been appointed superintendent of the Interurban Division, No. 6, of the Pittsburgh (Pa.) Railways, in charge of the operation of cars on the Washington, Canonsburg and Charleroi routes of the company. Mr. Fitch entered the service of the United Traction Company, Pittsburgh, as a motorman, and later became a conductor. In 1897 he resigned and became a motorman on the Hill Top division of the Birmingham Traction Company, remaining with the company until 1902, when it was absorbed by the Pittsburgh Railways. He was then appointed night dispatcher at the Hill Top car-house. At the end of three months he became day dispatcher, retaining this position until 1903, when he was appointed inspector of the newly opened Pittsburgh and Charleroi line. In October, 1906, Mr. Fitch was appointed acting superintendent of the Charleroi Division and has since continued in that capacity.

Mr. J. M. Loftis has been appointed superintendent of the Consolidated Division, No. 5, of the Pittsburgh (Pa.) Railways, in charge of the operation of cars from the Oakland, Homewood, Ardmore, Highland, Herron Hill and Butler Street car houses and will also have charge of cars of the Monongahela Division from Craig Street to the city limits. Mr. Loftis entered the service of the Citizens' Traction Company, Pittsburgh, on Nov. 9, 1899, as repairman on the cable road. Later he became night watchman at the Penn Avenue car-house of the company and a few months later night receiver at the same place. He became a gripman on the cable road and in 1896, when the Citizens' Traction Company became a part of the Consolidated Traction Company and was electrified, Mr. Loftis became a motorman. He remained at this one year, when he was appointed inspector, and in about 18 months he was appointed superintendent of the Butler Division of the Consolidated Traction Company. Mr. Loftis held this position after the absorption of the Consolidated Traction Company in 1902 by the Pittsburgh Railways, and on May 15, 1904, he was transferred to the Homewood Division as superintendent. He has since retained this position.

Mr. T. J. Brennan, who has been appointed general superintendent of the Dayton, Covington & Piqua Traction Company, West Milton, Ohio, to succeed Col. Edward C. Spring, began his electric railway career in 1901, when he entered the employ of the Dayton & Xenia Traction Company as a conductor.



T. J. Brennan

After a short term of service with the company in this capacity Mr. Brennan became connected with the Boston Industrial Company, Boston, Mass., as a timekeeper. The Boston Industrial Company was at that time building a 60-mile line of railroad, and after serving for a short period as timekeeper Mr. Brennan was made assistant superintendent of the company. When the construction of the Dayton-Covington Traction Company's line was begun by the Boston Industrial Company, Mr. Brennan returned to the West in the employ of the company, and when the road was completed he entered the service of the Dayton, Covington & Piqua Traction Company as a conductor. In November, 1906, he was appointed car house foreman and train dispatcher of the company and in November, 1907, he was appointed assistant superintendent of the company.

Construction News

Construction news notes are classified under each heading alphabetically by states.

RECENT INCORPORATIONS

Highland Pacific Railroad, Lakeport, Cal.—Incorporated to take over the Sonoma & Lake County Railroad, which proposes to build an electric railway from Upper Lake to Lakeport, and a branch of 3 miles from Kelseyville to the nearest point on the main line in Big Valley, in addition to the route heretofore mapped out, viz., from Lakeport to Preston and on to Santa Rosa, the total length of the railway being estimated at 70 miles. Practically all rights of way have been secured. Capital stock, \$2,500,000. Incorporators of the company are Col. J. E. Felton, R. M. Beattie, A. E. Dickinson and Henry Eickoff, San Francisco. [E. R. J., Sept. 11, '09.]

Murphysboro & Southern Railway, Murphysboro, Ill.—Incorporated to build an interurban railway from Murphysboro to Shawneetown. Capital stock, \$250,000. Incorporators: A. B. Minton, W. C. Alexander and J. G. Hardy.

Wahpeton & Breckenridge Street Railway, Breckenridge, Minn.—Incorporated to build an electric railway to connect Breckenridge and Wahpeton, N. D. Capital stock, \$50,000. Incorporators: D. J. Jones, secretary; Joseph Gunn, Breckenridge, and F. L. Strum. [E. R. J., June 19, '09.]

Fostoria & Fremont Railway, Fostoria, Ohio.—Application for a charter has been made by F. D. Carpenter, J. D. McDonel, F. R. Havens, A. H. Jackson and Charles Ash, to build an electric railway from Fostoria to Fremont. The railway will connect the Lake Shore Electric Railway, which is to furnish the power, and the Western Ohio Railway, of which F. D. Carpenter is general manager, over the tracks of the Toledo, Fostoria & Findlay Railway. [E. R. J., Oct. 2, '09.]

Toledo & Findlay Railway, Findlay, Ohio.—This company has been incorporated to take over the properties of the Toledo, Bowling Green & Southern Traction Company and the Toledo Urban & Interurban Railway. Capital stock, \$10,000. Incorporators: B. L. Kilgour, Anthony B. Dunlap, Morris McGrew and Frank H. Simpson.

Mid-Continent Traction & Power Company, Tulsa, Okla.—Incorporated to build an electric railway from Miami to Shawnee, a distance of about 200 miles. Estimated cost, \$4,000,000. Capital stock, \$100,000. Incorporators: L. J. Weatherwax, Sapulpa; F. C. Brown, Red Fork; J. L. Harnage, Graham Burnham and J. Robert Burnham, Tulsa.

Coos Bay Electric Railway, Marshfield, Ore.—Incorporated to build an electric railway between Roseburg, Marshfield and Coos Bay. Capital stock, \$150,000. Incorporators: James H. Flanagan, C. F. McColl and W. S. Chandler. [E. R. J., Jan. 2, '09.]

FRANCHISES

Claremont, Cal.—The City Council has granted a 50-year franchise to the Ontario & San Antonio Heights Railroad to extend its electric railway through Claremont from Upland to North Pomona, 6 miles distant.

Los Angeles, Cal.—The Board of Supervisors has passed an ordinance authorizing the sale on Oct. 22 of a 50-year franchise to build a street railway on West Adams Street, from Washington Street to the city limits.

Santa Barbara, Cal.—The City Council will receive sealed bids up to Oct. 21 for a franchise applied for by the Santa Barbara Consolidated Railway to build an electric railway over certain streets of Santa Barbara.

Champaign, Ill.—The Illinois Traction System has applied to the City Council for a 25-year franchise to extend its railway in Champaign.

Glasgow, Ky.—The Fiscal Court of Burren County has granted a franchise to Charles Van-Den-Burgh to build an electric railway through that county to Hart County. The railway will extend 18 miles from Glasgow to Horse Cave. J. Lewis Williams, Glasgow, attorney. [E. R. J., Sept. 25, '09.]

St. Louis, Mo.—The St. Louis County Belt Railroad, which was recently granted a franchise to build an electric railway in St. Louis County, accepted the franchise. James D. Houseman, in whose name the franchise was secured, states that work will be started at once. [E. R. J., Oct. 2, '09.]

Albuquerque, N. M.—M. P. Stamm and associates write that they have been granted a 50-year franchise to construct a 2-mile electric railway in Albuquerque, and a 25-year franchise to furnish power for lighting, etc. [E. R. J., June 6, '08.]

Ironton, Ohio.—The County Commissioners of Laurence County have granted a franchise to Chester Sanborn and William Lemley, Huntington, W. Va., representing A. E. Cox and associates, also of Huntington, to construct an electric railway through the county. The railway is to extend from Pittsburgh, Pa., to Cincinnati, Ohio. [E. R. J., Aug. 14, '09.]

Waynesburg, Pa.—The Pittsburgh, Monongahela & Washington Railways has applied to the City Council for a 99-year franchise to build its railway over the streets of Waynesboro. The franchise has been referred to the corporation committee.

Knoxville, Tenn.—The City Council has extended the franchise granted to Charles Dawes, representing the Knoxville-Kingston Interurban Railway, to build an electric railway over certain streets of Knoxville. The amendments provide that the railway shall be in operation two years from date of passage. [E. R. J., June 5, '09.]

Seattle, Wash.—The Corporation Committee of the City Council has recommended for passage the franchise of the Seattle Electric Company to extend its railway on Fourteenth Avenue, northwest, in Ballard.

Wheeling, West Va.—The County Commissioners have granted a franchise to the Rapid Transit Company, Wheeling, to build an electric railway through Ohio County, with the provision requiring \$40,000 cash payment on its acceptance. It is stated that the company will not accept the franchise. [E. R. J., July 31, '09.]

TRACK AND ROADWAY

Edmonton (Alta) Radial Railway.—This company expects to place contracts within the next six months for constructing 10 miles of single and double track.

British Columbia Electric Railway, Vancouver, B. C.—This company has let the contract for constructing 4 miles of single track in South Vancouver to the firm of Christian, Hartney & Christian, Vancouver. Operations will begin within two weeks, and the lines are to be completed before the end of the year.

Central California Traction Company, San Francisco, Cal.—This company has started the grading on its 3½-mile extension between Sacramento and Agricultural Park. Following this work the company will commence the construction of the Sacramento-Lodi extension for which bonds have been disposed of and all right of way practically secured.

Los Angeles & San Francisco Short Line Railway, Los Angeles, Cal.—It is stated that the project of connecting Los Angeles with San Francisco, by means of a double track electric railway will be rushed to an early fulfillment. Practically all the right of way has already been secured and property for a terminal in Los Angeles has been purchased. A preliminary survey has been made and engineers are to begin the final survey immediately. Capt. John Cross, 416 American National Bank Building, Los Angeles, president, and M. K. Miller, 40 Bacon Building, Oakland, chief engineer. [S. R. J., April 4, '08.]

Grand Junction Electric Railway, Colorado Springs, Col.—This company has started the final survey for its proposed electric railway from Grand Junction to Fruita, via Palisades, a distance of about 25 miles. Entire right-of-way has been secured. E. A. Sunderlin, general manager. [E. R. J., July 24, '09.]

Macon, Ga.—Frederick Kauffmann, who is projecting the electric railway from East Macon to Recreation Club, 4 miles, advises that franchises have been granted and charter is being advertised, the same requiring the lapse of 30 days before being issued. [E. R. J., Sept. 25, '09.]

Valdosta (Ga.) Street Railway.—This company will within two weeks place contracts for 600 ties to repair its roadbed in addition to 400 ties already placed.

Rockford & Interurban Railway, Rockford, Ill.—This company has placed orders for 5 miles of 70-lb. 7-in. rails, to be used for renewing city track.

Rock Island Southern Railway, Monmouth, Ill.—This company advises that it expects to have its new extension between Monmouth and Rock Island, 50 miles, in operation by Jan. 1, 1910. About three-fourths of the grading has been completed and rails have been laid for a distance of 25 miles. The following contracts have been recently

awarded: Wisconsin Bridge Company, for 615 ft. steel viaduct, 70 ft. high, across Cedar Creek; Myers Construction Company, St. Louis, Mo., 950 ft. wood trestle, 70 ft. high and a wood pile trestle 2500 ft. long and from 20 to 30 ft. high; A. M. Skinner, St. Louis, Mo., 870 ft. wood trestle, 75 ft. high, across Pope Creek; E. J. Peterson, Davenport, Ia., grading between Monmouth and Gilchrist, except steam-shovel work, consisting of about 600,000 yds. The contract for all the overhead material has been let to the Ohio Brass Company. The railway will be equipped with 9-in., 45-ft. poles outside of the city limits and 55-ft., 60-ft. and 65-ft., 10-in. poles in the city. The company is also building an extension from Gilchrist to Aledo and Viola. W. W. McCullough, Monmouth, general manager.

Cincinnati, Louisville, Lexington & Maysville Traction Company, Dry Ridge, Ky.—This company, which is to build an interurban railway between Cincinnati, Ohio, and Lexington, Ky., a total distance of more than 200 miles, has arranged with the Reliance Engineering Company, Cincinnati, to design and construct the entire system. The estimated cost is \$3,000,000. The Reliance Engineering Company has started a party of twelve engineers to make the preliminary surveys of the first section, which will extend from Dry Ridge to Owenton, Ky., and when that is completed, the engineers will begin the survey from Dry Ridge to Cincinnati, Ohio. Actual construction, it has been decided, will commence about Dec. 1. Grants of land for the right of way have already been made through several counties. W. T. Blackburn, Dry Ridge, president. [E. R. J., May 15, '09.]

Lake Charles Railway, Light & Water Works, Lake Charles, La.—This company has started construction on its Rodger Street extension to Hi Mount addition, 1½ miles. It is to be completed within 30 days.

Boston, Lowell & Lawrence Electric Railroad, Boston, Mass.—Hearings have been resumed by the Massachusetts Railroad Commission on the proposed high-speed electric interurban railway of this company, from Sullivan Square, Boston, to the cities named in the title of the company. The testimony was confined to statements of parties residing along the route in favor of the project, with vigorous cross-examination in opposition by counsel for the Boston & Maine Railroad and the Boston & Northern Street Railway. [E. R. J., June 19, '09.]

Middlesex & Boston Street Railway, Framington, Mass.—This company has petitioned the railroad commissioners for extension of time on construction work in Natick and Wellesley and for approval of a location on Central Street, Natick.

Worcester & Providence Street Railway, Worcester, Mass.—This company is surveying the proposed route of its electric railway from Worcester to Providence, R. I., and work is being hastened in order to make some progress before the franchise expires, on Dec. 1, so as to have it extended. Wagner Fisher, chief engineer. [E. R. J., May 29, '09.]

Escanaba (Mich.) Electric Street Railway.—This company is said to have commenced construction on its proposed extension from Escanaba to Gladstone. It is expected to have the line completed within a year. R. L. Utley, general manager.

Kansas City, Ozarks & Southern Railway, Mansfield, Mo.—This company purchased 600 tons of rails for an extension in Douglas County.

Mexico, Santa Fé & Perry Traction Company, Mexico, Mo.—This company has awarded general contract for construction of its interurban railway to Burns & Company, 705 Isabella Building, Chicago. The line is to extend south from Mexico to Columbia and Fulton, and north to Santa Fé, Perry and Hannibal, a total of 103 miles. Construction will be started at Mexico about Nov. 1 in both directions. Burns & Company will purchase all material and let all sub-contracts. [E. R. J., Aug. 14, '09.]

New York & North Shore Traction Company, Mineola, N. Y.—Construction on the roadbed for the extension of this electric railway from Flushing through Whitestone to the central north shore sections of Queens Borough has been started at Broadway, Prince Street and State Street, Flushing. At this point connections will be established with the New York & Queens County Railway, which will transport north shore passengers over the Queensboro Bridge to Manhattan. The cost of the 7 miles of tracks will be \$1,250,000.

Minot, N. D.—It is reported that the Fisher Construction Company, Chicago, Ill., is making preliminary surveys for an electric railway to extend from Minot to Boscurvis, Sask., and that \$150,000 has been subscribed. H. F. Bartling, Minot, is said to be interested. [E. R. J., July 24, '09.]

Northern Ohio Traction & Light Company, Akron, Ohio.—The board of directors of this company has authorized the expenditure of \$225,000 for improvements to its property in 1910. Of this, \$100,000 is to be spent for new rolling stock, and \$125,000 for underground work and for general maintenance and betterment.

Dayton & Xenia Traction Company, Dayton, Ohio.—This company has filed a bond for \$5000 to insure the completion of its proposed extension between the Xenia route and the rapid transit division in Dayton, for which a franchise was recently granted by the County Commissioners.

Oklahoma City, Okla.—Homer S. Hurst, Holdenville, president of a company which has been formed to build an electric railway from Oklahoma City to Shawnee via intermediate towns, totaling 100 miles, announces that the railway is under construction. The company has not yet incorporated, but is in the market for usual equipment for an electric railway. There are to be two power stations, the locations of which are yet to be ascertained, in connection with the North Canadian River Water Power Company. The repair shops are to be located at Oklahoma City and the amusement parks at Oklahoma City Park, Joes City Park and others yet to be selected. Officers elected are: W. F. Harn, vice-president; Alfred Hare, secretary, general manager, superintendent and purchasing agent, and J. F. Winans, treasurer, all of Oklahoma City. [E. R. J., Sept. 25, '09.]

Mid-Continent Traction Company, Tulsa, Okla.—The contract for constructing this electric railway from Tulsa to Sapulpa via Shawnee, 22 miles distant, has been let and a forfeit of \$35,000 posted. J. Robert Burnham, chief engineer, has a party of surveyors in the field.

Ottawa & St. Lawrence Electric Railway, Brockville, Ont.—This company has organized to build an electric railway from Ottawa, Ont., through Metcalf, Kenmore, Vernon, Ormond, Winchester, Williamsburg to Morrisburg along the St. Lawrence River, through Iroquois, Cardinal, Prescott, Maitlands, Brockville and Perth to Lanark; north through White Lake to Arnprior, Fitzroy Harbor to Ottawa, with branches from Ottawa to Morrisburg; from Kenmore to Russel, and from Darling to High Falls, a total distance of 193 miles. The estimated cost of the line is \$3,000,000. C. S. Cossett, Brockville, president, and A. H. N. Bruce, Ottawa, chief engineer. [E. R. J., March 27, '09.]

Port Arthur, Ont.—J. McTeigue, city clerk, advises that the City Council is endeavoring to organize a company to build an electric railway from Port Arthur through the townships of McIntyre and Oliver to Kakabeka Falls on the Canadian Northern Railway. J. J. Carrick, Port Arthur, is said to be interested. [E. R. J., Sept. 18, '09.]

Coos Bay Electric Railway, Marshfield, Ore.—Messrs. Knettener & Haas, Portland, promoters of the proposed railway from Marshfield to Roseburg via Coos Bay, are said to have agreed with the Commercial Club, Roseburg, to deposit a bond of \$100,000, to be forfeited if they fail to construct the railway within three years after the preliminary surveys are completed. Half of the survey has been completed, and the Commercial Club has decided to raise \$6000 to complete the rest. [E. R. J., Jan. 2, '09.]

Westmoreland & Red Boiling Springs Railroad, Lafayette, Tenn.—It is announced that the preliminary survey has been completed and that rights of way are being secured for this electric railway, which will extend from Westmoreland via Lafayette to Red Boiling Springs, Tenn., 36 miles distant, and later into Kentucky, to connect with the Queen & Crescent Route. Bright Brothers Construction Company, Nashville, contractors. Officers: W. A. Smith, president; E. K. Lamb, secretary; Albert Dean, treasurer; A. J. Bright, chief engineer, and J. D. Holland, Lafayette, corresponding secretary. [E. R. J., May 29, '09.]

Corsicana (Tex.) Transit Company.—This company is lasting and placing drain tile for sub-drainage on its track, and also putting on improved rail joints. J. W. Carpenter is superintending the work.

Wichita Falls (Tex.) Traction Company.—J. A. Kemp, president of the company, writes that the construction on this electric railway is completed and that the road was placed in operation on Sept. 15. The railway, which extends from Wichita Falls to Lake Wichita, 7 miles distant, is standard gage, and 8 cars are operated over the line. The shops and power station are located at Wichita Falls, and there is an amusement park at Lake Wichita, which is controlled by the company. The company has not yet determined whether to furnish power for lighting purposes. Capital stock, authorized and issued, \$150,000. Officers: Frank

Kell, vice president; W. T. Van Brunt, secretary, general manager and purchasing agent; M. M. Murray, treasurer; and F. P. St. Clair, general superintendent and electrical engineer; all of Wichita Falls. [E. R. J., Aug. 28, '09.]

Bellingham, Wash.—Samuel Alsop has suggested to the merchants and business men of Bellingham a plan to construct a 20-mile electric railway in Bellingham and through the Nooksack Valley.

***Waterville (Wash.) Railway.**—This company has closed a contract with Frank McKean, Seattle, for constructing an electric railway in Waterville, for a sum of \$80,000. The railway is to be completed in 90 days.

SHOPS AND BUILDINGS

Edmonton (Alta) Radial Railway.—This company expects to place contracts during the next six months for erecting a new car house, with a capacity of 20 cars.

Fresno (Cal.) Traction Company.—Announcement is made that this company will begin work at once on a new car house in Fresno to cost \$25,000. The building will be 138 ft. x 160 ft., and will be situated near the Pollasky depot. It will be of concrete and brick construction and will have a storage capacity of 44 cars. The building will contain an inspection pit 98 ft. x 95 ft., also a store room and armature room. The offices of the company will be located here. A blacksmith shop and oil house will be built adjoining the car house.

Los Angeles & Mt. Washington Railway, Los Angeles, Cal.—This company expects to place contracts for constructing a terminal station during the next 60 days.

Rockford & Interurban Railway, Rockford, Ill.—This company expects to build new repair shops next year.

Lawrence (Kan.) Street Railway.—This company has let the contract for its car house to C. E. Varnum, Lawrence. The building is located on South Massachusetts Street and will be of concrete and steel, 70 ft. x 190 ft. In addition to the stalls for the cars there are to be offices and rooms for the employees. [E. R. J., April 17, '09.]

Corsicana (Tex.) Transit Company.—It is reported that this company's car house, with some electrical supplies and two street cars, has been consumed by fire at an estimated loss of \$4000.

POWER HOUSES AND SUBSTATIONS

Edmonton (Alta) Radial Railway.—This company has purchased 5000 hp in generators, including lighting generators, which are being installed in the power station. The company expects during the next six months to build a new power station.

Los Angeles & Mt. Washington Railway, Los Angeles, Cal.—This company expects during the next 60 days to place contracts for constructing a power house.

Rock Island Southern Railway, Monmouth, Ill.—This company has recently placed contracts with the Westinghouse Electric & Manufacturing Company for two 1250-kw turbo-generators and condensers complete, also a steam outfit consisting of five 550-hp Babcock & Wilcox boilers with coal hopper and carrier.

Sioux City Service Company, Sioux City, Ia.—This company has recently purchased new equipment for its power station, consisting of boilers, pumps, heaters, etc. An addition to the boiler room is now in course of construction. E. L. Kirk, general manager.

Boston (Mass.) Elevated Railway.—This company is building a new substation at Washington Street and Brady Street, Boston, to furnish current for the extension of the elevated railway through Washington Street to Forest Hills. The structure will be 93 ft. x 50 ft., one story high and will be concrete and brick construction.

Vicksburg (Miss.) Traction Company.—This company expects to purchase within the next year coal handling machinery to be installed in its power station.

New York & North Shore Traction Company, Mineola, N. Y.—It is stated that a site for a power house has been purchased by this company, and contracts for erecting the plant awarded to Westinghouse, Kerr, Church & Company.

Parkersburg, Marietta & Interurban Railway, Parkersburg, W. Va.—It is announced that this company will begin at once the work of remodeling and improving its power station at Marietta.

Manufactures and Supplies

ROLLING STOCK

Cincinnati (Ohio) Traction Company, it is reported, has ordered four pay-as-you-enter cars from the Cincinnati Car Company.

Northern Ohio Traction & Light Company, Akron, Ohio, is reported to be in the market for 15 new cars, 6 of which will be for limited service.

Corsicana (Tex.) Transit Company suffered a loss of two cars in a fire which entirely destroyed the company's car house. The cars will be replaced.

Springfield (Mo.) Traction Company has ordered from the American Car Company the six cars for which it was reported in the issue of this paper for Sept. 4, 1909, to be in the market. Two of the cars will be double-truck and four will be single-truck.

Kansas City, Ozark & Southern Railway, Mansfield, Mo., is in the market for two storage-battery cars for section gangs. The company desires a small generating unit to charge the batteries of these cars and a locomotive and some cars to be used until its hydro-electric plant is completed.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis., reported in the *Electric Railway Journal* of July 31, 1909, as having ordered 100 double end closed motor city cars from the St. Louis Car Company, has specified that the cars shall be of semi-steel construction in addition to the pay-as-you-enter feature. Details of the cars follow: Seating capacity, 50; weight (car body only), 23,000 lb.; bolster centers, length, 24 ft. 6 in.; length of body, 35 ft.; over vestibules, 50 ft.; width, over sills, 8 ft. 5½ in., sill to trolley base, 8 ft. 3¾ in.; height from top of rails to sills, 3 ft. 3 in.; body, wood; interior trim, oak, sanitary type; underframe, steel; bolsters, body, truss type; curtain fixtures, Curtain Supply Company; curtain material, Pantasote; heating system, Peter Smith; roofs, monitor type; sanders, Nichols-Linterns; sash fixtures, Edwards; step treads, Mason; trucks, type, St. Louis; varnish, Chicago Varnish Company; ventilators, St. Louis special; wheels, St. Louis 34 in.

TRADE NOTES

Grip Nut Company, Old Colony Building, Chicago, Ill., is in the market for 2500 tons of Bessemer steel for the manufacture of grip nuts, 1910 delivery.

Acheson Oildag Company, Niagara Falls, N. Y., announces that F. H. Banbury, engineer of the company, has sailed for Europe to further the patent interests of the company. Mr. Banbury is an Englishman by birth. He came to America about five years ago, and was for a time connected with the Commonwealth Edison Company, Chicago, Ill.

Cooper Heater Company, Dayton, Ohio, reports the sale of its car heaters to the following companies: Oklahoma Railway, Atlantic Shore Line Railway, Cincinnati & Columbus Traction Company, Benton Harbor-St. Joe Railway & Light Company, Johnstown Passenger Railway, Indiana Union Traction Company, and the Western Ohio Railway.

Dearborn Drug & Chemical Works, Chicago, Ill., announce that Edward C. Brown, their manager in the Hawaiian Islands and the Orient, has been elected president of the Commercial Club of Honolulu, an organization which is similar to the chamber of commerce and association of commerce organizations in the large cities of the United States. Mr. and Mrs. Brown recently made a trip in the interests of the Dearborn Drug & Chemical Company to the Orient, spending several months in China, Japan, Korea and the Philippines.

Electric Service Supplies Company, Philadelphia, Pa., and Chicago, Ill., announces that the Denver (Colo.) City Tramway recently ordered from it Automotoneers for 15 new cars. These controller regulators are of a new design, made to fit the GE K-36 controllers. All of the cars of the Denver City Tramway are completely equipped with Automotoneers. The Philadelphia (Pa.) Rapid Transit Company is now installing on all of its cars the new type of Automotoneer furnished by the Electric Service Supplies Company. The Philadelphia Rapid Transit Company some years ago equipped all of its cars with a controller regulator, but the improvements made in the Automotoneer were found to be of such advantage that the company is now replacing the old regulators with the new type of Automotoneer. The machines are being shipped and installed as fast as the Electric Service Supplies Company can furnish them.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., announces that C. B. Humphrey, manager of the retail and supply sales department of the company, has resigned to become a vice president and director of the White Investing Company, New York, N. Y., which will finance, develop and operate enterprises based on natural resources, and deal in bonds and securities. Among the interests of the company are the Aguacate Gold Mines in Costa Rica, which are now being developed and will be in operation in the near future; the development and operation of a slate mine for the production of slate for roofing, electrical and industrial purposes will be undertaken at once, and a number of properties of other character acquired. W. F. White, president of the company, was formerly manager of the Cincinnati (Ohio) Edison Electric Company, and later vice president of the North American Company.

General Electric Company, Schenectady, N. Y., has received grand prizes (highest award) at the Alaska-Yukon-Pacific Exposition in each class of electrical apparatus in which an exhibit was made by the company. G. E. apparatus was ranked first in the following divisions: Apparatus for cooking by electricity, apparatus for heating by electricity, automatic motor starters, arc lamps, bonds, cabinets, circuit breakers, cut-outs, fans, indicating instruments, integrating instruments, insulated wires, insulated cables, incandescent lamps, mine locomotives, motor generators, motors for direct current, motors for alternating current, recording instruments, rectifiers (mercury arc), sockets, switches, transformers, wiring devices. G. E. turbines were also entered in the Government exhibit, in which no awards were made.

McConway & Torley Company, Pittsburgh, Pa., attracted much attention at the Denver convention with the Janney radial coupler. This coupler is of the standard M.C.B. type, which this company was the first to manufacture and apply to both freight and passenger cars of the steam railroads in the United States. These M.C.B. couplers have been applied to over one million cars on the railroads of the United States and foreign countries. The radial coupler is an adaptation of the well known Janney passenger car coupler, which is in use on thousands of steam railroad equipments, and is especially adapted to meet the service requirements of interurban cars. The success of the radial equipment on the several hundred cars on which it has already been applied is the practical proof of its efficiency. This company is now engaged in getting out a large number of these equipments for several large lots of new cars being built for various important lines, which is proof of the recognition of its desirable features. Any railroad officer interested in the coupler problem who did not have an opportunity to examine the demonstration of the coupler at the convention should write the company in Pittsburgh, Pa., for its booklet describing this equipment. On receipt of blue prints showing car platform framing, this company will make application designs of the equipment to suit requirements.

ADVERTISING LITERATURE

Packard Motor Car Company, Detroit, Mich., is mailing a card showing two 3-ton Packard trucks used for hauling merchandise in New York City.

U. S. Metal & Manufacturing Company, New York, N. Y., has just issued a small illustrated booklet describing the merits of the Wolfe automatic rail joint lock.

McGuire-Cummings Manufacturing Company, Chicago, Ill., is distributing an illustrated folder descriptive of its snow sweepers and snow plows, which contains a list of the cities where the company's snow fighting machines are in use, and letters from railway officials who have had experience with the company's snow equipment.

General Electric Company, Schenectady, N. Y., has issued bulletins Nos. 4692, 4693, 4694, 4699 and 4701, all of which relate to railway apparatus. They are entitled in the order of their numbers: "G. E. 210 Railway Motor," "G. E. 88-A and -B Railway Motors," "Portable Substations for Electric Railways," "Motor Driven Air Compressors—Geared Type," and "Emergency Straight-Air Brake System."

Rockwell Furnace Company, New York, N. Y., has printed a 40-page catalog, in which the various types of furnaces which it manufactures are illustrated and described. These include furnaces for heating any material, for forging and welding. They are adapted for either hand or machine work, where high temperatures are required. Specifications accompany the descriptions of each type of furnace. The publication also describes the various furnace appliances manufactured by the company.