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FOOL- PROOF LOCOMOTIVES

Judging by the most recent electric locomotive designs, the aim of the builders is to produce a machine that will stand any amount of rough handling. Both the Chicago, Milwaukee & St. Paul and the Norfolk & Western railroads will have locomotives that can exert full accelerating effort for a period of five minutes without injurious heating even though they may be unable to move. This is, indeed, a most important qualification. Ruggedness in design has received attention over everything else for years in railroad service, as is only to be expected. The primary object is the movement of freight. Considerations of economy are largely subordinate, and even satisfactory explanations of train delays constitute a poor return for the loss of earning power that has been involved. Heretofore the electric locomotive has frequently, and justly, been accused of being like an over-willing horse that would work itself to death if given the chance. As the chance is always given on a railroad, this feature has been a decidedly weak one, and now that the new form of motive power has embraced the principle of having a continuous capacity that is almost equal to its hourly rating, together with an ability to stand still almost indefinitely while exerting full tractive effort, its possibilities have broadened enormously.

ELECTRICAL VERSUS MECHANICAL FAILURES

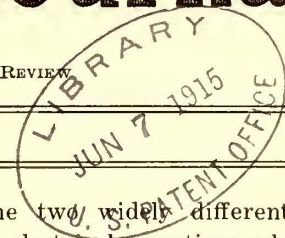
With the rapidly increasing interest in the electrification of steam railroads a question as to the relative reliability of electrical apparatus seems to have arisen quite frequently. The matter is, of course, impossible of direct settlement, but general indications point to the fact that the electrical machinery now being used for locomotives operates largely without repairs and with but comparatively little attention. As an example, on the New York, New Haven & Hartford Railroad's electric freight locomotives, there were eight engine failures during March. Two were due to hot bearings and two to broken parts. Four were due to electrical grounds and presumably were remedied without a vast amount of trouble. During the previous month exactly the same relation of mechanical to electrical failures was recorded, and incidentally it may be said that, during both months, the switch engines on the same road operated without failures of any kind. In the end the rugged equipment of electric locomotives hardly comprises enough inherent "grief" for the master mechanic to consider seriously. His work under electrification will be, as it always has been, the mechanical repairs involved by the heavy wear and even physical abuse to which every locomotive is subject.

CLEARANCE LIMITATIONS WITH ELECTRICITY

The two widely different types of electric locomotives which are described elsewhere in this issue possess the common characteristic of literally enormous power, and this has very material significance in view of the trend of modern railroading. Heavy trains are, of course, essential under the long-haul conditions that prevail in this country, and the constant endeavor to increase tonnage has resulted in a veritable struggle on the part of the locomotive designer to produce machines capable of meeting the demands of the transportation department. The difficulty with the large steam locomotive has been to confine its dimensions to the limits established by the standard gage and the tunnel and bridge clearances, and it has taken years of gradual development to bring the steam-driven unit to the point it has reached today. The electric locomotive, on the other hand, is inherently compact in design, and it has in one step acquired superiority in power over the steam locomotive, both of the electric units under discussion, with tractive efforts of the order of 100,000 lb. exceeding even the largest steam locomotives of the Mallet type. For the immediate future, perhaps, no demand will exist for much more powerful machines than these. But with the general introduction of the new couplers, with draft rigging to suit, the present limits on train length will again be advanced, and as the electric locomotive escapes absolutely any handicap involved by over-all dimensions it will be easily possible to provide designs suitable to the new conditions.

TESTING MOTOR INSULATION

As a result of the long experience of designers and users of electric railway motors and of electrical machinery in general, standard recommendations as to insulation tests have been evolved. Such recommendations are incorporated in the A. I. E. E. standardization rules, which specify a test voltage of twice the normal plus 1000, and in the recommended practice of the A. E. R. E. A. For trolley roads the latter specifies 2500 volts alternating current for five seconds on new armatures and fields, and 1000 volts alternating current for five seconds on old armatures and fields. This practice appears to be rational, as it provides a test which, while searching, is in no wise destructive. The factor of safety is no more than is reasonable to provide for deterioration in service and to enable the insulation to stand the extra voltages sure to be imposed upon it. Such extra voltages are produced by the opening of circuit-breakers, resulting in sudden collapse of the magnetic field of the motors, with consequent self-induced voltages. High voltage discharges are apt to occur also



during atmospheric disturbance, as is clearly evident in strings of incandescent lamps connected between trolley wire and ground when a thunderstorm is in progress. While we understand that some, and possibly many, railways do not employ the high-voltage tests on account of their supposed severity and at the same time have very satisfactory success in maintaining motor equipment, it is probably true that the motor insulation in these cases is so carefully looked after anyway that it would withstand the recommended test voltages without injury. It is obvious that recommended standards can only be successful when they epitomize good practice in their respective lines, but when they have been evolved as in the present case by competent representatives of both manufacturer and user there is every reason for adopting them and profiting by them.

SUPPLEMENTARY FINANCING

The sale of about \$9,890,000 of cumulative first preferred stock by the Pacific Gas & Electric Company during the eleven months ended April 30 has caused considerable comment in regard to the rise of such a class of securities as a financing medium. Probably the ablest exposition of this subject is that presented by G. K. Weeks, president San Francisco-Oakland Terminal Railways, before a recent meeting of the San Francisco section of the American Institute of Electrical Engineers.

It goes without amplification that the primary financing of public utilities is accomplished through the sale of mortgage bonds. Owing to the existence of certain conditions, however, additional financing is generally necessary. In the first place, bondholders and bond houses are chary of investing in any property that does not provide a one-quarter or one-third equity above the mortgaged indebtedness. Some public service commissioners have had this fact in mind in expressing the opinion that not more than 75 per cent of the investment in any public utility should be secured through the sale of bonds. In the second place, every well-drawn indenture of an open-end or limited-open-end character contains a provision that all bonds subsequent to the original issue may be sold to cover only a specified percentage of new capital costs—such percentages usually ranging from 66 $\frac{2}{3}$ to 90 per cent. It is evident from these facts that from 10 to 33 $\frac{1}{3}$ per cent of public utility investment must be secured from stockholders' assessments, surplus earnings or the issuance of junior securities.

Assessments of stockholders are, of course, unpopular and can be considered as only emergency measures of the most extreme type. Moreover, the surplus earnings that are available for reinvestment in the case of most properties are not large enough to take care of the additional financing even if such were desired. Paradoxical as it may seem, the larger and more prosperous the utility, the less likely it is to possess sufficient surplus to provide all needed capital above that obtainable from mortgage bonds, for with its progressiveness and potential prosperity comes a correspondingly increased need for new construction and

extensions. The third expedient, junior securities, is also not without its difficulties, for the inclination may be to secure the needed funds through the issuance of short-term obligations, funded or unfunded, which on account of their comparatively imminent payment or refunding only serve to complicate the supplementary financing as the necessity for this continues year by year.

By virtue of necessity, therefore, it seems that some authorized stock issue should be used for supplementary financing. This step is not at all devoid of propriety, however, for it is quite fitting that the equity above mortgage indebtedness should be created by those who through their voting power control the management and who share in the disposition of the net income. But what sort of stock should be sold—common or preferred? The answer to the question, we believe, depends on the interrelated factors of marketability and valuation. In the case of companies with a larger surplus, a good dividend record and all outstanding stock fully covered by property investment, it may be possible to dispose of common stock at the price fixed by the authorizing commission. Such a method is conservative and satisfactory. Yet if the outstanding stock issue is already in excess of a recognized valuation, or if a general financial stringency makes unattractive the issuance of common stock, the logical medium to be used is preferred stock. A cumulative and non-assessable issue of this kind, perhaps participating both as to dividends and as to assets, is desirable as a standard in all cases when common stock cannot well be sold. It is wise to have a check against over-extension, such as the California Railroad Commission provision that if the property value amounts to only 50 per cent of the par value of the preferred shares outstanding after deducting senior obligations, no more of such stock may be sold even if a market exists at a satisfactory price. With such a safeguard to investors, preferred stock should become quite popular as a supplementary financing medium.

SIMPLICITY—AN ESSENTIAL OF DESIGN

It is frequently the case that American machines are classed as crude, an imputation that is generally extended to our mechanics as well. No doubt there is much upon which to base such a belief, but even so, the rough-and-ready practices that have been at the root of our machine design, especially in the field of transportation, have not been adopted without material reasons to commend them. Indeed, it is with more than a trace of doubt that many engineers of to-day look upon the ready acceptance of complication for the sake of somewhat improved economy, and it may well be asked whether the growing spirit of willingness to abandon the rugged, albeit somewhat uneconomical, designs of the past fifteen or twenty years is going to be altogether beneficial.

Probably the best example of the change that seems to be taking place is found in the steam locomotive, which for some four score years remained almost exactly in the form devised by one of the earliest of its

designers. Such changes as took place were largely those of increased size. The details remained the same, and even they were limited to the minimum established by a rigid policy of simplicity. But within the past ten years these conditions have been absolutely reversed, and to-day the steam locomotive in many cases is a bewildering complexity of compound cylinders, articulated frames, superheaters, feed-water heaters and other things that are characterized, even by the younger generation of officials, as "frills" whose liability to break-down increases engine failures. Already there is arising a question as to whether or not they really pay.

In the field of power generation the rise of the Diesel engine is equally conspicuous. Compared with the turbine its multiplicity of parts seems to be infinite. Its economy, of course, is excellent and its ability to avoid stand-by losses during the hours of no load constitutes a splendid argument in its favor. Yet do these advantages compensate at all for the fact that the failure of one of its many essential details means a shut-down? Apparently an affirmative answer has been frequently given, at least in England, where insurance of Diesel engines against break-down seems to be the rule, the annual premiums ranging from 3 per cent to $7\frac{1}{2}$ per cent on the amount of the insurance. These rates, it is true, are considered by the Diesel Engine Users' Association to be unduly high, but at that is it possible to calculate the indirect losses due to a shut-down? Certainly the normal savings of a slightly improved operating efficiency are a small return for the enforced use of a prime mover whose reliability, unlike that of Caesar's wife, is always subject to suspicion.

The tendency toward the acceptance of complexity in design in the electric railway industry is perhaps not distinguished by any particularly shining example. Yet automatic details that stand very close to the border line of "frills" in their limited ability to improve operating efficiency as opposed to their complexity have been introduced by the score during the past five years. Many of them, of course, have fallen by the wayside. But on the other hand, many more have sprung up to take their places so that in the end every railway is constantly under a temptation to adopt devices which will admittedly effect a saving, but which cost enough more in labor and in lost time to reduce the saving to zero. This it would seem is something that could well be borne in mind at all times by railway managers. To make an increase in operating efficiency may not be excessively difficult, but to make it simply is a problem of Gargantuan proportions.

THE PHASE CONVERTER

By the use of a simple but commercially novel phase converter it has been possible to combine the advantages of single-phase power distribution and three-phase torque production in the Norfolk & Western locomotives which are exhaustively described in this issue. The principles of operation of this particular type of converter are fully described in the article. The peculiar virtues of the polyphase motor for certain kinds of heavy railroad work were clearly laid down by Cary T.

Hutchinson in his A. I. E. E. paper of Nov. 12, 1909. In spite of these facts but one traction application of this motor has heretofore been made in the United States, the chief obstacle to its progress in this field having been the second overhead wire. The phase converter renders this wire unnecessary, and is considered by the designers in the present case the lesser of two evils.

The induction motor is ideal as a phase converter in most particulars. It is simplicity itself structurally, and its ruggedness leaves little to be desired as to durability. There is no limit to the speed of the rotor excepting that set by the strength of the constituent parts so that the machine may be made quite light per unit of output. Like the traction motors it imposes no frequency limitations on the power supply, and it requires even less attention than the motors as there are no sliding contacts.

The addition of induction apparatus to the equipment necessarily involves some exciting current with corresponding loss of efficiency and lowering of power factor, and there are bearing, windage and electrical resistance losses also. Only a part of the power, however, passes through the phase converter, and this fact must be borne in mind in estimating the relation of the phase converter losses to the total input. The main problems in connection with the converter design have not been in reducing power and other losses, in the control of which there is much experience to guide, but rather in counteracting the effects of magnetic reactions. When a simple phase converter, like that described in the article, furnishes current to a load circuit that current reacts upon the revolving field and shifts its phase position. This effect appears in the load circuit as a phase displacement of emfs; in other words, the voltages become unbalanced. The efficiency of the circuit as a power producer is correspondingly impaired. The T-connection of the stationary transformer and the phase converter windings in the Norfolk & Western locomotive give a simple means of correcting phase distortion by shifting the point of T-connection. A second plan not substantially different in principle for neutralizing the reactive mmf, as experimentally developed by the General Electric Company, was described in the issue of the ELECTRIC RAILWAY JOURNAL for Oct. 11, 1913, page 678. In this a variable amount of line emf is introduced into the quadrature circuit (in a two-phase motor) to bring the emf of the latter to its normal value and phase position. In the General Electric plan also the converter was excited from an auxiliary winding carried on the cage-wound rotor and supplied with current from a synchronous exciter for the purpose of improving the power factor.

In view of all of the above facts regarding the phase converter it will be interesting from the electrical engineering standpoint to have, for purpose of comparison with other systems, the following among other data: The power factor in the line circuit at various loads; the voltages and phase relations in the three-phase and two-phase circuits under starting and running conditions, and the efficiencies of the locomotive as a whole and of the phase converter under the same conditions.

The Norfolk & Western Electrification

The First Month's Service of This Important Installation Has Demonstrated the Complete Success of the Single-Phase Contact System in Combination with Three-Phase Locomotives Having Rotary Phase-Converters
—Train Loads of 3250 Tons Are Handled Up 2 Per Cent Grades at 14 M.P.H.

During the past month regular operation on the electrified division of the Norfolk & Western Railway has been inaugurated under thoroughly successful circumstances, an outcome that establishes one of the most important forward steps in the progress of electrification of steam railroads. The installation, which has been mentioned from time to time in these columns, is unique in its combination of the inexpensive and efficient single-phase overhead contact system with the rugged three-phase motor for the locomotives.

The electric zone is located on the main line where it passes through the coal fields in the southern part of West Virginia, extending from Bluefield to Vivian, a distance of about 30 miles. The line is double track throughout except in the Elkhorn tunnel, and there is a large mileage of third-track, passing sidings, branches into the coal workings along the line, and yard trackage. The grades are heavy, and fully 60 per cent of the line is on curves, the maximum being 12 deg. Primarily, the traffic consists in collecting loaded coal cars from the mine sidings and yards, and transporting them up the grades and over the summit of the mountain range to the general classification yard at Bluefield, a division point for the railway. From Bluefield, after classification, the cars are shipped east to the various destination points, chiefly to the railway company's marine shipping pier at Norfolk, Va. All coal traffic originates west of Flat Top, a station about 6 miles east of the mountain summit. Coal shipments to the east con-

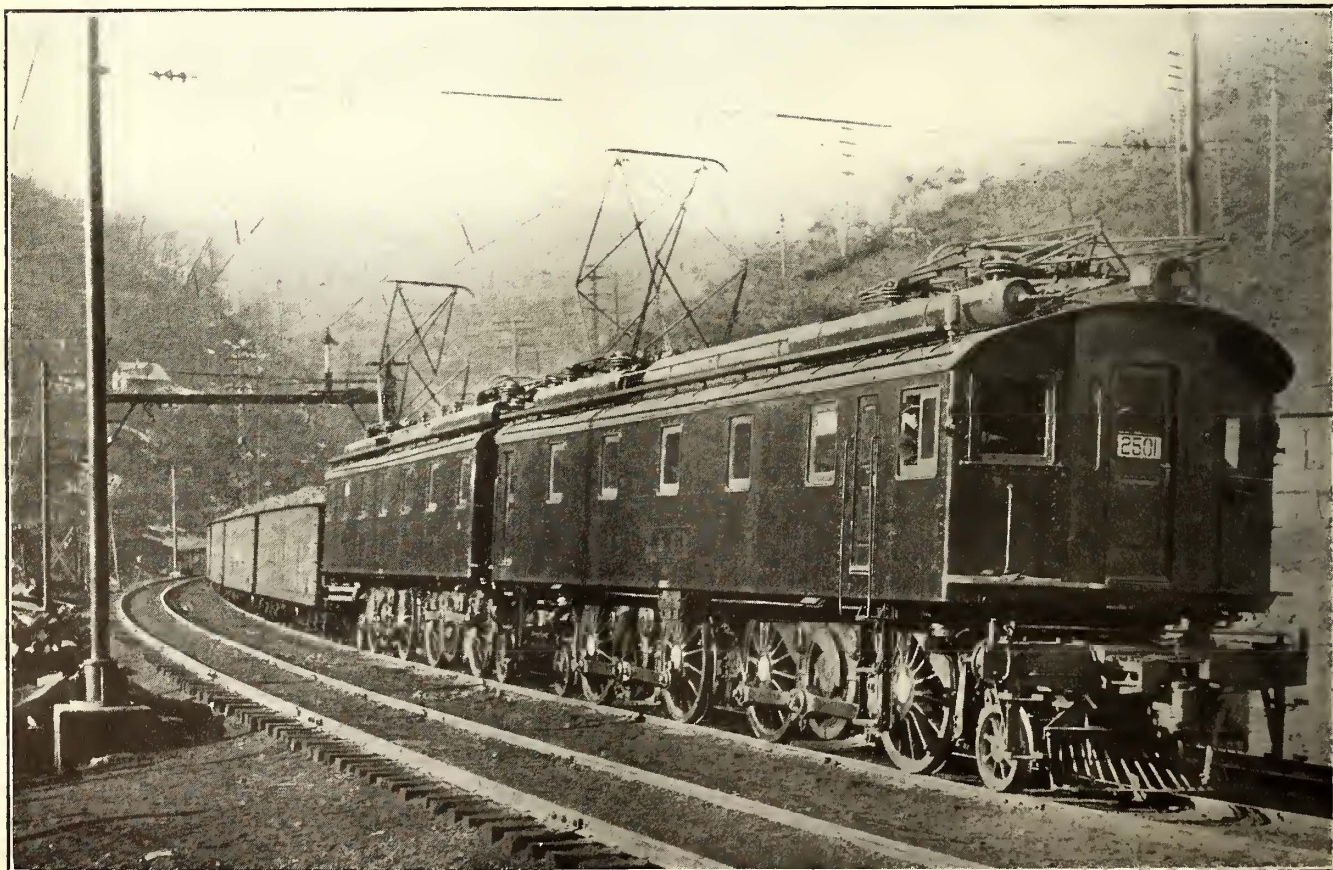
stitute the chief load to be handled electrically, but some coal originating east of the summit is shipped to the west, and this also is hauled by the electric engines to the yards near the west end of the electric zone.

There are numerous colliery sidings throughout the coal fields and the service includes the delivery of empties on the return trip as well as the collection of loaded east-bound cars. The electric zone is, therefore, practically a local switching and short-haul division between the coal fields and Bluefield, and it is operated to a large extent independently of the other traffic on the main division. In addition to the heavy tonnage of coal trains, however, through merchandise freight and passenger traffic over the electric zone is helped up the grade by the electric locomotives which are used as pushers, the steam locomotives remaining at the head end.

These conditions are especially favorable to electric traction because trains may be dispatched at fairly uniform intervals throughout the day, thus imposing a fairly uniform load on the power system. At the same time the full service is handled with a moderate number of locomotives, each one of which is able to make several round trips in each day.

TRAFFIC CONDITIONS IMPROVED BY ELECTRIFICATION

The purpose of the substitution of electricity for steam was to increase the capacity of the line by materially reducing the time required to handle trains, and



NORFOLK & WESTERN ELECTRIFICATION—SINGLE LOCOMOTIVE COUPLED TO TONNAGE TRAIN

also to provide a more economical and efficient service over the heavy grades. To this end the electric locomotives were designed to handle the heavy freight trains up the grades at the high running speed of 14 m.p.h. as compared with about 7.5 m.p.h. under steam operation. A further saving in time is effected by the elimination of the delays that were experienced by steam trains because of their occupation of the tracks while the two or three locomotives coupled to each train took on coal and water, one at a time, at the several coal and water stations on the grade. The effect of increased speed is especially marked at the single-track Elkhorn tunnel. This is 3000 ft. long and is on a 1.5 per cent grade. Under steam operation it had been necessary on account of the requirements of ventilation to reduce the up-grade speed in the tunnel to about 6 m.p.h. This involved a time interval of seven minutes for clearing the block that included the tunnel. Under electric operation, however, the movement is made in about three minutes.

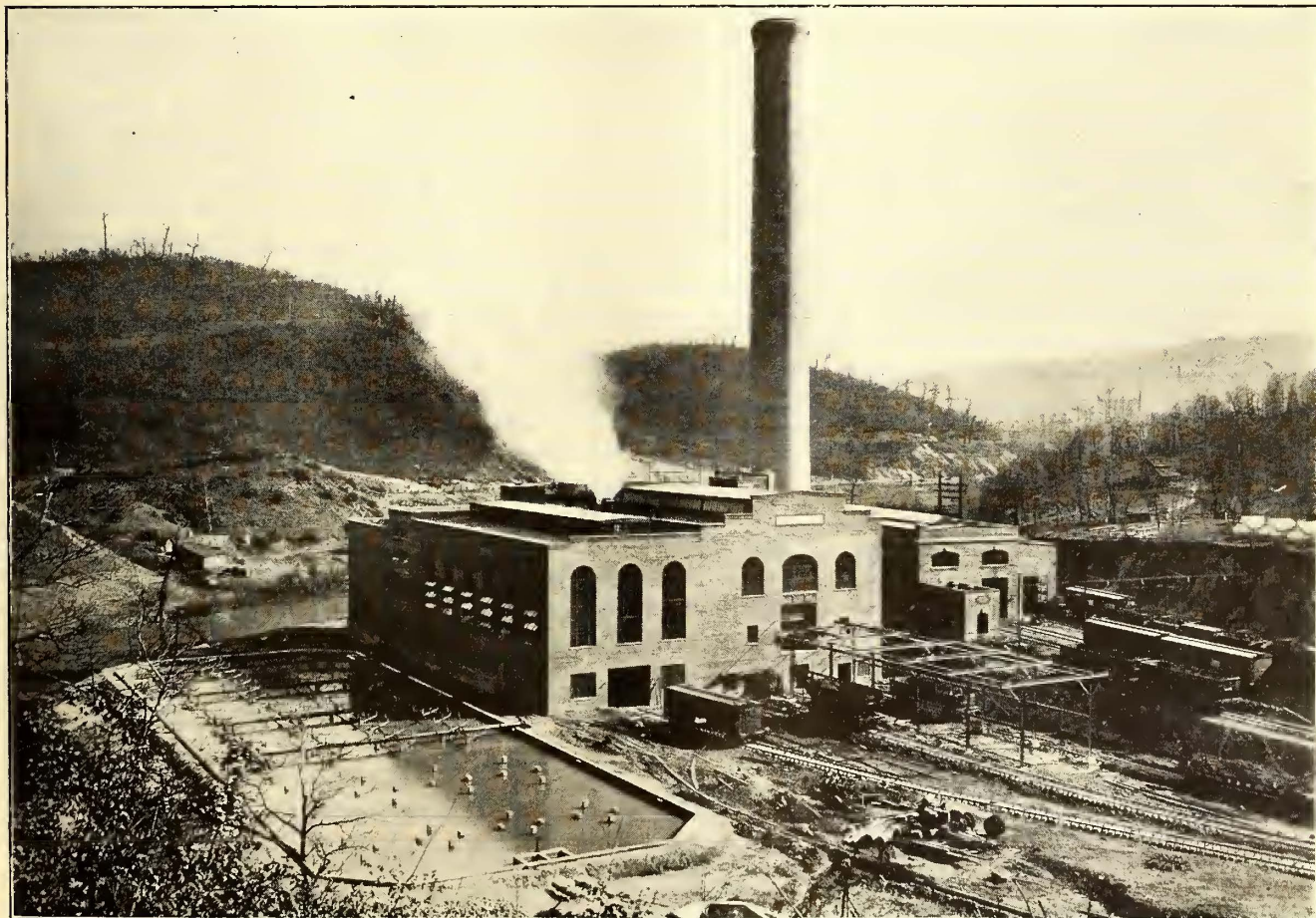
The coal trains handled in this service weigh 3250 tons and were formerly hauled up the grade by three steam locomotives. Two of these, a road engine and a helper, were used over the entire division. The third engine, located at the rear, served as a pusher up the 1.5 per cent and 2 per cent grades, and was cut off at the summit, all of the steam locomotives being of the highly developed, heavy, Mallet type fitted with mechanical stokers and superheaters. Under electric operation a single road engine is used over the electric division and a second electric engine is used as a pusher up the heavy grades. One electric engine, therefore, takes the place of two Mallets over the division, and two electric engines take the place of three Mallets up the grade.

In a recent test a 4800-ton train was hauled over the division by three electric engines, two of which acted as pushers. In all cases the electric locomotives handle the trains at approximately double the speed obtained with steam. On the 9-mile grade between Cooper and Graham, where the maximum rise is 0.4 per cent and some stretches are level, the speed of the electric locomotives is 28 m.p.h.

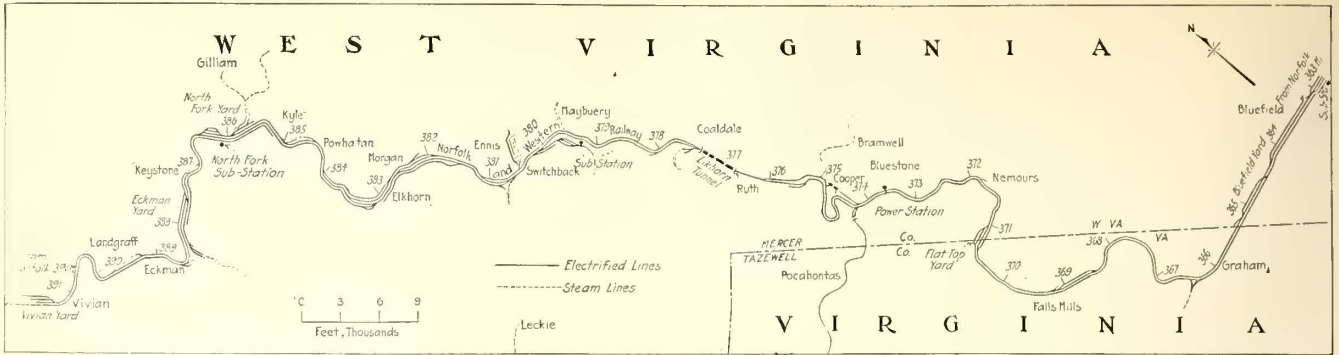
The electric installation has been designed for handling a daily total of twenty eastbound trains, or 65,000 tons, over the division, but ample provision has been made for additional traffic and extensions of electrified tracks when required. At the present time the number of tonnage trains handled daily is about twelve, and pusher or helper service is also provided for all of the through-freight and passenger trains.

In addition to the direct advantages and the economies resulting from the electric train service, the presence of an adequate and efficient power supply has permitted the electrical operation of various auxiliary plants in the vicinity. Thus, a large steam pumping station at Bluestone for the water supply for steam locomotives has been shut down and the pumping is done at the electric power station located nearby. Also the fans for ventilating the Elkhorn tunnel will now be driven by electric motors, and ultimately electric power will be used for operating shops and pumps at Bluefield as well as at several other points on the division.

Although the electrification of this division had long been under consideration, the actual decision to electrify was not reached until about three years ago, when the lay-out and design of the entire installation was worked out in all details by Gibbs & Hill, engineers for



NORFOLK & WESTERN ELECTRIFICATION—VIEW OF POWER HOUSE AND COOLING POND, WITH REPAIR SHOP AT EXTREME RIGHT



NORFOLK & WESTERN ELECTRIFICATION—MAP OF ELECTRIC ZONE

the railway company. All construction, excepting the power house and repair shop, and some of the power-station equipment, was carried out by a specially organized railroad force under the supervision of the engineers.

SINGLE-PHASE-THREE-PHASE LOCOMOTIVES

Probably the most interesting of the many striking features of the installation is the Baldwin-Westinghouse, single-phase-three-phase locomotive. The traffic on the electric zone is handled by twelve of these machines each consisting of two 135-ton units or halves so that the total locomotive weight is 270 tons.

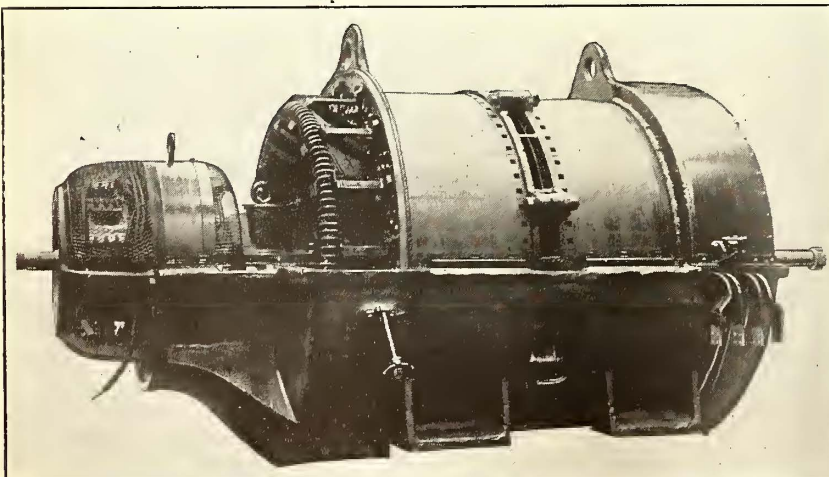
In the case of the Norfolk & Western electrification the train weights are so great that it is obviously necessary to have part of the motive power at the rear in order to avoid excessive strain on the draft rigging of the cars. However, the trains are of such great length that there is difficulty in signaling from the locomotive at the head end of the train to the one at the rear, and thus the locomotives are subject to treatment which would be considered impossible in ordinary service. For example, it is not unusual for the rear locomotive to receive a signal to go ahead one full minute or even more before the head locomotive has come into action. In consequence, the rear locomotive will stand still during this period, although it is exerting full tractive effort in an endeavor to start the train. This condition arises most frequently when the rail is wet and permits slipping the drivers, or when the air brakes do not release promptly. Under such circumstances, the train must frequently be allowed to drop back a little and the attempt to start must be repeated. Also, when a train on an up grade comes to a stop the head engine will shut off power and will apply the brakes while the rear engine keeps pushing the train until its tractive effort is exceeded by the bunching of the front cars.

Ordinarily, these requirements would involve exceed-

ingly careful handling, but the locomotives have been designed especially to meet these severe conditions so that their manipulation does not even involve especial attention. The rugged construction of the three-phase induction motor, with its freedom from commutator troubles, together with the liquid rheostat that is installed on the locomotive, is of the greatest importance in meeting these conditions. The rheostat not only gives the smoothest possible gradation of tractive effort, but the latent heat of the steam that is generated within it makes possible the dissipation of an extraordinarily large amount of heat without difficulty. It may be said also that the inherent characteristics of the induction motor enable the locomotives automatically to hold the train at a constant speed without the use of brakes on descending grades by regenerating and returning power to the line. This is accomplished without additional or complicated apparatus. Conditions are such that full advantage of this form of braking can be secured, in that the trains are very heavy, the grades are severe, and the speed relatively high. In actual service the performance of this feature of the installation has proved to be highly satisfactory, the heaviest train being handled down the mountain grade by a single locomotive at a uniform speed of about 15 m.p.h. with the air brakes held in reserve to bring the train to a standstill when desired.

FEATURES OF DESIGN

Each unit or half locomotive has two main trucks connected by a Mallet-type hinge, and each main truck has two driving axles included in a rigid wheel base with a radial, two-wheel, leading truck. The buffing and pulling strains are transmitted through the main truck frame and through a twin draft rigging mounted on the main truck at each end of the unit. The cab is of the box type and is supported on the main truck



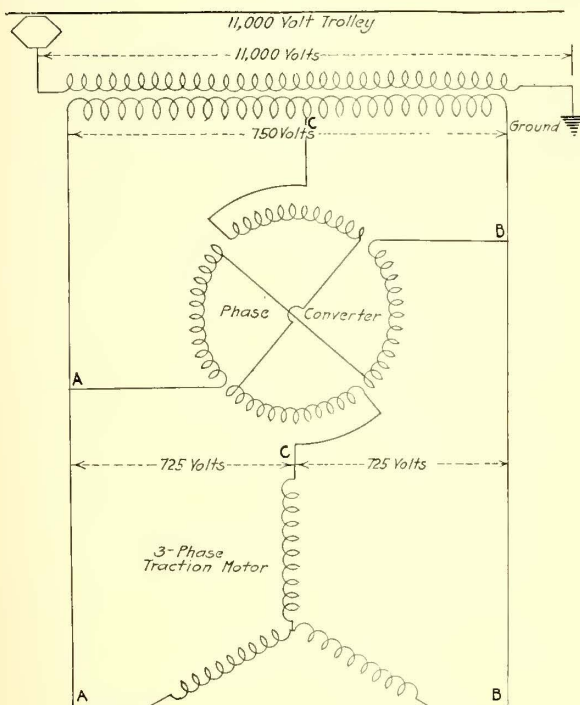
NORFOLK & WESTERN ELECTRIFICATION—PHASE CONVERTER AND LIQUID RHEOSTAT

entirely by spring cushion friction plates and there is no weight on the center pins, which serve only to maintain the cab in its proper position on the truck. An engineer's compartment is provided at one end of each unit, the two units being so coupled as to provide for operation from either end of the locomotive.

Each locomotive has eight pairs of drivers connected in pairs by side rods to a jack shaft between the two wheels. Each jack shaft is driven by two motors geared to it so that the locomotive has eight traction motors. These are of the three-phase induction type with wound secondaries and with field-windings arranged for four-pole and for eight-pole operation. They are ventilated by forced draught, the air being supplied from the main ventilating duct which also delivers cooling air to the phase converter and to the cooling towers for the liquid rheostat.

Provision is made for two running speeds, respectively 14 and 28 m.p.h. When the locomotive is starting, resistance is inserted in the secondary circuit of the motors by means of the liquid rheostat, the amount of resistance being varied by hand at the controller. For the 14-m.p.h. speed all motors are connected in parallel, and the eight-pole combination is set up for each one. For the 28-m.p.h. speed the motors are also connected in parallel, but four of the poles of each motor are cut out, thus doubling the synchronous speed. The locomotives are equipped with the unit-switch type of control and are arranged for the simultaneous operation of the two units from the control end of either one.

The single-phase current collected from the 11,000-

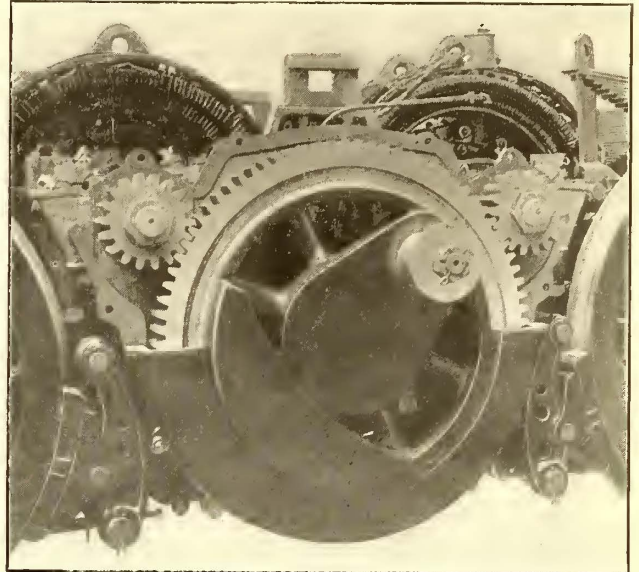


NORFOLK AND WESTERN ELECTRIFICATION—DIAGRAM INDICATING CONNECTIONS FOR PHASE CONVERTER AND TRACTION MOTORS

volt line by the pantograph is fed through an oil-type circuit breaker to the main transformer. The phase-converter, which changes the single-phase current to the three-phase form, is connected to the low-tension side of this transformer, and it operates constantly when the engine is in service. To the extended shaft of the converter are coupled a ventilating blower for the motors and transformers and an air-compressor for the train brakes, the latter being connected through a clutch.

THE PHASE CONVERTER

The phase converter is a single-phase induction motor with a short-circuited, squirrel-cage rotor, or secondary and with two primary windings on the stator. One of these windings is connected across the secondary of a transformer, and when the rotor is running there is generated in the second winding an emf of 90 deg. phase displacement from that of the secondary of the stationary transformer. The use of this device in railway work



NORFOLK & WESTERN ELECTRIFICATION—MOTORS, GEARS AND JACK SHAFT ON LOCOMOTIVE

is so novel that a review of the fundamental principle may be of interest before the other design details are taken up.

Any polyphase induction motor will operate as a single-phase motor on one phase of a polyphase circuit if the motor is brought up to its "pick-up" speed by some external or internal means. Thus if one wire of an operating two-phase motor is broken, leaving but one phase in action, it will continue to run. Moreover, a voltmeter, applied to the open primary winding will show a voltage practically equal to that in the line from which it was disconnected. The motor is, therefore, performing two functions, motor and phase transformer or converter. The reason why it does so is as follows:

Consider first that the motor is operating normally on the two-phase circuit. The two-phase magnetizing current produces a rotating magnetic field which, cutting the secondary conductors (cage-wound or phase-wound) generates emf and currents therein. The latter react upon the magnetic field and produce torque. The rotor maintains a speed slightly below the rotating speed of the field (synchronous speed), the difference or "slip" varying slightly with the load.

If a primary lead is opened with the motor running, as suggested above, there is only single-phase magnetizing current available. By transformer action, however, this produces in the rotor conductors surrounding the magnetic field a single-phase secondary current. At the same time the motion of the rotor conductors in the single-phase magnetic field produces emf and another current phase displaced 90 deg. from the first. Thus there are two rotor currents in phase quadrature and in different parts of the rotor winding. The speed-generated current acts as a second magnetizing current and, combined with the magnetizing current from the line, produces a rotating field, just as when the machine was operating as a two-phase motor. In this field the



NORFOLK & WESTERN ELECTRIFICATION—CROSS CATENARY USED FOR YARD TRACKS

rotor produces torque and will carry a mechanical load satisfactorily.

This rotating field cuts the open primary winding of the motor and generates in it an emf in quadrature with the line emf. From this winding current can be drawn as from the secondary winding of any transformer. It and the line current, taken together, form a two-phase current. A three-phase current can be generated in a similar manner.

In the diagram on page 1061, showing the connections used in the Norfolk & Western locomotives, a two-pole phase converter as described is diagrammatically represented with the rotor omitted, as the function of this is inductive only, as explained. The diagram also shows the familiar T-connection used to produce three-phase from two-phase current. One terminal of the quadrature winding is connected at *C*, at or near the center of the stationary transformer secondary winding. The converter winding is so designed that the voltage between *C* and *C* will be sufficient to produce equal voltages, equally displaced in phase, between *A* and *C*, *C* and *B*, and *B* and *A*. Thus three-phase current is provided for the traction motors. By this arrangement it is necessary only to convert a portion of the current used in the main motors as a large part comes directly from the main transformers.

For starting the rotor a single-phase, series, commutator-type motor is mounted directly on the converter shaft. The converter is forced ventilated, having a connection at its center to the main ventilating air duct of the unit.

OTHER LOCOMOTIVE DETAILS

Two pantographs are mounted on the roof of each half-locomotive. These are unique in that they have been arranged to be fitted if necessary with end horns which will automatically fold in when the pantograph is lowered by the tunnel trolley wire, and in this way the

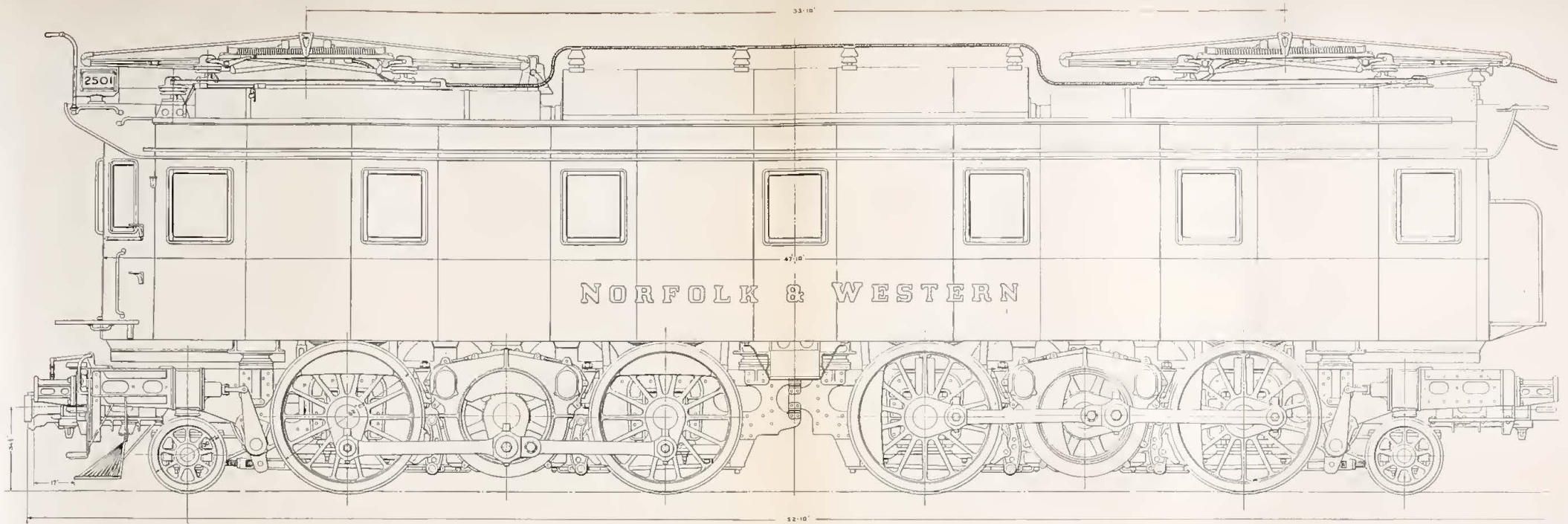
unusually wide sliding surface will accommodate itself to the restricted tunnel clearances.

There are four liquid rheostats on each half-locomotive, one for each motor. These are operated in pairs, each pair having in common one storage reservoir and cooling tower, one circulating pump and one operating mechanism. The essential elements of each rheostat include a cast-iron tank in which are mounted electrodes consisting of certain metal plates connected to ground. A hollow plunger is located at the center of the tank for regulating the height of the liquid and this is raised or lowered by an operating mechanism. There is also a motor-driven centrifugal circulating pump by which the liquid is continuously circulated to prevent excessive heating. This forces the liquid up through the bottom of the tank and over the top of the hollow plunger when the plunger is raised, and back through the inside of the plunger to the storage reservoir.

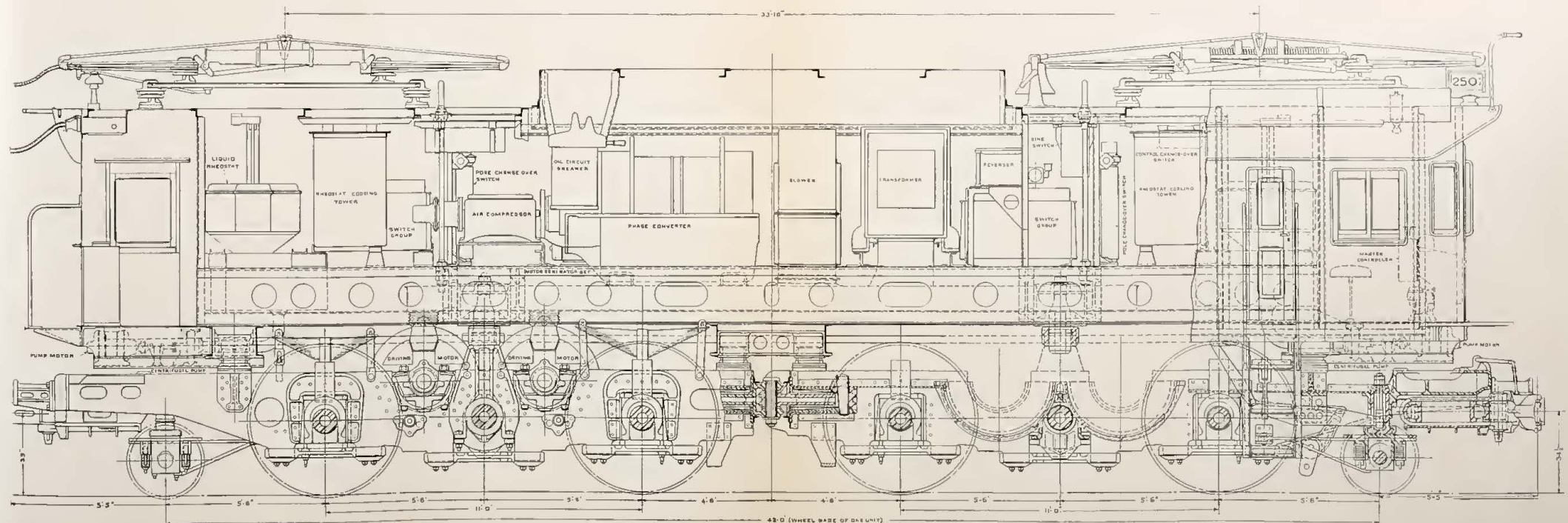
When the liquid is raised so as to submerge the lower ends of the plates, current may flow between the motor-connected plates and the adjacent ground-connected plates, the circuit between the three phases of the motor being thus established. The higher the liquid rises on the plates, the lower the resistance becomes. When the plates are entirely submerged, the liquid going all the way up, the resistance is reduced to the minimum.

To keep the temperature of the circulating liquid as low as possible, a portion is by-passed through a cooling tower containing a series of trays so arranged that the liquid will flow over them in a thin sheet and be cooled by air from the main ventilating duct to which the towers are connected.

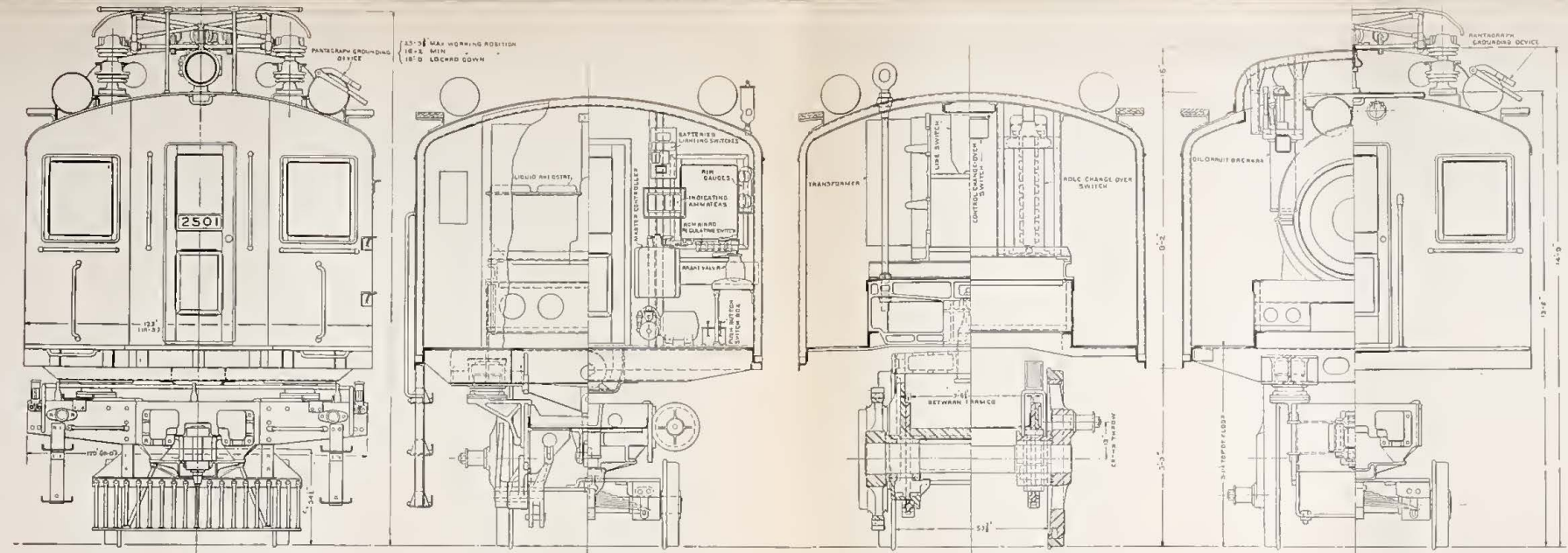
This main ventilating duct is supplied by a 36-in. Sirocco fan mounted on the shaft of the phase converter. It is built into the cab floor under the deck, and runs lengthwise through the cab, being arranged with openings at various points where connections are made to the traction motors, converters, cooling towers, etc.



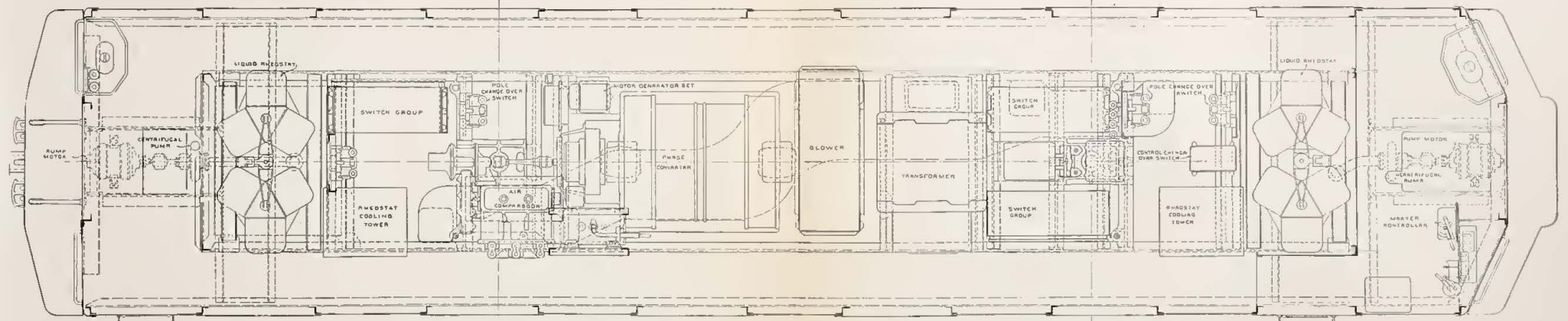
Side Elevation of Single Unit or Half-Locomotive for Norfolk & Western Electrification
[Scale 1/4 in. = 1 ft.]



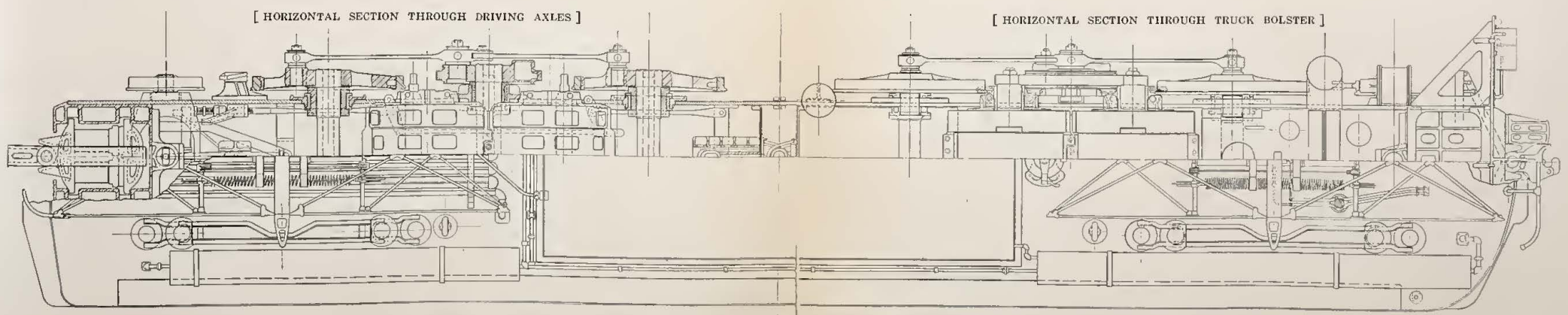
Longitudinal Section of Locomotive Unit for Norfolk & Western Electrification
[Scale 1/4 in. = 1 ft.]



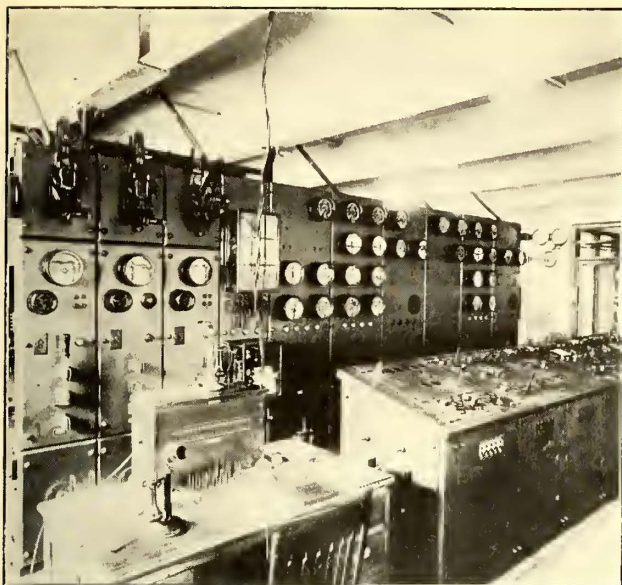
End Elevation and Cross Sections of Norfolk & Western Electric Locomotive Unit
[Scale 1/4 in. = 1 ft.]



Floor Plan of Norfolk & Western Electric Locomotive Unit, Showing Arrangement of Equipment in Cab
[Scale 1/4 in. = 1 ft.]



Quarter Horizontal Sections and Half Roof Plan of Norfolk & Western Electric Locomotive Unit
[Scale 1/4 in. = 1 ft.]



NORFOLK & WESTERN ELECTRIFICATION—TELEPHONE SET AND OPERATORS' BENCH BOARD IN POWER HOUSE

Table I shows the principal dimensions and weights of the complete locomotive:

TABLE I—PRINCIPAL DIMENSIONS AND WEIGHTS OF COMPLETE LOCOMOTIVE

Length over all.....	105 ft. 8 in.
Driving wheelbase, total.....	83 ft. 10 in.
Rigid wheelbase.....	11 ft. 0 in.
Truck wheelbase.....	16 ft. 6 in.
Height, rail to pantagraph (locked).....	16 ft. 0 in.
Height, rail to top of cab (maximum).....	14 ft. 9 in.
Width over all (maximum).....	11 ft. 6 1/4 in.
Width over car body.....	10 ft. 3 in.
Diameter of driving wheels.....	62 in.
Diameter of pony wheels.....	30 in.
Weight on drivers.....	220 tons
Total weight of locomotive.....	270 tons

The performance of the locomotives under varying conditions of load is indicated by the ratings shown in Table II. However, on tests and in service the loco-

TABLE II—LOCOMOTIVE PERFORMANCES UNDER VARYING LOAD CONDITIONS

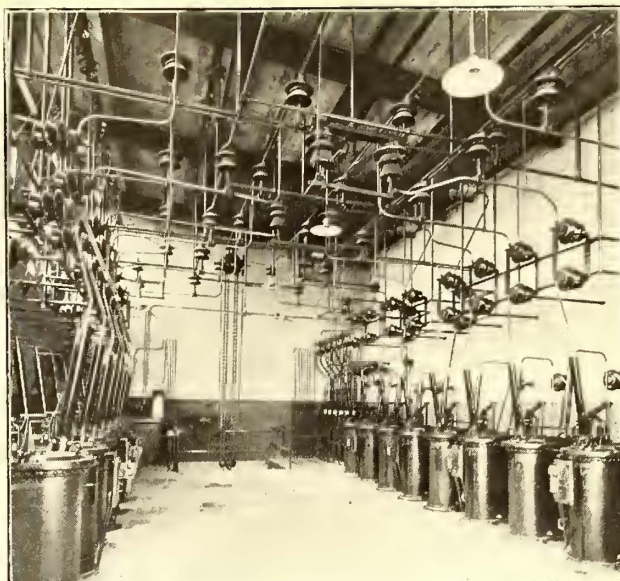
	Train on 1.5 and 2 per cent grades	Train on 1 per cent grades	Train on 0.4 per cent grades
Weight of train—tons.....	3,250	3,250	3,250
Locomotives per train.....	2	1	1
Approximate speed, miles per hour.....	14	14	28
Drawbar pull per locomotive, pounds:			
Uniform acceleration.....	91,800	114,000	79,400
At speed on 2 per cent grade.....	75,400		
At speed on 1 per cent grade.....		85,800	
At speed on 0.4 per cent grade.....			4,600
Maximum guaranteed accelerating tractive effort per locomotive.....	133,000	133,000	90,000
Approximate maximum guaranteed horsepower developed by motors.....	5,000	5,000	6,700

tives have developed a drawbar pull considerably in excess of the guaranteed maximum, the highest record with the dynamometer car being 180,000 lb. This corresponds to an adhesion of about 40 per cent.

POWER STATION

The power station at Bluestone that supplies power to the locomotives is of the usual type, using steam boilers and turbines for the prime movers. It is located on the Bluestone River about 11 miles west of the town of Bluefield. This site was chosen because it had almost the only available supply of water for boiler-feed and condensing purposes in the district and because the railway company had already constructed a dam and reservoir at the point for a water supply for its steam locomotives.

The plant is equipped with ten Babcock & Wilcox Stirling-type boilers, each having 6772 sq. ft. of heating



NORFOLK & WESTERN ELECTRIFICATION—INTERIOR VIEW OF HIGH-TENSION SWITCH ROOM

surface. These operate at 200-lb. steam pressure with 150 deg. superheat. Coal is handled mechanically by conveyors built by R. H. Beaumont & Company, and ash-handling equipment furnished by the Shepard Crane & Hoist Company is installed. Westinghouse underfeed stokers are provided, these having capacity for the actual evaporation of 9 lb. of water per square foot of heating surface. Forced draft is supplied at a static pressure of 6 in. of water, the three fans being of the Sturtevant multivane type geared to 300-hp turbines. A 250-ft. x 20-ft. brick stack is provided also. The heaters are of the open type, and the feed pumps are centrifugal and turbine-driven, the exhaust from these and other auxiliaries going to the heaters.

The main units are three 10,000-kw Westinghouse double-flow reaction turbines operating at 1500 r.p.m., and provision has been made for the future installation of a fourth unit. The generators are designed for 11,000 volts and twenty-five-cycle current with a twenty-four-hour rating of 10,000 kw. A five-minute overload capacity of 25 per cent is provided, the ratings being based on 80 per cent power factor. The fields are of the two-pole revolving type designed to operate under a temperature rise of 60 deg. Cent., but they are capable of withstanding a temperature of 150 deg. Cent. without injury.

The generator armatures are designed to withstand a temperature of 90 deg. Cent. and are wound for three-phase current. Thermo-couples are embedded in the armatures, and these furnish continuous temperature records. Separate excitation is provided by two steam-driven units and one motor-driven unit, voltage regulation being effected by a Tirrill regulator.

The condensers are of the jet type with LeBlanc turbine-driven air and circulating pumps. Steam from the exhaust of these pumps is turned into the condenser automatically when the supply of exhaust steam from the other auxiliaries in the plant is more than sufficient for the feed water. A spray cooling pond has been installed on account of the muddy condition of the Bluestone River during certain seasons of the year. In addition, a reservoir has been provided by damming the river, and when the river water is clean it is circulated through the reservoir for a total distance of 1400 ft., thus permitting the shutting down of the spray nozzles. The pond may be drained by gravity through a sluice gate discharging below the dam.

Switching arrangements are provided in the usual operating galleries. The main 11,000-volt bus is sectionalized and three-phase power for auxiliary purposes is taken from it. No brick or concrete bus compartments are used, the bus being of copper tube carried on insulators mounted on a pipe frame work. Copper tubing and bare wire are used wherever possible, insulated wire being installed only where conductors are carried in conduit, the Fibre Conduit Company's product being largely used for this purpose. The generator voltage of 11,000 for one of the phases is raised to 44,000 by step-up transformers, the 44,000-volt bus being sectionalized, and two high-tension feeders are taken from each side of this for feeding the substations. The usual equipment of Pyrene fire extinguishers is distributed throughout the building.

REGENERATIVE LOADING RHEOSTATS

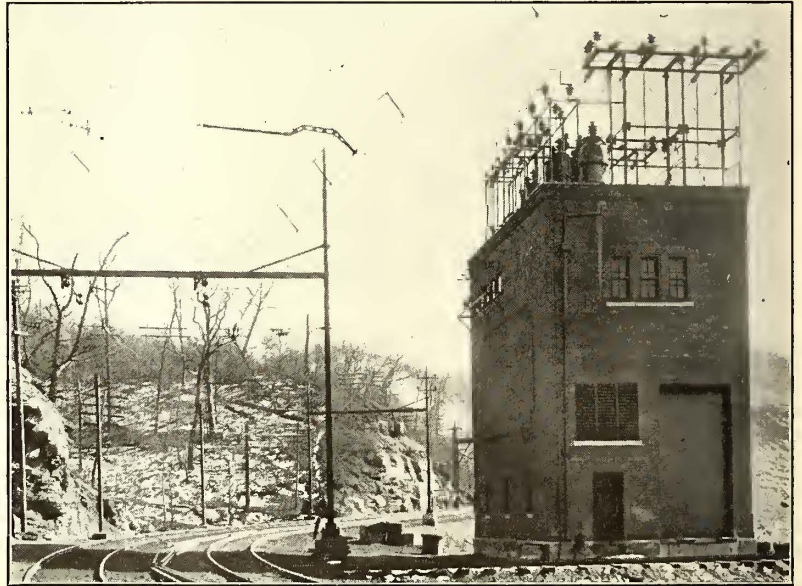
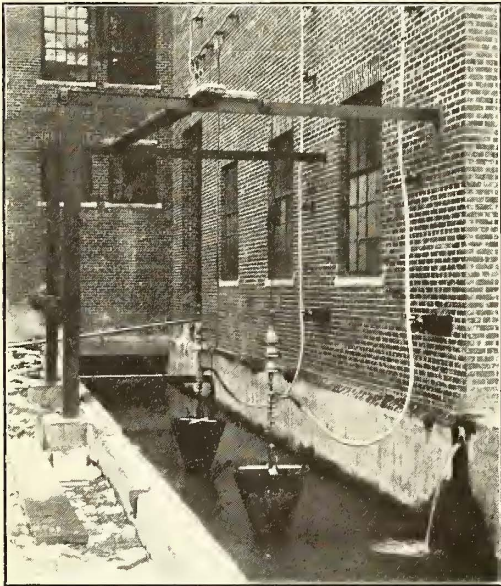
Excess regenerated power from locomotives on downgrades that is returned to the power house passes through the 11,000-volt bus through the various transformers back to the generators if the generators are running under very light loads. If no other load should be provided the regenerated power would reverse the generators and operate them as motors, and to prevent this a loading-device, consisting of electrodes immersed

power drops to 2000 kva one of the relays opens the breaker which was closed first and cuts one rheostat out of service, the other rheostat remaining in until the excess regenerated power drops to zero, when this, too, is cut out of service.

The water rheostats are located outside of the transformer house at the power station. Each consists of a steel cone carrying a lead from the circuit breakers and a 6-in. iron plate located at the bottom of the intake canal and grounded to a copper plate embedded in the earth outside of the canal. The power-dissipating capacity is adjusted by varying the distance between the cone and the iron plate. The cone is raised or lowered in the water of the canal by means of a hand-operated winch and cable carried on a steel bracket across the canal.

TRANSMISSION SYSTEM AND SUBSTATIONS

High-tension power is transmitted at 44,000 volts, twenty-five cycles, single phase. The wires are carried on catenary supports except in the tunnels, where the line goes above ground over the summit. There are two single-phase lines, each of which consists of four No. 00, seven-strand, hard-drawn copper wire. A $\frac{3}{8}$ -in. steel ground wire is carried on the poles for the length of the line.



NORFOLK & WESTERN ELECTRIFICATION—WATER RHEOSTAT AT POWER HOUSE FOR DISSIPATING ENERGY OF REGENERATION—A TYPICAL SUBSTATION

in the intake canal, is provided, this being controlled by suitable switches.

The operation of the switches is made automatic by means of a group of relays and magnetic switches, current transformers, etc., so connected as to give the following results: When the amount of excess regenerated power reaches, say, 300 kva, the closing relays throw in one water rheostat on the 11,000-volt bus. As soon as the regenerated power exceeds the capacity of one water rheostat by 300 kva another closing relay throws in the second water rheostat on the 11,000-volt bus. The difference between the amount of excess regenerated power and the capacity of the water rheostats in service is made up by the generator.

When the excess regenerated power has become reduced to zero with one rheostat in service and all of the rheostat load is supplied by the generators, one of the tripping relays trips the circuit breakers and this cuts the rheostat off from the 11,000-volt bus. With two rheostats in service when the excess regenerated

The high-tension insulators are of the four-petticoat, pin type, with a maximum diameter of 12 in., and these are tested at 165,000 volts and at 120,000 volts respectively for dry and wet flashover. Their ultimate mechanical strength is about 4000 lb., applied at right angles to the pin at the wire groove. The poles for the high-tension line over the tunnel summit are of chestnut. At present they carry three arms each having two wires. The two upper arms carry the 44,000-volt wires and the lower arms the 4400-volt signal wires. An 11,000-volt trolley feeder also is carried over the Elkhorn tunnel summit.

The cross-arms on all poles are connected to the ground wire, which in turn is grounded by means of a copper cable terminating in a copper plate at the base of every fourth pole. The high-tension lines are sectionalized at each substation by means of air-break switches on steel structures on the roof.

All power for trains is obtained from transformers which step down the voltage from 44,000 volts to 11,000

volts. These are located at five points on the line and are housed in suitable buildings except at West Vivian, where the apparatus is of the out-door type and un-housed. The primary reason for the out-door type of substation at this point is that the desirable and proper location for the building when the electrification is extended would be several miles west of the present location. Therefore the present arrangement is considered only temporary. One of the substations is located in the transformer and switching house of the power station, because the objectionable conditions which would result from short-circuits made it undesirable to feed the nearby sections of trolley lines directly from the 11,000-volt generator bus in the power house. The substation buildings are all of the same type as shown on one of the accompanying illustrations.

No attendants are required in the substations because the oil circuit breakers are remotely controlled from adjacent signal towers or passenger stations or from yard masters' offices. The location of the various substations together with their equipment is as follows:

Bluefield, two 3000-kva units.

Bluestone (power house), two 2000-kva units.

Maybeury, two 5000-kva units.

North Fork, two 3000-kva units.

Vivian, one 2000-kva unit.

The total capacity of all substations is 28,000 kva. All of the transformer units are of the Westinghouse, single-phase, oil-insulated, waterproof type, the water for cooling being taken from the company's pipe line. They are equipped with thermostats which close a bell alarm at high temperatures, thus giving warning at the operator's office. Two General Electric transformer-oil filter outfits have been provided, one for the power house and one for the substations. The latter is transferred from one location to another as required. Each outfit consists of a filter press, drying oven and motor-driven centrifugal pump, and has a capacity between 7 gal. and 10 gal. of oil per minute.

CATENARY SUPPORTING STRUCTURES

In the distribution system no supplementary feeders are required as the power supply is effected entirely by means of the contact lines. For supporting these two distinct types of structures are used. The one on the main line has wires suspended from overhead beams, and the other, which is used only in the yards, has an overhead cross catenary cable to support the longitudinal catenary wires for the several tracks.

A typical main-line structure is shown in the illustration on page 1066. This consists of two tubular steel poles set in concrete foundations and carrying between them a structural steel beam, which is partially supported by means of sag braces extending up to the pole tops. Extensions of the poles above the sag braces support cross-arms which carry the high-tension feeders and the signal lines, and the protecting ground wires are clamped to castings screwed onto the extreme ends of the poles.

On tangent tracks the bridge structure is unguyed, but on curved tracks guys are used at the outside of the curve to take the pull of the catenary system. This design has proved to be very satisfactory wherever there is room on the right-of-way for guying as it is simple and rugged in design, can be readily arranged to give any desired horizontal or vertical clearance, and is easy to erect. The use of sag braces instead of knee braces gives the desired clearance under the beam for the wires, although nothing is added to the height of the pole since it must be extended in any event to carry the high-tension and signal wires. On long stretches of tangent track the cross beams might interfere some-

what with a clear view of the signals, but in the present case there is but little tangent track and no long stretches at all, so that interference with the signal aspects is not noticeable.

The catenary supporting structures are nominally 300 ft. apart on tangent track and somewhat closer on curves. However, many adjustments and compromises in location had to be made on account of existing structures, and the spacing is not rigidly maintained.

Reinforced concrete foundations are used in all cases and a proper ground plate is set in coke underneath one of the two foundations for each structure. A substantial copper cable is carried up through the concrete for attachment to the pole with an expanded pin-type bond terminal. A reinforcing collar of 1/2-in. plate protects the pole at the top of the foundation.

The poles are made up of pieces of National Tube Company's steel pipe of various lengths, sizes and weights, these being swedged together. They change in size at the height of the cross-beams, thus making a shoulder on which rest the heavy steel castings holding the cross-beam. To these castings also are attached the guy rods when these are used. The poles, during construction, were grouted into cored holes that had been cast in the foundation.

Guy rods, which are attached to anchors of concrete containing two or more pieces of old rail, are provided with protection at the anchor end consisting of a boiler tube filled with grout. The end pieces of the rods are of uniform length, while the closing or middle pieces were cut on the ground during construction to the proper length, the final adjustment being made by means of turnbuckles. In general, double guys are used, the two making an angle of 20 deg. with the pole and being spread at the anchor ends so that they make an angle of about 40 deg. with each other. Structural bridges guyed longitudinally with the track are used where it is desired to anchor or dead-end the catenary system.

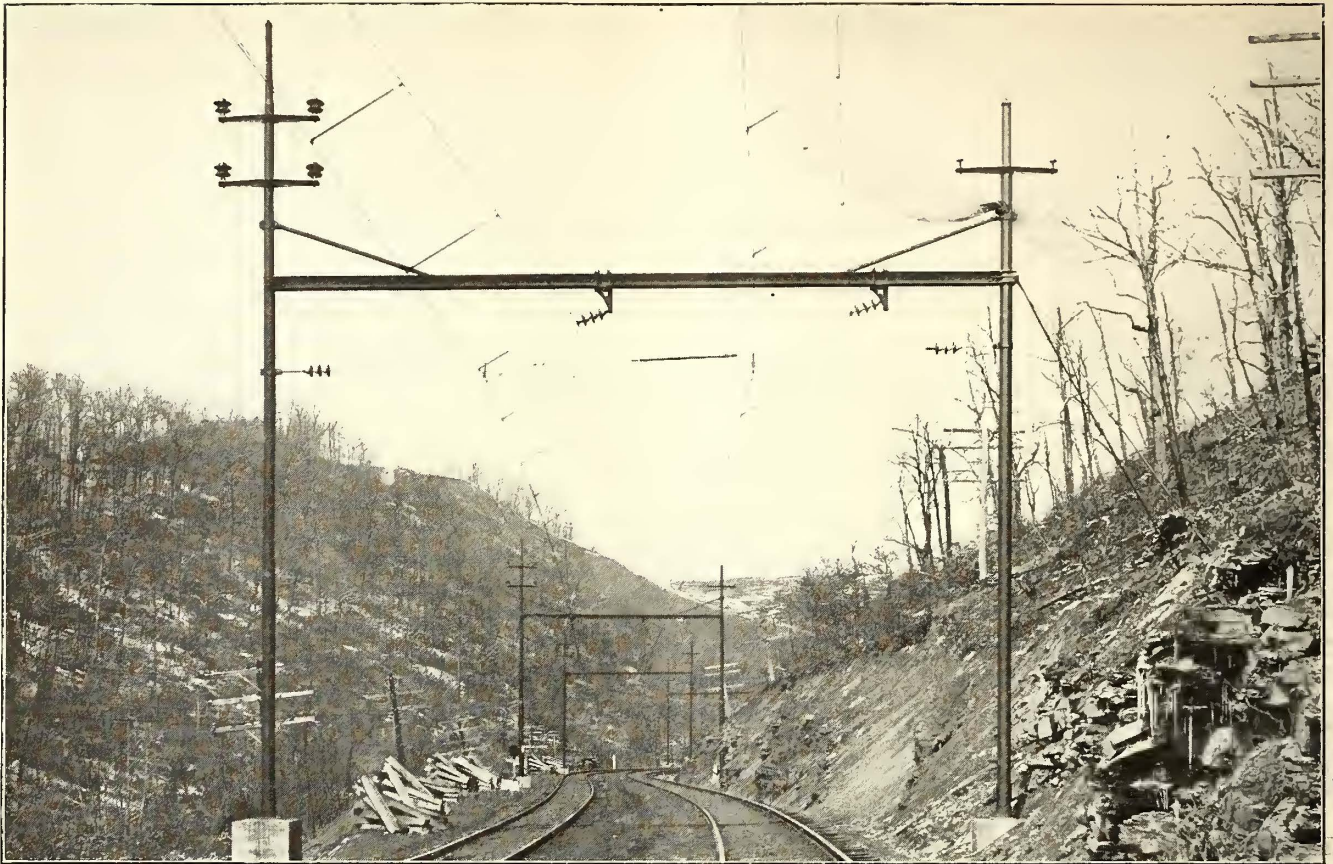
In the yards the catenary-carrying structure consists of two or more high structural-steel posts either guyed or self-supporting, from the tops of which a cross-catenary cable of extra-high-tension, galvanized, steel strand is run across the tracks to support the longitudinal catenaries.

THE CATENARY SYSTEM

The catenary system is designed to hold a No. 000 grooved, phono-electric contact wire at a uniform height of 24 ft. above the top of the rails in such a location that it will not vary horizontally more than 12 in. from the center of the track, allowing for super-elevation. Above the contact wire is a horizontal auxiliary messenger wire, and above this is the main messenger wire that supports both of the other wires. In this section of the country the temperature ranges from about 110 deg. to minus 10 deg. Fahr., and this changes the stresses in the wires from almost zero to approximately the elastic limit.

Over tangent tracks the construction is simple. From each supporting structure a steel casting attached to the horizontal beam acts as a support for three suspension-type, Locke insulators. Each of these insulators is of itself good for a working voltage of 11,000, and the three are used as a special insurance against line troubles. The insulators are of porcelain and are 8 in. in diameter, somewhat over 5 in. long, having an ultimate strength of 12,000 lb. Since the initial energizing of the line about the middle of December there has not been a single failure of any of these strings of insulators.

There is attached to the bottom insulator a malleable-



NORFOLK & WESTERN ELECTRIFICATION—TYPICAL MAIN-LINE CATENARY CONSTRUCTION AND TUBULAR BRIDGE

iron casting which supports the messenger wire by being clamped to it. This casting has ample bearing for the wire and also has arcing horns so that in case of an insulator failing the arc would probably be from the casting instead of from the wire. The messenger wire is $\frac{1}{2}$ -in. extra-high-tension, galvanized, steel cable having a breaking strength of over 30,000 lb. It is jointed by forged sockets which were especially designed to develop the full strength of the cable. The nominal sag in the messenger wire is 5 ft. in a 300-ft. span, the actual sag, of course, depending upon the particular span.

Spaced at 30-ft. intervals along the messenger wire are bent-strap clips which hold the hanger straps. These latter are of galvanized steel and they are all of different lengths, depending upon the distance from the low point of the messenger wire, the length of each hanger being calculated so that the bottom of all hangers will be the same distance above top of rail. To the bottom of each hanger is bolted a pair of malleable iron trolley clips which, however, on tangent track do not grip the contact wire, but hold only the auxiliary messenger wire. This auxiliary messenger wire is a No. 0 round copper or steel wire, depending on whether the load conditions require the added carrying capacity of copper over steel. The various wires required for the overhead construction were furnished by the Bridgeport Brass Company, the Standard Underground Cable Company, and the John Roebbling's Sons Company.

From the auxiliary messenger wire the No. 000 grooved contact wire is supported by a pair of clips bolted together and spaced 15 ft. apart. These are so spaced, however, that they are equi-distant from the hangers holding up the auxiliary messenger wire, and the result is an extremely flexible and smooth-running trolley.

As all calculations were made for an average tempera-

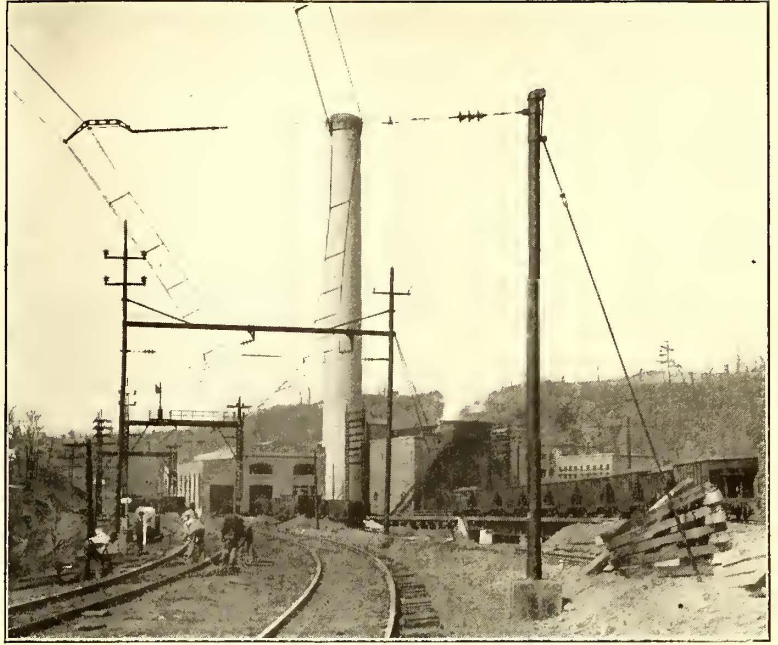
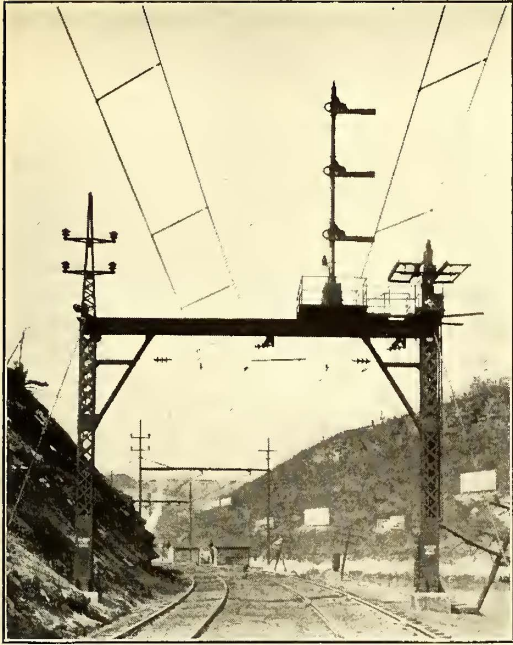
ture of 60 deg., the winter temperature increases the tension in all wires and the contact wire rises somewhat in the center of the span. However, even a 6-in. rise in a 300-ft. span makes the trolley gradient of only 0.08 per cent, whereas gradients of even 0.5 per cent are permissible.

Steady strands are used on long tangent stretches. These are insulated from ground by strings of three suspension type insulators, and wherever one of these cross steady strands from pole to pole of a structure attaches to the wires over two or more tracks it is sectionalized between tracks by an impregnated, wood-stick insulator 4 ft. long. The latter are tested to 8000 lb. or largely in excess of the maximum load where they are used.

The trolley is sectionalized longitudinally where necessary by breaking the messenger wire with two parallel strings of three insulators each. Directly below the electrical break in the messenger wire the auxiliary messenger and contact wires are attached with turn-buckles to the ends of a heavy wood insulator. Tee-iron runners are supported from the trolley wires and from the wooden insulators, and as the runners are supported at opposite ends and sides of the insulators they have ample electrical clearance from each other. But since they are of the same elevation and overlapping longitudinally, the pantograph makes contact with the second before leaving the first, so that while the catenary system is sectionalized there is no interruption to the current supplied to the locomotives when they pass the break.

At the section breaks which are provided to permit isolation of parts of the line for repairs, but which are normally connected through electrically, specially-designed disconnecting switches are mounted on top of the wood insulators. These can be opened or closed by means of a long impregnated wooden switch-stick.

At certain locations the catenary system is anchored



NORFOLK & WESTERN ELECTRIFICATION—TYPICAL SIGNAL BRIDGE—PULL-OFF POLE ON MAIN-LINE CURVE

longitudinally, or dead-ended, by being solidly attached to the cross girders of special structural bridges provided to limit the zone of trouble should a wreck or unforeseen accident break a messenger wire. The normal messenger-wire support at the bottoms of the strings of insulators is so designed that in general the messenger wire will slip through. Hence, should a messenger break between anchors it is expected that it will slip through several supports adjacent to the break and distribute the abnormal strain over several bridges instead of concentrating the load on the structures at either side of the break.

Where the track is curved, as it is over the larger portion of the route, the trolley wire must also be curved so that it approximates the track curvature, but the system has been designed within limits such that the contact wire may be 12 in. off the center line of the track in one direction at the bridges or points of support, and 6 in. off the center line of the track in the other direction at the center of the span. This allows the trolley curvature to be less than the track curvature.

On curved tracks the hangers from the messenger wire are 15 ft. apart and the clips at the bottom hold both the auxiliary messenger and the contact wire. This is essential to keep the contact wire and the auxiliary messenger wire in a vertical plane. The holding of both wires by the same clip at the end of the hanger, however, does not result in hard spots in the trolleys. Since all such hangers lie on angles to the horizontal, the whole system is sufficiently free to move vertically under a slight upward pressure of the pantograph, and this assures smooth riding.

To avoid an uneconomically close spacing of structures on sharp curves pull-out poles are used in some cases between bridges. These are single tubular steel poles set in concrete foundations and having single guys of the same type as used on the catenary bridges. To the tops of these poles a wire strand is connected through three of the suspension type insulators to both messenger and contact wire, and this serves to bend the plane of a catenary system.

In the yards the catenary system is, of course, very similar to that on the main line except that only two of the suspension-type insulators are used between live wires and grounded structures. The auxiliary messen-

ger wire is omitted, and the clips at the ends of the hanger straps hold the contact wire in tangent as well as in curve construction. This, of course, makes the contact wire in tangent, yard construction less flexible than where the auxiliary messenger is used, but it gives quite satisfactory results when the speed is low.

In the Elkhorn tunnel special catenary construction was necessary. The tunnel walls are 14 ft. apart at the spring line and 13 ft. apart at the base, the spring line being 11 ft. 1 in. above the top of the rails. The top of the arch is 19 ft. 3 in. high. Extended experiments with insulators and their arrangement were made by the engineers prior to the construction in a sample metal-lined tunnel where high voltages were submitted to the smoke and steam from a locomotive. The arrangement finally adopted was to have a supporting structure every 75 ft., the structure consisting of two cast-iron brackets on each side of the tunnel held to the brick lining by large bronze expansion bolts. Each bracket carries a 44,000-volt, transmission-line insulator. Supported by the pair of insulators on each side of the tunnel is a 2-in. brass pipe parallel to the tracks, and mounted on this piece of pipe is another line insulator upon which rests a cross pipe that is bent to follow the arch of the tunnel. The cross pipe is used as a support for the bronze messenger wire. All line catenary parts have, therefore, double insulation to ground. Notwithstanding the necessarily limited clearance, the overhead construction in this tunnel stood a test of three times the normal trolley voltage, and thus far has performed in a very satisfactory manner for the several weeks that it has been in service.

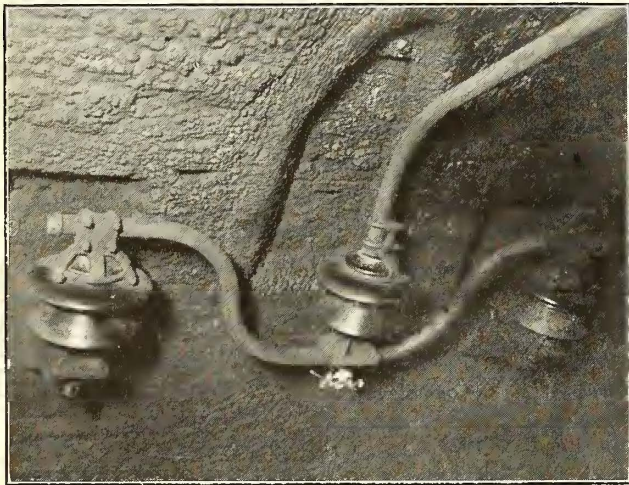
On branches and coal mine sidings a wooden-pole, bracket-type construction is used. In such cases only two of the suspension type insulators are installed. The messenger wire is $\frac{3}{8}$ -in. steel strand and the contact wire No. 00, no auxiliary messenger being used.

TRACK BONDING

A special type of track bond has been designed for this installation, the construction permitting it to be installed by removing only one bolt in the fish-plate. In this way the bonds may be installed almost as quickly as the exposed type, although they retain all the advantages of the concealed type. The method of installa-

tion requires a bond sufficiently rigid to be passed between the rail-web and the fish-plates so that the cable consists of thirty-seven strands of copper wire, making a bond equivalent to 0.275 in. diameter. As received from the manufacturer the bond consists of a 36-in. cable with a terminal welded on one end, the free end of the cable being tinned only, to prevent the separation of the strands. After the bond has been shoved through under the fish-plates the free socket terminal is soldered in place, and both terminals are expanded into the holes in the rail by means of steel drift pins. These track bonds together with the impedance bonds installed for the signal system were furnished by the Ohio Brass Company, the Electric Service Supplies Company, and the American Steel & Wire Company.

It may be mentioned here that the electrified zone was originally equipped with automatic signals of the d.c. type requiring primary storage batteries, these signals being usually mounted on posts along the track. Under electric operation, however, it was deemed advisable to make use of these signals, which were only recently installed and practically new, on other parts



NORFOLK & WESTERN ELECTRIFICATION—CATENARY BRACKET SUPPORT IN ELKHORN TUNNEL

of the railway and to provide new a.c. signals in connection with a.c. track circuits, the signals being mounted on the catenary bridges. This part of the work was carried out by the railway company.

PROTECTION OF TELEGRAPH WIRES

Electrification made it necessary to move the telegraph pole line which originally had shifted from one side of the track to the other at frequent intervals. This was placed entirely to the north side of the track and at the extreme edge of the right-of-way. Ample clearance was thus provided against danger of physical contact between the telegraph wires and the high-voltage power wires in case the former should break and fall.

To provide against the effect of induction it was decided to place the transformer substations somewhat closer together than would have been required by considerations of voltage regulation and losses and to place the end substations near the ends of the line. This has resulted in feeding each important or long section of trolley from both ends, and in consequence the current fed to the trains in a section between substations goes in both directions in the trolley and track circuits, the induced voltage in parallel telephone and telegraph lines being thus largely localized and neutralized. In addition, however, in order to provide for such disturbances when one substation might be out of service, as well as

for the excessively high currents which occur in cases of short circuits and grounds, it was decided to install the so-called "track-transformers," or boosters, in both trolley and track circuits at intervals of about 1 mile.

The track transformers are series transformers having the primary windings connected in series with the trolley and the secondary connected in series with the tracks at the middle points of the impedance bonds which are required at each signal location. These booster transformers are mounted on signal bridges, the track connections being carefully worked out so as not to interfere with the functioning of the signals. They cause the return current, of which a considerable amount would ordinarily leak through the ground, to flow in the track rails so that it is kept at a fixed distance from the trolley wire and the telephone and telegraph wires. The rails and the trolley wire occupy approximately symmetrical positions with relation to the telephone and telegraph circuits, and as the current is flowing in opposite directions in trolley and in track the effect is largely to neutralize the exterior inductive effect. While all of the above provisions were made primarily to protect the company's own circuits which are nearest to the track, they likewise serve to minimize the tendency to induced voltages in the telephone lines of other companies.

There are two sets of coils wound on the core of each transformer, one for the eastbound and the other for the westbound track. Hence only one transformer is required at each point. Since this arrangement has been in service it has been found that the telephone and telegraph service is not interfered with in any way by the operation of the electric trains.

FACILITIES FOR MAINTENANCE

A great deal of attention has been given to the provision of adequate facilities for the inspection and maintenance of all parts of the installation. The natural headquarters of the electric zone is at Bluestone, where the power house was necessarily located on account of the water supply, and it was decided to locate the inspection building and machine shop for maintenance of electric locomotives at that point also rather than to try to take care of electric engines at the steam engine shops at Bluefield. The line maintenance force is also located at Bluestone, and is in constant touch with all parts of the electrified section by means of a patrol telephone line having telephones placed at signal bridges in addition to the usual telephone facilities. Thus the general foreman and the foremen of all departments of the electrical maintenance work are located at one central point and provided with means by which constant connection is maintained with all points, including train despatchers, yard masters, and the superintendent and other division heads. To this end the company has provided dwellings for foremen and others on its property near the power house.

The locomotive inspection building is designed primarily for the electric locomotives, but the machine shop provided in connection therewith also serves the power plant, and thus the necessity of installing machine shop facilities in the power station is avoided. The building is 148 ft. by 68 ft. in size and is of the same type as the power station, which is just north of it. There are two main pits running for the full building length and each will hold one locomotive or two units. The pits are substantially constructed of concrete with sloping floors and numerous outlets to provide drainage, and they are equipped with electric wiring for lighting and power purposes as well as with compressed air.

At the west end of the shop is a short wheel-pit

which is connected to the two other pits by means of a covered lateral pit. This pit is equipped with a narrow-gauge track to handle the pneumatic jack by which the wheels are removed from the locomotives and are run to the storage track in front of the heavy wheel lathe.

One of the pits is used almost exclusively for inspection, and for this purpose a 112-ft. platform has been located 12 ft. 8 in. above the rails, extending close to the side of a locomotive on the tracks. All repair work is done in the part of the building where the machine tools are located. This part of the shop as well as one inspection pit and the short wheel pit are spanned by a 30-ton Whiting crane. It is equipped with four General Electric motors and two hoists, the main hoist having a capacity of 30 tons and the auxiliary hoist having a capacity of 5 tons. The following machine tools are installed in the machine shop:

Motor Driven Tools

- 80-in. heavy wheel lathe.
- 30-in. x 8-ft. planer.
- 60-in. x 6-ft. horizontal boring machine.
- 3-ft. Mueller radial drill.
- 20-in. Stockbridge crank shaper.
- 73-in. boring mill.
- 36-in. double-back-geared lathe.

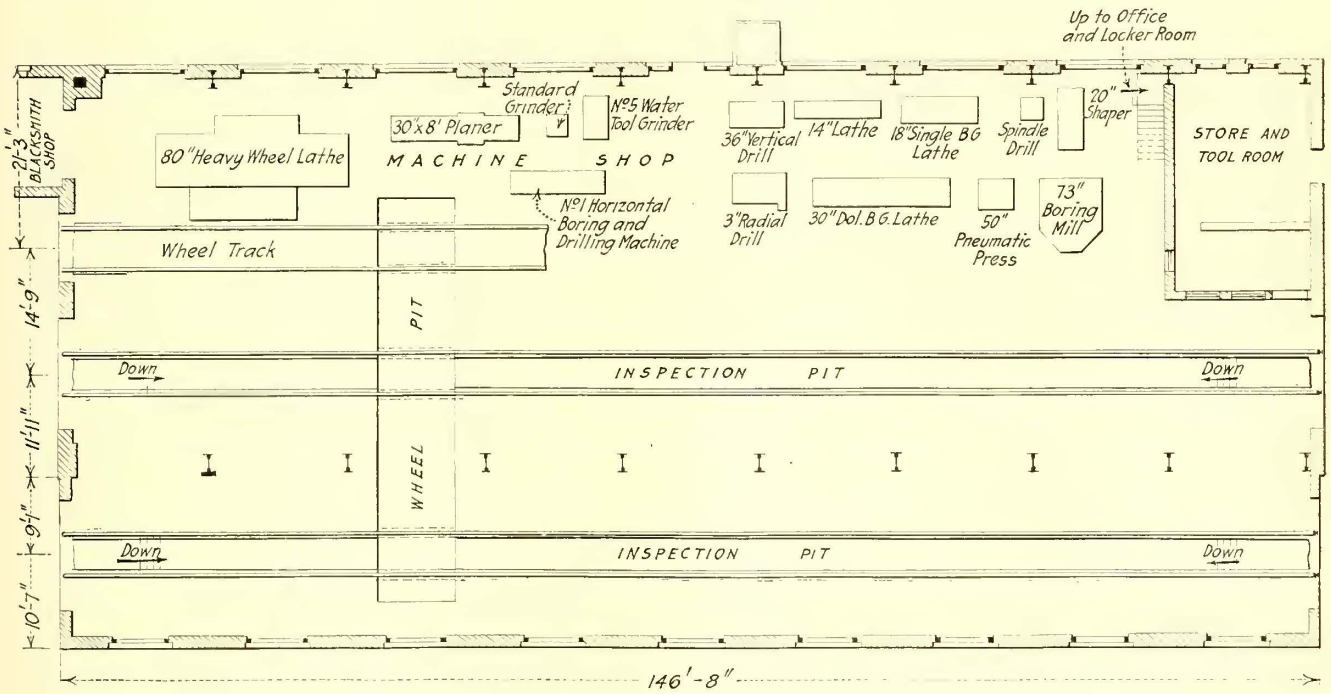
Belt Driven Tools

- 1 Diamond double emery grinder.
- 1 Diamond wet tool grinder.
- 36-in. Aurora vertical drill.
- 18-in. x 10-ft. single-back-geared lathe.
- 14-in. Barr two-spindle sensitive drill.
- 50-ton pneumatic press.

consisting of a tower car, tool car and flat car, which is constantly held in readiness for heavy emergency repairs. The ordinary repairs, however, are taken care of by comparatively small gangs consisting of from three to five men for whom there are provided three small gasoline cars fitted to carry tools and an assortment of wire, insulators, and other repair parts as well as extension ladders.

Wherever possible repairs are made from the overhead bridges or from ladders. In order to avoid interruption to electric service to the greatest extent possible, specially treated and impregnated wooden ladders are provided and these can be used for light repairs to trolley fingers, clips, and other details on the 11,000-volt catenary system while it is alive. Very rigid rules permit the use of only one ladder at one point at any time and only one man is allowed on the ladder. The use of long lengths of wire which might reach across to other wires or to a grounded structure is prohibited. Certain of the line repairmen are regularly stationed at other points from which they can quickly respond to an emergency call by the use of gasoline cars.

The previously mentioned patrol telephone line is installed over the entire length of the electrified section and it has telephones in locked boxes at certain signal bridges spaced about 1 mile apart. This patrol



NORFOLK & WESTERN ELECTRIFICATION—PLAN OF ELECTRIC LOCOMOTIVE REPAIR SHOP

The pneumatic press and the pit wheel-jack were made by the railway company according to their own designs. Pneumatic pressure is used instead of hydraulic because of its extensive use in all buildings for other purposes.

LINE MAINTENANCE EQUIPMENT

A brick building at Bluestone, formerly used as a pumping station for locomotive water supply, is used as headquarters for the line inspection and maintenance force. Here a supply of line materials is carried, and part of the building will be fitted up as a bunk room for line repairmen, who will thus be available and subject to call at any time during the day or night. On a near-by siding is stationed an emergency repair train,

line is connected with the power house and it is valuable for use in reporting either line or locomotive troubles.

Through the telephone operator located at the power house communication can be established with the train despatcher and other officials. The power director is located at the switchboard in the power station, and he is also in constant telephone communication with the signal tower operators, passenger station agents, yard masters, and others who are responsible for manipulation of switches in the substations or along the line. By means of these facilities power can be switched off or on quickly whenever necessary, or the line may be sectioned and service restored in part after interruptions.

Southwestern Association Question Box

Track, Shop, Distribution, Transportation and Management Topics Were Covered in Symposium Form

For the benefit of the members of the Southwestern Electrical & Gas Association, of which the annual meeting was held in Galveston from May 19 to 22, the "Question Box" was issued in pamphlet form in advance of the meeting. The pamphlet contained 125 questions, of which many were of interest to electric railway men, and a number of questions were accompanied by digests of answers received at the association office. The questions and answers of electric railway interest may be grouped under the following headings: Track and roadway, distribution system, shops, transportation and management.

TRACK AND ROADWAY

The pin terminal bond was recommended in response to a question as to the best method of bonding aside from welding or brazing. The latter should be well protected from corrosion.

The factors which determine the width of "devil strip" in city streets, in addition to the extreme width of car, were stated to be as follows: On tangent track side oscillation, uneven loading and uneven surfacing of track must be considered. Where the railway paves between tracks the cost of paving is also a factor. On curves the elevation of the outside rail of the outside track and clearance for the car overhang are additional factors. While in some cities clearance for persons standing between tracks is provided, this "safety space" is the cause of accidents rather than the preventative.

In regard to the crowning of paving between rails and tracks it was stated that, with T-rails, paving should be crowned slightly between rails, but not with grooved or girder rail. There should never be any crowning between tracks.

Unanswered questions related to screw and driven spikes, relative merits, and best sizes and methods of installing the former; the use of oxy-acetylene in rail bonding; the minimum radius of curve allowable with a single guard rail; the use of asphalt paving blocks against the rail; the proper relation of rail-head and wheel-tread widths; elimination of rail corrugation; building up special work by electric welding; the use of spring-point switches on high-speed, interurban lines; the traffic necessary to render the use of electric track switches economical, and the reclaiming of old materials from the scrap pile.

DISTRIBUTION SYSTEM

On the subject of bond testing the recommendation was made that such testing be combined with a general testing of the return circuit when possible. This can be done best when traffic is suspended. In regard to grounding of poles, it is not safe to depend upon a concrete setting of a metal pole for grounding.

A question as to the reliability of sherardizing and galvanizing of trolley wire and line fittings was asked. In reply the secretary explained the processes of coating metal objects with zinc oxide or zinc, stating that zinc oxide makes a non-porous "metallic varnish" which resists corrosion by many acids and alkalis. There are, however, some substances which attack zinc, particularly those carried in seashore air and in coal and gas smoke. In bending and otherwise handling zinc-coated fittings, there is danger of separating the coatings from the fittings, and rust will form under the coatings if the latter are broken. It is advisable to paint fittings, especially such as are subjected to bending or surface abrasion.

Several questions relating to poles and their preservation brought out information as follows: In eastern Texas both treated and untreated native yellow pine poles are used, but in the West, western cedar is the favorite on account of freight rates. Practically all kinds of poles can be economically "treated" without deleterious effect on the wood fiber. Improper manipulation in treating may injure the fiber by overheating or rupturing the cell structure.

Unanswered questions on distribution topics related to splicers for grooved trolley wire, mechanical trolley-wire ears, trolley-wire tension in city and interurban service and concrete poles in city span-wire construction.

SHOP PRACTICE

In reply to a question as to the useful life of axles it was recommended that axles be tested after making a mileage which allows a large factor of safety. For this purpose inspection in place is not sufficient but in general the axles must be stripped and thoroughly tested.

Unanswered questions related to the following topics: Results obtained with combinations of different kinds of gears and pinions; experience with roller and ball bearings in high-speed and low-speed service; mileage to be obtained with heat-treated axles; car ventilators; artificial light for car-sheds, pits and shops, and experience with sand-blasting of metal parts of cars.

TRANSPORTATION

A member asked as to the advantages and disadvantages of street sprinkling. The response was that there are no advantages to anyone concerned. The disadvantages to the railway are the making of slippery rail and soggy road-bed. It is recommended that the water wasted in sprinkling be used in washing the streets.

The discussion on methods for insuring intelligent reading of company notices by employees brought out the need for such methods, but no successful methods were described.

Regarding the possibility of holding conductors jointly responsible with the motormen for the observance of signals, it was pointed out that this would be highly undesirable as the conductor must concentrate on the duties which are peculiarly his own.

The replies on the subject of operating cars during lightning storms were unanimous in favoring such operation providing that suitable lightning arresters are used and the lighting circuits are kept closed.

A question as to the practice of companies as to allowing motor men to be seated while on duty brought out a response stating that motormen are allowed to sit in sections where vehicle and pedestrian traffic is light, providing their own stools for this purpose.

Unanswered questions on transportation related to the following: Possibility of using ordinary single entrance and exit cars in pay-enter service; practice in stopping cars near fire engine houses; relative advantages of near-side and far-side stops; practical results from the use of coasting clocks in city and interurban service; effects on schedules of the use of closed doors and folding steps; best alarm signal for city cars; disadvantages of devices for limiting car acceleration; use of the water jet for removing mud and leaves from rail, and water lubrication of wheel flanges on curves.

MANAGEMENT

On this broad subject the answered questions related to principally ejection of passengers, and the practice and esthetics of advertising. On the first topic the recommendation was that offending passengers be forcibly ejected only when necessary for the protection of other

passengers or the employee. There is no one best method of informing the public regarding changes in schedules, etc. Advertisements and reading notices in newspapers, "notice boxes" on cars, slips handed out by conductors, etc., are all effective. Esthetic objections to certain kinds of advertising on cars are often very practical ones. Advertisements will be tolerated by patrons only when cars are not "mussed up" and no inconvenience or danger to passengers is caused.

Unanswered questions on management referred to these subjects: Effects of advertising on railway traffic; free transportation for trainmen when not in uniform; information to be allowed to non-concerned employees in accident cases, and results of paid publicity campaigns in the public press.

Convention of Missouri Association

Boat Trip on Four Rivers Enjoyed—Jitney Discussed

A convention of the Missouri Association of Public Utilities was held on Board the steamer *Quincy*, May 27-30, during a trip from St. Louis down the Mississippi River, up the Ohio, the Cumberland and Tennessee Rivers and back to St. Louis. During the trip stops were made at Paducah, Ky., and Cairo, Ill. The technical sessions of the association were held during the trip.

In a paper on "The Modern Public Utility—Its Duty Toward the Public It Serves," H. B. Porter of St. Joseph, Mo., said that the whole idea of modern business is service. Money is not earned nowadays when it enters the cash register, but only after complete satisfactory service has been rendered to the purchasers. Employees must see to it that there is never the least suggestion of insincerity in the utilities' attitude towards the public.

J. H. Van Brunt of St. Joseph, in a paper on "Public Utility Commissions," said in part: "If the public utilities and the Public Utilities' Commission of Missouri shall so co-operate as to bring extended and better service to the public, greater security to investors in utilities' securities and greater prosperity to the utilities themselves, the dream of the author of the public utilities' commission's bill will doubtless have been realized."

The most important paper, from an electric railway standpoint, was by P. J. Kealy, member board of control Kansas City Electric Railways, Kansas City, Mo. The subject was the jitney. An abstract appears below.

The election of officers for the ensuing year resulted as follows: President, George E. Hayler, Jr., of Joplin; first vice-president, Hugo Wurdack of St. Louis; second vice-president, Bruce Cameron of St. Louis; third vice-president, J. H. Van Brunt of St. Joseph; secretary-treasurer, F. D. Beardslee of St. Louis.

THE JITNEY

In his paper on the jitney bus Mr. Kealy first traced the responsibility for its existence, which, he said, was due to the tremendous output of automobiles during the past three or four years, the rapid change in models, and, as a result, the market of second-hand automobiles being flooded. Then the industrial depression threw many men out of employment, and the jitney craze brought together these two unproductive elements, i. e., the unsalable car and the man without employment. Any wages which these men could earn so long as the car they ran was serviceable, represented food and clothing to them. A second reason for the jitney was the rapid increase in population of American cities which had made it practically impossible for the electric railways to provide adequate transportation in the evening rush-hours in most communities.

Mr. Kealy then analyzed the cost of operation of the jitney and determined that it was approximately 10 cents a mile for a small car and 15 cents a mile for a large car, and that this operating expense could not be met if passengers were carried beyond a 3-mile zone for 5 cents. The question, Mr. Kealy said, was not how objectionable the jitney is to the traction company, but whether it is an economic possibility and whether it can render better transportation to the community at the same cost as the street railway is now doing.

The author then pointed out that the practical limits of the jitney radius of operation to but 3 miles would justify legislation driving it out of existence because otherwise the property values given to real estate beyond the 3-mile zone by the traction company would be destroyed. The speaker also referred to the great expense which has been undertaken in large cities to reduce street congestion by relocating freight terminals, building elevated railways, etc., but if the jitney supplanted the street railway there would be ten times the congestion within the business districts as at present. This would be an intolerable condition. Finally, the speaker quoted some English figures to show that the motor buses abroad had many times the total accidents per vehicle as the tramways.

In conclusion he quoted a man as having succinctly said: "Every time you take a jitney you are wronging your neighbor who lives beyond the jitney limits, abandoning the congested tenements for the open air and garden opportunities for his family. You wrong the children who must ride to school from the outlying districts on the street car. You are not considering the justice in the matter when you take a jitney for a short one-way trip and take a street car beyond the jitney limit. You are not considering the wrong you are doing your friends who live beyond the jitney in making it necessary to limit his opportunity for frequent service by the street railway company. You forget the possibilities of the street car system being prevented from extending their lines. The patronage of the jitneys is unfair to the city, unfair to renters, unfair to suburban property owners and unfair to the traction company."

Interstate Monthly Report on Accidents

The Interstate Commerce Commission, Division of Statistics, has issued a tentative draft of its rules governing monthly reports of railway accidents to carriers and others interested for the purpose of receiving criticisms and suggestions. Criticisms were requested by June 1. The new draft differs from the one distributed under date of Jan. 9, 1915, in that the number of forms is considerably reduced, only one form being provided for the several different classes of train accidents and train-service accidents. The proposed requirement for individual reports of non-train accidents has been withdrawn and only a summary statement of non-train accidents is provided for in the report. The proposed summary statement of train accidents and train-service accidents has also been withdrawn. A requirement for reports of rail failures resulting in train accidents has been added. The definition of reportable injuries to employees has been modified so as to make the minimum limit three days' incapacitation in the ten days following the accident, as is now in force. Numerous other, but minor, changes have been made which appear upon a reading of the draft.

In making the revision the commission says that it has had the benefit of the suggestions of the committee of the American Railway Association, composed of Julius Kruttschnitt, chairman; W. W. Atterbury and W. G. Besler.

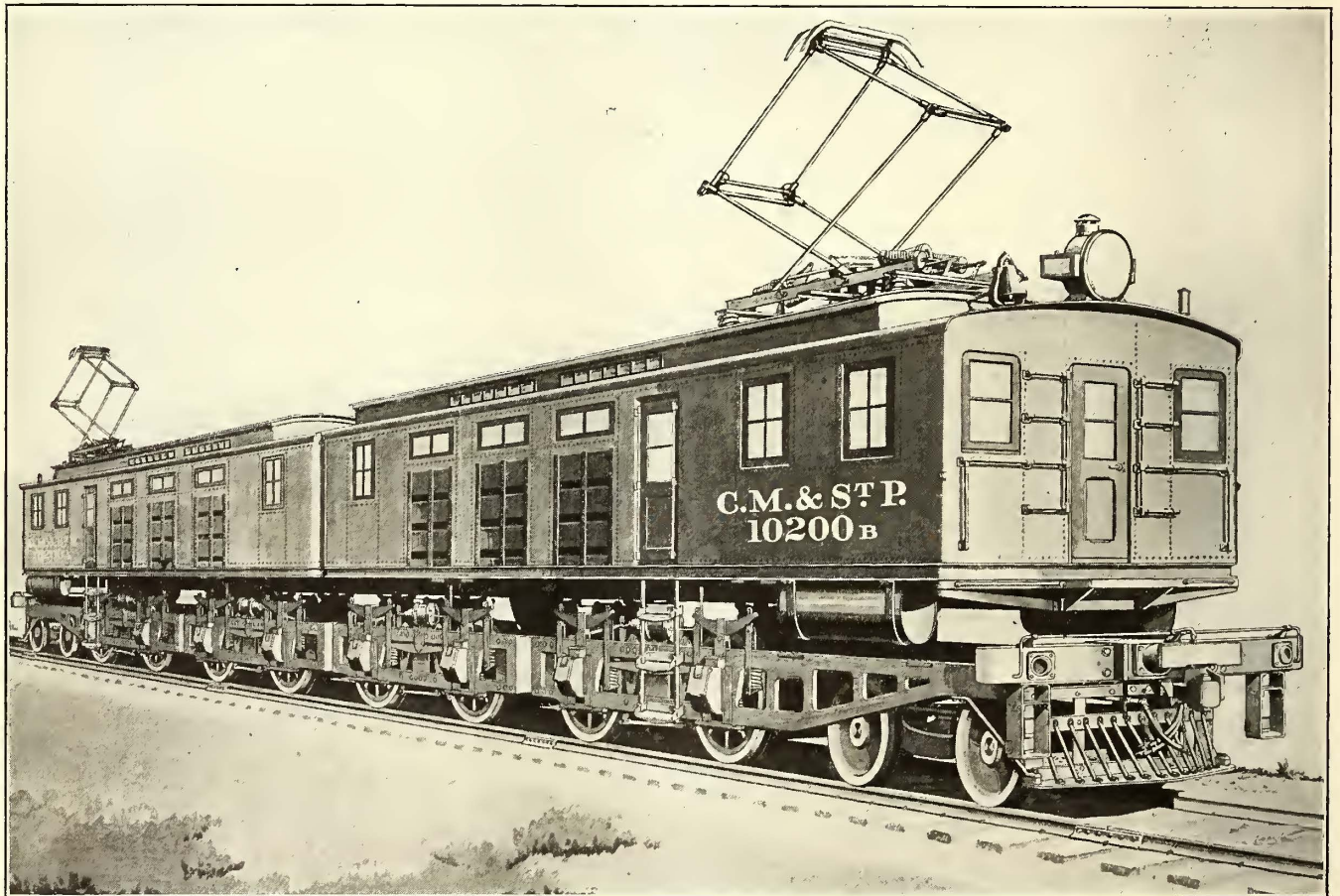
The Chicago, Milwaukee & St. Paul Locomotives

Among the Interesting Features of These New Electric Locomotives Are Large Motor Capacity with Axle Mounted Motors, Regeneration on Down Grades and a Novel Method of Current Collection

BY A. H. ARMSTRONG, ASSISTANT ENGINEER, RAILWAY AND TRACTION DEPARTMENT, GENERAL ELECTRIC COMPANY

The flexibility in design and operation of the electric locomotive afforded by the use of electric motors renders this type of motive power especially well suited to the hauling of trains, either high-speed passenger or slow-speed freight. In fact, the electric locomotive possesses inherent qualifications for haulage service that are be-

the heavy demands that will be placed upon it under service-operating conditions. The motors are wound for 1500 volts and connected two in series for 3000 volts. The power axles are driven by twin gears, in this respect being similar to the drive on the Great Northern, Detroit Tunnel, B. & O. and Butte, Anaconda & Pacific,



C., M. & ST. P. LOCOMOTIVE—VIEW OF COMPLETE UNIT OF WHICH TWENTY-ONE ARE NOW UNDER CONSTRUCTION. EACH LOCOMOTIVE HAS EIGHT MOTORS, TOTALING 3440 HP.

coming more fully appreciated as constituting the fundamental reasons for bringing about the change from steam to electricity, and interest in any new projected electrification therefore largely centers in the characteristics of the locomotives proposed. Work has progressed upon the Chicago, Milwaukee & St. Paul locomotives at the Schenectady and Erie works of the General Electric Company to such an extent as to make available certain facts as to construction and capacity that are of especial interest owing to the magnitude of the problems involved in this extensive electrification.

The general data applying to the St. Paul freight locomotives are given in Table I on the next page.

A very exhaustive series of tests has just been completed upon the first sample motor built at Schenectady, and has demonstrated that it has ample capacity to meet

except that springs are used in the axle gears. On account of the high voltage for which the motors are wound, the commutator width is small, thus allowing more space for armature iron and copper, with the result that the motor has a continuous capacity of 375 hp. In fact, special interest attaches to the large continuous capacity of the St. Paul locomotive as this is the first instance where such a liberal motor capacity has been required and provided for, and it should be noted that this large capacity is secured in an axle motor without departing from well known and thoroughly tried out forms of construction.

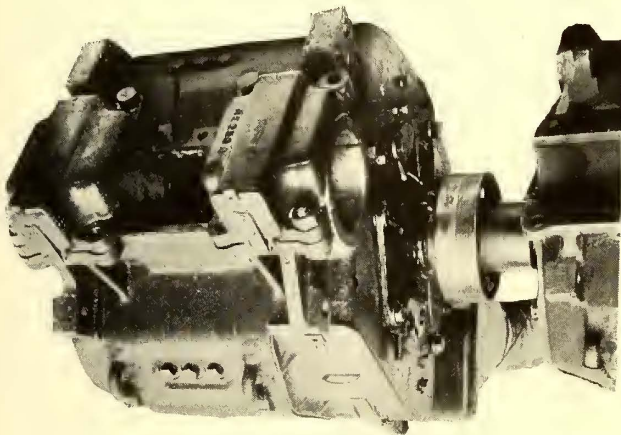
A study of the train dispatcher's sheet covering performance on mountain grade divisions of our steam railways shows that it is general practice to assign such a trailing tonnage to a locomotive on ruling grade

as to demand a tractive effort at the driver rims equivalent to approximately 18 per cent to 19 per cent of the weight upon the drivers. In other words, steam prac-

TABLE I—GENERAL DATA ON CHICAGO, MILWAUKEE & ST. PAUL FREIGHT LOCOMOTIVES

Type of locomotive.....	3000 volts direct current
Length over all.....	112 ft.
Total wheel base.....	103 ft.
Rigid wheel base.....	10 ft. 6 in.
Total weight.....	520,000 lb.
Weight on drivers.....	400,000 lb.
Weight on driving axle.....	50,000 lb.
Weight on guiding axle.....	30,000 lb.
Diameter of driving wheel.....	52 in.
Diameter of guiding wheel.....	36 in.
Number of driving motors.....	8
Total output (continuous rating).....	3000 hp.
Total output (one hour rating).....	3430 hp.
Tractive effort (continuous rating).....	71,000 lb.
Per cent of this T. E. to weight on drivers.....	17.75
Speed at this T. E. at 3000 volts.....	15.75 m.p.h.
Tractive effort (one hour rating).....	85,000 lb.
Per cent of this T. E. to weight upon drivers.....	21.2
Speed at this T. E. at 3000 volts.....	15.25 m.p.h.

tice calls for a locomotive which can operate for long periods at a coefficient of adhesion of from 18 per cent to 19 per cent, leaving the difference between this value and the slipping point of the drivers, as a sufficient margin with which to start on ruling gradients. Under



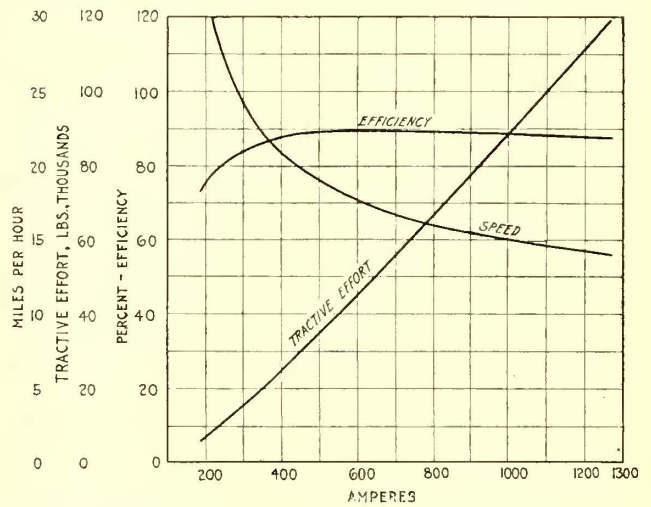
C., M. & ST. P. LOCOMOTIVE—END VIEW OF MOTOR ARRANGED FOR STAND TEST

like track conditions, the uniform torque of the electric motor should make available some 10 per cent more tractive effort than is possible with the reciprocating drive of the steam locomotive having the same weight upon the drivers. Until sufficient operating experience is available, however, to prove that an electric locomotive can be rated at 20 per cent coefficient of adhesion, it seems reasonable to adhere to the present steam practice of a somewhat lower value. The St. Paul locomotive, therefore, with its continuous motor capacity of 17.75 per cent and a one hour rating of 21.2 per cent of weight on drivers gives ample assurance of ability to handle its assigned tonnage under all service conditions.

The St. Paul freight locomotive is guaranteed to have a hauling capacity of 2500 tons trailing load on all gradients up to 1 per cent, and its heaviest duty will be to haul this load from Lombard to Summit over the Belt Mountains, a distance of 49 miles with a ruling grade of 1 per cent and an average grade of 0.7 per cent over the entire distance. Including the locomotive of 260 tons, the gross train weight of 2760 tons will require a tractive effort of approximately 72,000 lb. on the 1 per cent ruling grade, based upon a train resistance of 6 lb. per ton. This practically corresponds to the continuous rating of the locomotive, as tabulated above, and brings out the interesting fact that these locomotives are so proportioned as to motor capacity that they cannot be abused under normal service operation.

The necessity of rating main line electric locomotives upon a practically continuous basis is still further emphasized in the case of the St. Paul locomotives by the introduction of electric regenerative braking. The heavy demands upon the motors when operating up-grade may be nearly duplicated during the following down-grade running when regenerating, thus giving small chance for the time element of the motor heating to enter as a factor in proportioning its capacity for such exacting service. A 2 per cent grade requires a motor output of 46 lb. per ton up grade and gives 34 lb. per ton motor input down grade. Making due allowance for internal locomotive losses, it is evident that the motor output when operating as a generator down grade will approximate 60 per cent of its input when hauling the same train up a 2 per cent gradient. Hence the need of making provision for a practically continuous motor capacity in the St. Paul locomotives in order to meet the service requirements of the broken profile over which they are designed to operate.

It is interesting to compare the relative capacity of



C., M. & ST. P. LOCOMOTIVE—CHARACTERISTIC CURVES OF 3000-VOLT D.C.-FREIGHT LOCOMOTIVE

the new electric locomotives and the Mallet engines they will replace. This is shown in Table II:

TABLE II—COMPARISON MALLETT AND ELECTRIC LOCOMOTIVES

	Mallet	Electric
Total weight.....	555,700 lb.	520,000 lb.
Weight on drivers.....	324,500 lb.	400,000 lb.
Rated tractive effort.....	76,200 lb.	85,000 lb.
Per cent of weight on drivers.....	23.5%	21.2%
Rated tonnage 1% grade.....	1,800 tons	2,500 tons
Tractive effort for above tonnage.....	54,000 lb.	71,700 lb.
Coefficient of adhesion.....	16.7%	17.9%
Wheels per guiding truck.....	2	4
Weight per driving axle.....	54,000 lb.	50,000 lb.
Total weight on one rigid wheel base truck.....	162,000 lb.	100,000 lb.

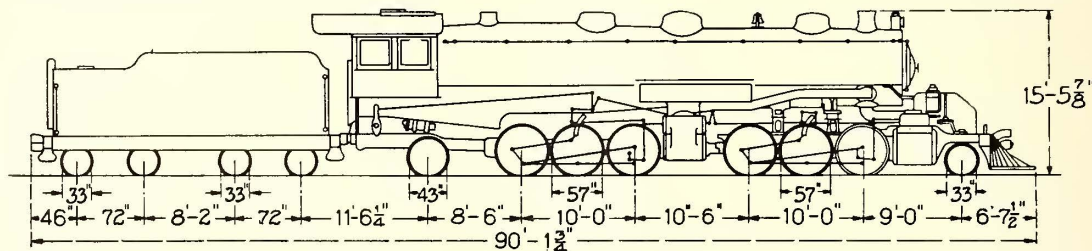
Under favorable conditions the Mallet engine can haul 2000 tons on 1 per cent grade, thus bringing its tractive effort up to 59,000 lb. and the coefficient of adhesion on its drivers up to 18.3 per cent. The electric locomotive weighs 94 per cent of the combined weight of Mallet engine and tender and has a tonnage rating of 23½ per cent greater, based upon using the same coefficient of adhesion in each case, that is, 17.9 per cent. This comparison indicates that the electric locomotive has a hauling capacity one-third greater than the steam engine and tender of the same total weight, has less weight per axle, is provided with four-wheel guiding truck in place of two-wheel, requires no turntable as it operates equally well in either direction, and, finally, eliminates the necessity for stopping to take on coal and water.

The same type of locomotive is used for both freight

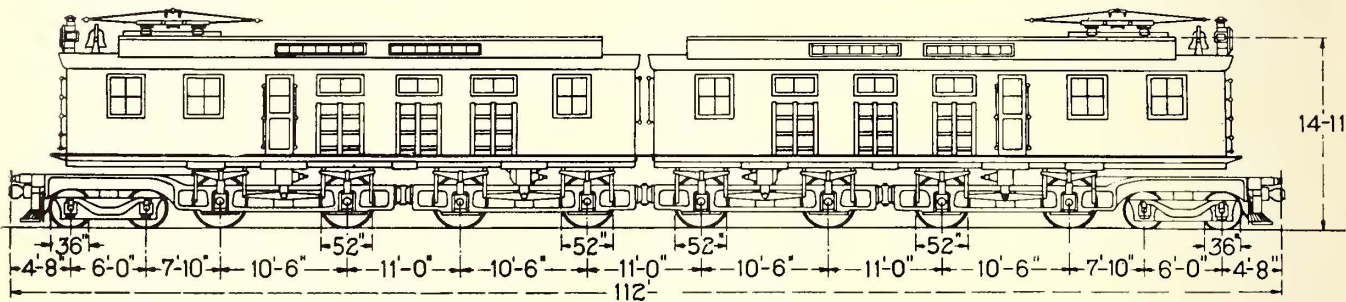
and passenger service, the only difference between the two being the gear ratio which is 4.56 for freight and 2.45 for passenger service. This interchangeability of all parts of the freight and passenger locomotive and the adoption of one uniform type for all classes of service should be reflected later in the low cost of maintenance of the locomotive as well as prove of great benefit in the economical handling of the traffic. For facility in shop repairs, the locomotive is constructed in halves, and in fact each half can be provided with draft gear in place of the articulated joint and operate singly in service up to its capacity. One passenger locomotive will haul a trailing load of 800 tons over all gradients of the road without assistance except upon the 2 per cent grade section over the main divide of the Rocky Mountains. Even on this grade a 600-ton train can be handled without assistance. This illustrates the exacting nature of mountain railroading

twin conductor trolley wires is capable of taking off a current of 2000 amp. at speeds as high as 60 m.p.h. This is several times the demand upon one collector of the St. Paul locomotives, and the double pan was adopted in place of the roller collector, although the latter has been giving excellent results, reaching a life of nearly 30,000 miles in the passenger service of the Butte, Anaconda & Pacific Railway.

Provision has been made in the control to enable two locomotives to be run together in multiple unit, but the enormous starting effort of two such locomotives, 240,000 lb. tractive effort at 30 per cent coefficient of adhesion, makes such a combination of use only when it acts as a pusher on the rear of a train. The motors and starting resistances are designed to permit of a starting effort of 120,000 lb., being maintained on one locomotive for a period of five minutes without destructive heating, and in this connection the thermal



WEIGHT-LOCOMOTIVE & TENDER.....555,700 lb.
 WEIGHT ON DRIVERS.....324,500 "
 TRACTIVE EFFORT.....76,200 "



WEIGHT-TOTAL.....520,000 lb.
 WEIGHT ON DRIVERS.....400,000 "
 TRACTIVE EFFORT.....85,000 "

C., M. & ST. P. LOCOMOTIVE—DIAGRAM GIVING COMPARATIVE DATA OF COMPLETE ELECTRIC UNIT AND MALLET COMPOUND STEAM LOCOMOTIVE

which demands in this instance that the passenger locomotive shall have the necessary motor capacity and smooth running qualities to successfully haul an 800-ton train at 60 m.p.h. on level track and also operate over 20 miles of 2 per cent up grade. Add to this the regenerative braking feature and steam heaters for train heating, and the broad nature of the problem of designing an electric locomotive for main line mountain service becomes very apparent. The locomotive superstructure contains space for two oil-fired steam heaters, together with ample provision for storage of oil and water. All passenger locomotives and a certain number of freight locomotives intended as reserve passenger units will be equipped with heater boilers.

CURRENT COLLECTOR AND OTHER DETAILS

A departure from the roller current collector of the Butte locomotive has been made in the St. Paul locomotives as the result of numerous experiments made upon the test tracks at Schenectady and Erie. These tests indicate that a double pan collector bearing against

capacity of the heavy slow-speed motors will be of great assistance.

The first completed St. Paul locomotive will probably be placed upon the test tracks at Erie during September and shipment of these locomotives commenced soon thereafter. The construction work upon trolley and substations of the first engine division between Three Forks and Deer Lodge has been so far completed as to give promise of being finished and ready for the trial runs of the locomotives as soon as they are received this fall. Ample provision has been made for power and transmission line facilities by the Montana Power Company, so that electrical operation of the Chicago, Milwaukee & St. Paul Railway should soon be an accomplished fact.

A reduction of 511 in the number of accidents reported for February of this year as compared with the same month the year before is a record of the Detroit United Railway. There were 1655 accidents in February, 1914, and 1144 in February, 1915.

ANNUAL CONVENTION
SAN FRANCISCO
OCTOBER 4 TO 8, 1915

American Association News

ANNUAL CONVENTION
SAN FRANCISCO
OCTOBER 4 TO 8, 1915

Association Headquarters Moved this Week to No. 8 West Fortieth Street—A Plan of the Offices is Given Below
—Chicago Elevated Section Holds Its Second Meeting and Plans to Select Delegates to the Convention

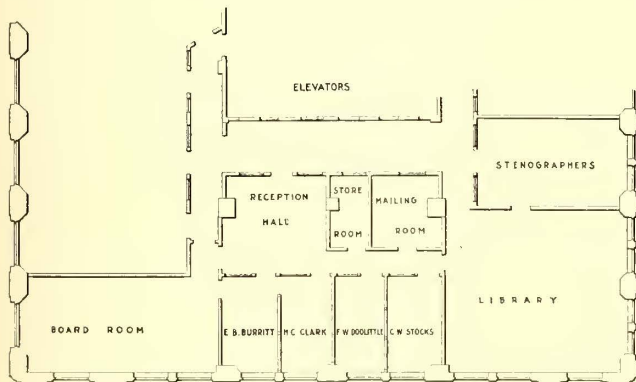
THE NEW ASSOCIATION HEADQUARTERS

As was announced last week on this page the offices of the association in New York have been moved to No. 8 West Fortieth Street. A view of the building, a structure just completed, is given herewith. As the illustration shows, the new building is but a few doors from the Engineers' Club, which appears at the right.



VIEW ON WEST FORTIETH STREET, NEW YORK CITY, SHOWING NO. 8 AT LEFT AND ENGINEERS' CLUB AT RIGHT

The building is just west of Fifth Avenue, from which buildings are numbered east and west in New York City, and opposite one end of the New York Public Library, which extends from Fortieth to Forty-second Street on Fifth Avenue. The general layout of the



PLAN OF NEW ASSOCIATION OFFICES AT NO. 8 WEST FORTIETH STREET, NEW YORK CITY

association offices on the seventh floor is shown in the diagram printed above. In this layout the best possible use of the available space is made, and Mr. Burritt and his colleagues are grouped for convenience of communication.

The moving was accomplished without interference

with the work and so expeditiously that when the rules committee arrived on June 3 for the meeting announced below, the board room and offices had quite a "settled" appearance.

The association rooms stretch along the west side of the building, facing toward the Engineers' Club, while the end window in the board room overlooks the New York Public Library, of which a corner is seen at the left-hand edge of the photograph.

CHICAGO ELEVATED RAILROAD SECTION

The meeting of company section No. 6 was held on May 25 with 115 members in attendance. Secretary Dwight L. Smith announced that seventeen applications for membership had been received and passed by the executive council, and nine other applications are awaiting acceptance. This will bring the total membership up to 162.

Two interesting papers illustrated with lantern slides were presented at this meeting; one a description of a new double-deck bridge over the Chicago River, by C. M. Mock, chief engineer, and the other a description of the new steel cars recently purchased by the company, by H. A. Johnson, master mechanic. Both of these papers treated the subjects in an educational way, discussing them particularly from an engineering standpoint. For instance, the description of the bridge not only took up the engineering difficulties, but described how the construction would proceed and how it would affect operation. The steel-car paper discussed the engineering considerations entering the design, and compared the new cars with the wooden ones now in service.

Announcement was also made at this meeting of the plans for selecting the two delegates who are to be sent by President B. I. Budd to the San Francisco convention of the association. One representative will be the member of the section who submits the best suggestion tending to further the company's interests, along such lines as improving the service, increasing safety, reducing expenses, stimulating traffic, improving equipment, or outlining more efficient methods to be employed in the maintenance of equipment. The other representative will be elected by popular vote, after a primary election for the choice of five candidates.

COMMITTEE ON RULES

The final meeting of the T. & T. Association committee on rules met in New York at No. 8 West 40th Street, on June 3, with the following in attendance: W. H. Collins, Gloversville, N. Y., chairman; L. H. Palmer, New York, vice-chairman, and C. E. Morgan, Jackson, Mich. No new topics were considered, but the conclusions reached at earlier meetings were put into form for the annual report and in this form will be submitted to the entire committee at once. Recent important meetings of this committee were reported in the ELECTRIC RAILWAY JOURNAL as follows: Feb. 20, page 379; March 20, page 589 (joint meeting with block signal committee); April 10, page 713 (meeting of joint sub-committee appointed March 17).

COMING COMMITTEE MEETING

The committee on way matters of the Engineering Association will meet in Chicago on June 11 and 12.

COMMUNICATIONS

Mr. Sprague on Regenerative Braking

NEW YORK, May 19, 1915.

To the Editors:

I note that the *ELECTRIC RAILWAY JOURNAL* has been giving considerable editorial attention of late to the subject of regeneration of electrical energy in heavy electric traction. As I have been engaged in pioneer work along regeneration lines for many years you may be interested in a few historical notes regarding this work. It has been based upon the principles which first found their development and practical application in my constant-speed electric motors developed for stationary work some thirty years ago in the early days of this art. At that time I pointed out that in order to get constant speed under variable load, with a shunt motor supplied from a constant-potential circuit, it was necessary automatically to vary the field magnet strength inversely with the load, and therefore the motor or counter emfs, so as to vary the effective or differential emfs and currents directly with the load.

The principle underlying this regulation, applied to motors with shunt fields alternately driving a load or being driven by one, of course indicated that when so driven by a load the raising of the motor emf above that of the source of supply would produce a reversal of current and consequent delivery of energy to the line.

The first practical commercial application of this principle that I know of was in my use of shunt-wound motors to drive line shafts from which balanced freight elevators were operated by direct and reverse belts. In such cases when a load was being lowered it drove the motor at a slightly accelerated speed and delivered current to the line, thus making it possible to operate a very large number of elevators from a common source of supply with a minimum total expenditure of current.

I early developed this principle in its application to railway work, and in December, 1885, before the Society of Arts in Boston, outlined at length a method of electrifying and operating the Manhattan Elevated Railroad, so that by using shunt motors and the principle of shunt-field regulation it would be possible to save fully 60 per cent in the size of the central station and in the amount of power required, because every car or train running on a down grade, or approaching a station at a speed above a certain value, would constitute a moving supply station to supplement the main power station in providing current for cars accelerating, ascending a grade, or operating at constant speed.

Such operation was demonstrated for a considerable period on a platform car at the old Durant Sugar Refinery on East Twenty-seventh Street, New York, in 1886, and for some months on the Thirty-fourth Street branch of the Elevated Railroad in the winter of 1886-1887. At this time I used shunt field variation, not only for speed control but also for first delivering current back to the line in slowing down the speed of a car, and then, breaking away from the line, for bringing the car to rest by sending the current generated in the armature through a diminishing resistance until finally it became practically a short circuit, the field still being connected to the line. In the public tests in this connection the car was often handled entirely without the ordinary wheel brakes.

The method of operating trains with shunt-wound, constant-potential motors had two difficulties, one being a lack of starting torque as compared with a series-wound motor, and the other that success in using this method of regeneration required motors of similar

characteristics and wheels of like diameters, or methods of adjustment to take care of any differences which might exist. With these factors equalized there was no question of the remarkable efficiency of control and saving of energy.

In 1886 I extended my patents to cover the application of the same principle to the recharging of storage batteries when used upon a street car. I think that I am correct in stating that these various patents and the principles outlined in them marked the first recognition of the possibility of the use of a regenerative principle in a practical way.

Since that time a great many uses have been made of this scheme. One very common one was that developed by me about 1890 in connection with elevators operated against gravity. In my earlier multiple-sheave screw machines the load was always against the machine, that is, even with no load in the car the weight was unbalanced by, say, 600 lb. or 700 lb., enough to rapidly overhaul the machine. The motors, therefore, on the up-trip always worked against a load, but on the down trip the armature was detached from the source of supply, closed upon an adjustable rheostat, and the speed of the car was governed by the retardation so established. The safety device at the bottom operating on failure of current also made use of this principle.

On the Central London elevators, which represented by far the largest elevator equipment ever put in at the time of its installation in 1897-1898, the operation was on similar principles, except that in this case the elevators were practically counter-balanced, so that the motors were sometimes driving and were sometimes driven in each direction of movement. This resulted in material economy.

Various attempts have been made in recent years to apply this principle to series-wound motors in operating street cars, and a number of tests were made in England in this connection. In the application of poly-phase motors to railway service the principle of regeneration to line was, of course, the natural application of their shunt-wound motor characteristics. Following this application in Italy various plans have been advanced for using the regenerative principle in connection with single-phase motors, although the problem in this case is not by any means so simple, especially if it be desired to use all the motors of an equipment. Incidentally, I had, on the first modern electric railway installed in Italy by my assistant in 1890, used this same principle as a special safeguard made necessary by a grave accident occurring shortly after the opening of the road. After this accident it seemed important to put into the hands of the conductor the ability to take the control of the car acceleration out of the motorman's hands, and to make the car act as its own braking power.

Later, I proposed for d.c. motors on mountain duty the use of the regenerative principle, primarily for braking or checking the train on a down grade, using all the motors, not for sending current back to the line but for generating current under controlled resistances upon the locomotive, the motors being self excited with reversed armature connections. This was not done for purposes of power economy but primarily to avoid the disastrous consequences of over-heated brakeshoes and wheel rims after long brake applications, and the failure of air supply when perhaps unduly overtaxed. In this case the braking could be alternated or divided between motors and air brakes.

I proposed this plan practically for a suggested electrification of the Sacramento division of the Southern Pacific Railroad over the Sierra Nevada mountains in

1907, 1908 and 1909. A variation of this use of motors as self-exciting generators on a locally closed circuit is to use a line-excited motor-generator to excite the series field coils of the motors, leaving the armatures connected with the line so as to be able to receive current from, or send back current to it, with provision for changing the connections so as to get local self-excitation for rheostatic braking in case of necessity.

This later plan, like many others which I have found necessary to carry through in the face of doubt and criticism, did not meet early acceptance, but it is probably the method which must be adopted at least with direct current motors. FRANK J. SPRAGUE.

Investment Per Passenger

SLOAN, HUDDLE, FEUSTEL & FREEMAN
CONSULTING ENGINEERS

MADISON, WIS., June 2, 1915.

To the Editors:

I have noticed the article by D. J. McGrath in the *ELECTRIC RAILWAY JOURNAL* of May 8, and was much interested in finding that a study was being made to show more clearly to the public just what application was made of the fare received by street railway companies from its patrons. The studies described by Mr. McGrath represent, to my mind, the first step in presenting this matter properly to the public.

In my work with a considerable number of public service commissions throughout the country who are regulating rates for utility commodities, it has usually developed that when the consumer came to a clear understanding of the basis for the charge which was being made upon him, he was willing to pay fairly for the cost of the service which was being furnished.

Unfortunately, due to the operation of certain misguided public utility men, who were really financiers and not operators, the problem of convincing the public that utilities of various kinds are not a veritable gold mine has been a difficult one. The wide variation in the laws governing the issuance of utility securities has helped to increase the doubt in the public mind. Published extracts from annual reports of utility companies indicating satisfactory dividends, some times issued for financial purposes, have also added fuel to the fire of mistrust. As pointed out in Mr. McGrath's paper, the past practice of indicating the investment per mile of track or per dollar of gross revenue has been unsatisfactory not only to the public but to the trained operator. The varied conditions which obtain in small and large city construction, where street improvements and varying length of haul play such an important part, make these figures of little value. We must, therefore, find some method of presenting these facts in terms simple enough to be readily understood by the average patron.

I believe that further development should be made along the lines suggested in the article and units should be prepared which will further divide the average fare so that the patron can see at a glance its various applications. For example, in the case of the Manchester Street Railway Company, of Manchester, N. H., which was cited by Mr. McGrath, the investment per passenger would be somewhat misleading, as he points out, due to the fact that this company is purchasing power and does not have any investment in a power station. We would, accordingly, expect to find its operating expenses for power charges greater than that of a company furnishing its own power.

I believe, therefore, that it is necessary to take additional steps to show the application of the total amount of the average fare received per passenger to all the

fixed and variable expenses which enter into the cost of furnishing street railway service. If this were done, in many cases patrons of the city lines would be very much surprised to find out the portion of the average 5-cent fare which goes toward paying a fair return on the investment, and that which goes for operating expenses and depreciation.

ROBERT M. FEUSTEL.

Traffic Characteristics

AMERICAN ELECTRIC RAILWAY ASSOCIATION
BUREAU OF FARE RESEARCH

NEW YORK, June 2, 1915.

To the Editors:

In the article on "Traffic Characteristics," appearing in the issue of the *ELECTRIC RAILWAY JOURNAL* of May 15, the descriptive titles of Fig. 3 and 4 (pages 927 and 928), have been transposed. Probably no confusion resulted from this, as the units of each scale are shown in the figures, but I am taking the liberty of calling the matter to your attention in this manner, in order to remove any possibility of confusion.

The method of construction of these models may be of interest.

On a sheet of cross section paper there was first laid off a horizontal line representing to scale the distance between points where traffic observations were made on a typical line.

Ordinates were next erected at each point of observation, representing to scale "total passengers" or "passengers per car" observed at that point. The plotted ordinates represent "hourly rates"; that is to say, where the total number of passengers passing a point of observation was, say 200 from 3:30 to 4:00 p. m. and 300 from 4:00 to 4:30 p. m. The ordinate erected at that point of observation would be drawn to represent 500 passengers per hour.

The next step was to connect the ends of the ordinates by a curve. The cross section paper was then pasted to a sheet of cardboard and cut along the base line and the curve connecting the tops of the ordinates. This process was repeated for each of the twenty-four hour-periods of a typical day. Values used in this work were averages determined from observations extending over a period of three days.

The twenty-four cardboard curves were next arranged in order, in notches sawed in the board which forms the basis of the model. The position of these cardboard strips is shown by the dark lines transversing the figures. Between the strips a plastic material was placed, and each of the twenty-four prisms was smoothed off to conform with the trend indicated by the adjoining prisms. The resulting surface was finally painted and varnished.

F. W. DOOLITTLE, Director.

The Nashville Railway & Light Company, Nashville, Tenn., profiting by the experience of the Knoxville Railway & Light Company, Knoxville, Tenn., is enlisting the interest of the pupils in the public schools in the safety-first work it is doing. Blotters on which there are pictures of typical accidents that are the penalties of carelessness and "hooking rides" have been distributed among the children of the schools and the teachers are having the pupils write short articles on the impressions gained from the pictures. The Knoxville Railway & Light Company provided a schedule of prizes, in the form of free-ride books, each containing tickets for fifty rides. The local company may follow the same course next season, but as the school term will soon be over no action of the kind will be taken this summer.

Equipment and Its Maintenance

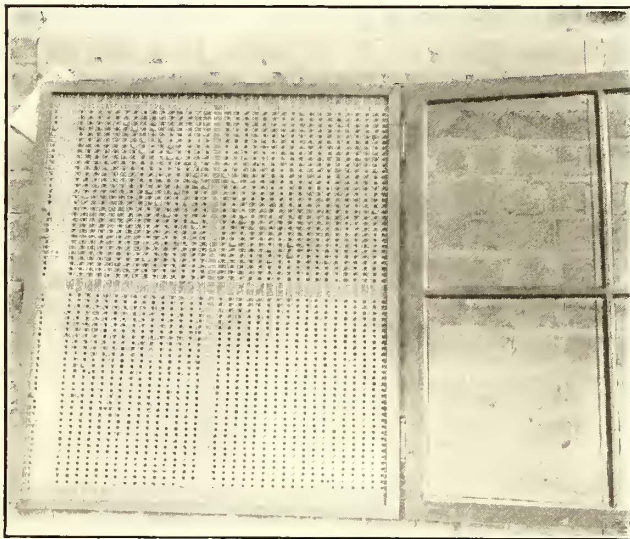
Short Descriptions of Labor, Mechanical and Electrical
Practices in Every Department of Electric Railroading

(Contributions from the Men in the Field Are Solicited and Will be Paid for at Special Rates.)

The Tri-City Railway Trouble Board

BY JOHN SUTHERLAND, MASTER MECHANIC TRI-CITY RAILWAY & LIGHT COMPANY, DAVENPORT, IA.

The trouble board has become an indispensable part of the shop records of the Tri-City Railway & Light Company, Davenport, Ia. This board is made as simple as possible, and, for the sake of accuracy, the record is kept covered with a locked glass door and no extra pegs are supplied. The essential features of this board are shown in the accompanying illustration. The records for two groups of cars appear on the board as pegs inserted in the proper vertical column to designate the date and on the same line as the car number. The upper group includes pay-as-you-enter cars and other cars in regular service, and the lower group all extra and open cars. The car numbers are recorded with chalk so that their position may be changed to show their track location. The unmarked column at the extreme left of the board is used only for extra pegs. Two columns at the extreme right of the board



TRI-CITY RAILWAY TROUBLE BOARD

are for dead cars, those out of service on account of wrecks and those being overhauled or painted. A black peg in one of these columns indicates that the car has been in a wreck, and a white peg that the car is being overhauled or painted. In the dated columns, black pegs indicate when the car was last inspected and white pegs when the car was last oiled. The oiling pegs are inserted by the oiler and inspection pegs by the shop foreman, and, in addition to the trouble board, a book record is kept.

During the winter months only white pegs appear in the lower group, since the cars in this group are used only during the summer months. All cars are oiled and inspected every fifteen days, the time being changed occasionally according to the condition of the car. A rule has been made that an interval of at least two days shall elapse between an oiling and an inspec-

tion unless the car is in bad order, which is indicated by a black and a white peg inserted in adjacent holes. The track location of the car is shown by the line on which the number is written on the board. All car-storage spaces in the shops receive consecutive numbers which correspond to the line on which the car numbers are written.

Mysterious Derailments

BY R. P. WILLIAMS, INSPECTOR OF SPECIAL WORK BROOKLYN RAPID TRANSIT SYSTEM

Determining the cause of derailments is often a difficult matter, and investigation may show many conditions of a contributory nature. Each may be removed as found and yet the real reason still remain a mystery.

A notable case of this kind occurred on one of our lines some time ago, with the introduction of a new type of truck. The cars were operated successfully over the various switches about the carhouse, there being right and left-hand switches of 50-ft., 75-ft. and 100-ft. radii. But one particular switch on the main line of 150-ft. radius, at a short line terminus, could not be negotiated without considerable trouble. In many cases the air brake had to be abandoned, the hand brake used, and the process of jumping or jerking the truck in short movements resorted to. Examination of the switch and mate showed gage and surface to be good. Travel on the main line, the straight track, being much greater than on the curve, left the mate floor high. The tangent guards, also, having a 1¼-in. groove, showed ¾ in. above the level of the head.

The tongue of the switch was of manganese steel, and straight track wear gave the top guard edge a degree of sharpness that might tend to lift a wheel. The distance between the inner edges of guards was found to be nearly the limit in width. None of these defects was so pronounced as to be considered dangerous, and as no other type of truck gave trouble, it was decided to investigate truck condition. This showed various minor conditions tending toward derailment, but not sufficient to cause it.

Beginning with the switch, every known tendency to derailment was removed by grinding until the switch was in perfect condition, but derailments still continued. The truck then received its share of attention, the builders of the truck taking a lively interest.

In one of these trials, after some new adjustment of the truck, conditions showing very little improvement, our engineer of surface lines suggested that possibly the trouble might be caused by the condition of the tangent track just ahead of the switch, the mate-side rail being low. But, inasmuch as all cars were brought to a full stop before entering the switch, the switch mate and guard rails themselves being level, this low spot, it was thought, could not have much bearing on the case. After some further adjustment of the truck without improving conditions, examination of the low spot referred to showed that it corresponded to the length of truck base. The track was leveled and derailments ceased entirely.

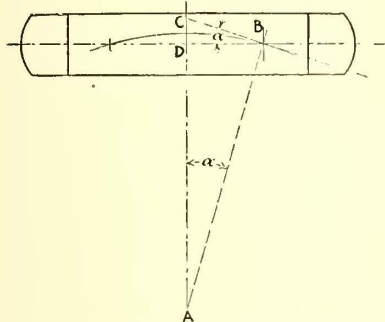
It was reasoned that, on account of this low spot, the

weight of the car was thrown on opposite side bearings, the truck entering the switch having most of its weight thrown to the mate-side wheels, correspondingly lighting the tongue-switch side and accentuating all of the defects in the truck and track.

It would be of interest to know if the leveling of the track in the first place would have been sufficient to have prevented the derailments.

Truck Angularity on Curves

A correspondent in Kansas City, Mo., calls attention to a useful short-cut method for finding the angle which a truck makes with the car body when the car is on a curve. He states that he has found the practice in many drafting rooms to be to lay out on a curve all of the



TRUCK ANGULARITY ON CURVES

lines shown in the accompanying diagram in order to find the angle *CBD*. Here *AB* is the radius of curvature and *DB* is one-half the distance between truck centers. From the diagram it is evident that triangle *CBD* is similar to triangle *BAD* and, therefore, that angle *CBD* equals angle *CAB*. These angles have

been designated by α . Now if any triangle similar to *CBD* be constructed such that the short side is proportional to one-half the distance between truck centers and the hypotenuse is, to the same scale, proportional to the radius of curvature, the desired angle can be found at once. The only drawing necessary is this one right triangle.

If a table of sines is at hand the angle can be calculated without making any diagrams by noting that

$$\text{sine } \alpha = \frac{DB}{BA}$$

That is, the angle which a truck center line makes with a car-body center line is that whose sine is one-half the distance between truck centers divided by the radius of curvature.

Paving Experiences at Joliet

BY JOHN B. TINNON, ENGINEER MAINTENANCE OF WAY CHICAGO & JOLIET ELECTRIC RAILWAY

The standard rail of the Chicago & Joliet Electric Railway for work in streets with brick pavement is 100-lb., A. R. A. "A" Illinois Steel Company section No. 10,020, although we still have a great deal of pavement with Lorain Steel Company section Nos. 60-263 and 80-335.

We have a single track on a 42-ft. street, the main business artery of Joliet, that was built and paved in the year 1906. This construction consists of Lorain No. 80-335 rail in connection with wooden ties, a concrete paving foundation of 1-3-6 mixture from the bottom of the ties up to 5½ in. below the top of the rail, a 1½-in. sand cushion and a brick paving with grout filler. Nelsonville filler and stretcher brick were used on this work, and the pavement is still in very good condition, although a count made last autumn showed that the vehicular traffic on this section is about 2000 vehicles in ten hours. If it had not been necessary on several occasions to disturb this pavement in order to repair and finally to remove all thermit joints and to put in 10-ft. sections of new rails where the joints

were cut out, the paving would have been in almost as good condition as when it was laid. In some cases the stretcher bricks are beginning to show considerable wear.

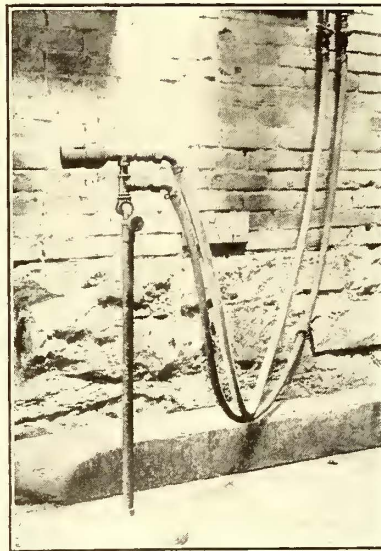
We have no 100-lb. rail that has been in use longer than 2½ years. As the paving with this rail has not commenced to show any wear at all, we cannot give any data on it; nor is any wear shown on light travel streets with overhauled 60-lb. rail where this style of pavement has been used for the last four or five years.

This company has always used brick pavement in paved streets except that some asphalt was used about fifteen years ago. Originally, and until about 1905, we used a common small paving brick for stretcher, and building brick for filler. The foundation was of concrete made from natural cement, usually placed by a contractor and not very stable. The bricks were laid on a sand cushion and filled with sand. During the coming summer we expect to remove the last of this type of pavement because the rail, which is of Lorain 60-263 section, is too light for the cars. Although this pavement is in bad condition it would last for two or three years and possibly for five years more if some general repairs were undertaken. However, as the city expects to repave the streets affected, new paving is a necessity. The street in question is one of the heavily-traveled thoroughfares of Joliet and the amount of its traffic is about 1500 vehicles in ten hours.

Commutator Soldering Torch

BY J. C. DONOVAN, MASTER MECHANIC UNION ELECTRIC COMPANY, DUBUQUE, IOWA

To preheat the commutator leads of armatures so that solder will flow in freely, a solder-melting torch has been provided in the armature repair department of the Union Electric Company, Dubuque, Ia. A



DUBUQUE RAILWAY—COMMUTATOR SOLDERING TORCH

view of this torch is shown in the accompanying illustration. The burner and mixer, which are of a standard type, are fitted with two hose connections, one to the shop compressed-air supply and the other to the shop gas supply. The flow of gas and air to the mixer is regulated by brass shut-off cocks at the point where the hose connects to the torch. Valves at the point where the hose connects to the shop gas and air systems, however, are used to admit air and gas to the burner. The

burner is pivoted horizontally and may be fixed in any position by a set screw, and an extension feature in the standard permits vertical adjustment. This is obtained by connecting the burner on a rod which fits the ¾-in. pipe standard snugly, and the set screw at the top of this pipe fastens the burner in any position. The base of the standard was made of a defective gong filled with refuse babbitt. The outfit complete with hose, brass shut-off cocks and labor cost approximately \$5.

Economical Asphalt Relaying with Hot Mixer

The way and structures department of the Milwaukee Electric Railway & Light Company is obtaining successful results in patching and relaying asphalt street pavement by the use of a portable concrete mixer and a heating plant built in one unit. While this is used primarily for bituminous mixing, it is readily convertible for concrete mixing as well.

The Milwaukee company has a large mileage of asphalt pavement which requires the usual amount of resurfacing and patching, and all of this work formerly was done by contract. The company has a large stationary asphalt plant, but for relaying and patching jobs generally distributed in all parts of the city this small portable-unit has demonstrated superior economy. The hot mixer, which is shown in the accompanying engravings, was purchased from the Koehring Machine Company of Milwaukee and has recently been used with

ten men the way department of the Milwaukee company has been able to take up and relay more than 180 sq. yd. of asphalt pavement between rails in a working day. The thickness of the paving is between 2 in. and 3 in., and the entire operating cost of the plant, including team charges but no depreciation or interest on the special investment, has been found to be about 42 cents per square yard for patch work. This includes tearing out, remixing and repaving with the old material, and adding such small amount of new material as may be required.

The procedure is to repair one track at a time and to maintain uninterrupted car operation over both tracks without blocking vehicular traffic except on one side of the street.

The gang is composed of the following men: One foreman, one man breaking up asphalt, five men preparing concrete sub-base and wheeling remixed asphalt, one man feeding charges to the mixer, one man painting paving stones with hot asphalt and applying cement



MILWAUKEE PAVING—LOADING OLD ASPHALT INTO HOT MIXER



MILWAUKEE PAVING—DISCHARGING HOT REMIXED ASPHALT

success on three jobs totaling about 3 miles of double track.

The machine is a combination heating plant and mixer designed for bituminous concrete road mixtures and for sheet asphalt, rock asphalt and cement concrete work. The capacity is a 22-cu.-ft. batch. The general design is such that the machine will pass under all overhead structures, and it is of narrow construction so that it may stand beside the curb and yet leave space for cars to pass on the near track while men are working between the track and the mixer. The machine is not special, except that for general use such plants are driven by gasoline or steam engines while this plant is driven by a 15-hp., 550-volt, 550-r.p.m. G. E. motor fed from the trolley. This motor serves to operate the entire mixer, with its mechanical charger and hot-blast apparatus, and also, through a set of transmission gears, it serves to propel the mixer at either of two speeds in either direction. For long moves, such as from one part of town to another, the outfit is drawn by a utility car or horses, but for progressing along a job the self-propelling feature is employed.

By disconnecting the blower and asphalt tank and connecting the water-measuring tank, the hot mixer may be used as an ordinary concrete mixer.

With this portable mixing plant and a gang of fif-

teen men the way department of the Milwaukee company has been able to take up and relay more than 180 sq. yd. of asphalt pavement between rails in a working day. The thickness of the paving is between 2 in. and 3 in., and the entire operating cost of the plant, including team charges but no depreciation or interest on the special investment, has been found to be about 42 cents per square yard for patch work. This includes tearing out, remixing and repaving with the old material, and adding such small amount of new material as may be required.

The procedure is to repair one track at a time and to maintain uninterrupted car operation over both tracks without blocking vehicular traffic except on one side of the street. The gang is composed of the following men: One foreman, one man breaking up asphalt, five men preparing concrete sub-base and wheeling remixed asphalt, one man feeding charges to the mixer, one man painting paving stones with hot asphalt and applying cement

to surface of finished pavement, one man running the mixer, three men raking, smoothing and tamping, and one night watchman, and one teamster. In addition to ripping up the old asphalt and relaying the pavement, this gang also keeps the street in safe operating condition. A two-horse general-utility team also is a part of this outfit. On the job recently completed, a part of the work consisted in relaying the asphalt between the granite gage blocks on a busy double-track line. The procedure of the work from front to rear is as follows: The old asphalt surface is first picked up and broken into pieces about 6-in. square, the smaller sizes being more readily melted. The mixer is charged with approximately 8 cu. ft. of this old material and new asphalt in varying amounts, usually about 10 lb. per charge, is added in accordance with the character of the old mix. About nine minutes' time is required for melting and mixing a charge. During the first six minutes the maximum hot blast is applied, the temperature being reduced for the last three minutes. The blast is furnished by a blower driven by the main motor. This blower operates in connection with two crude-oil burners, the flame from which is distributed in such a way that only the hot-air blast, and no flame, strike the mix, thus preventing burning. The construction of the mixer

is such that the material is continually raised in large buckets inside the drum, and cascaded from top of the drum down through the incoming hot blast to the reversed discharge chute, which spouts it to the farther side of the drum. Thus all material is subjected to repeated hot-blast baths, and the material itself aids in maintaining high temperature in the remotest sections of the drum. The oil consumption is about 50 gal. per day. Crude oil is purchased in tank cars and delivered to the job in a steel tank which holds 310 gal.

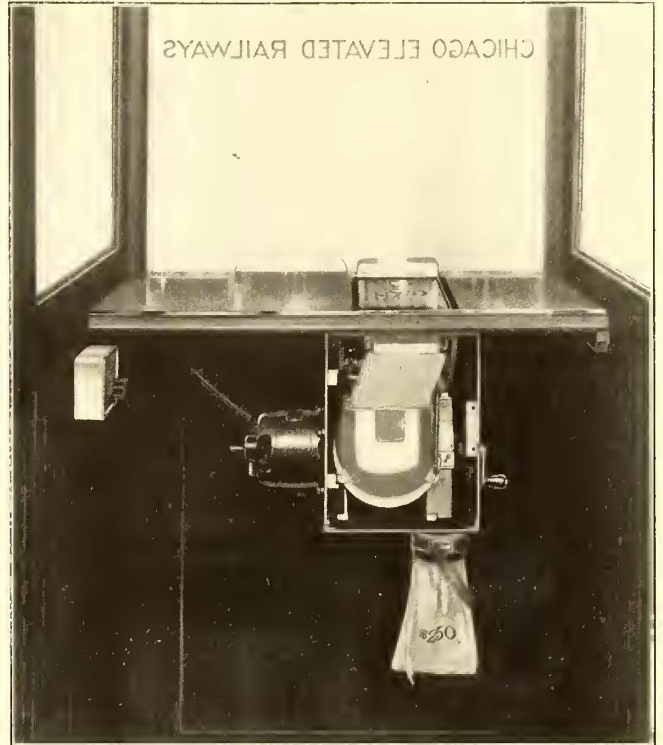
After a mix has been heated it is discharged into two-wheel Sterling concrete carts and immediately dumped in the track. Then the asphalt is raked, tamped and smoothed in the usual manner. Finally a surface is given it by rolling with a hand roller loaded with water.

Representatives of the railway company state that the quality and speed of work performed with this hot-mixing outfit will improve with experience in its operation and that they are now satisfied that the unit costs, particularly for pickup and patch work, are considerably lower than those which usually obtain for similar work executed under old methods or under contract.

New Form of Cash and Ticket Fare Box

For some time inventors have been at work on the design of a registering fare box to handle tickets as well as coins. Otherwise, some other kind of fare register has to be used to register the tickets, a method more or less unsatisfactory when there is a large percentage of ticket fares, partly because it necessitates a division of fares handled by the conductor and partly because the fares cannot be handled fast enough under heavy traffic conditions.

Several makes of fare boxes are now being put on the market adapted to receive and register in a single device both cash and ticket fares. The coins and tickets are separated automatically, the cash being registered and computed in dollars and cents, as in the ordinary fare box, and the tickets are counted, cancelled and delivered into a separate locked compartment of the box. One of the latest types of combination cash and ticket



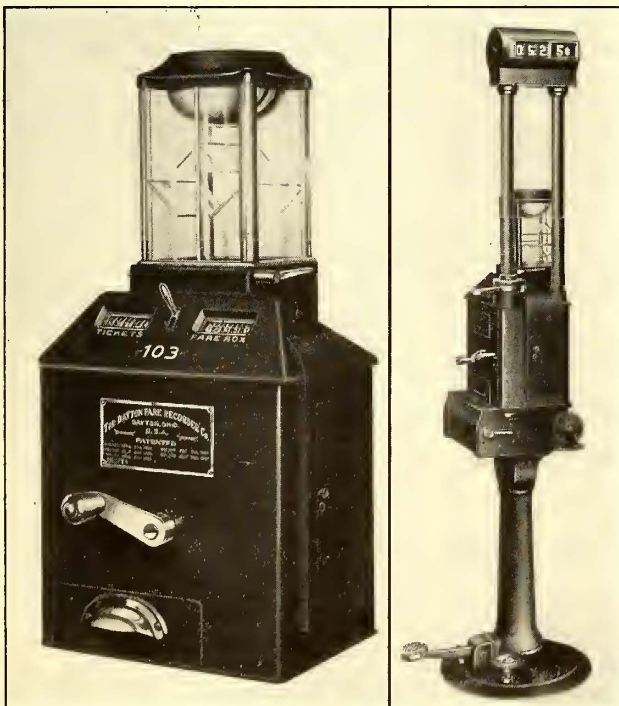
RECORDING FARE BOX WITH TRAVELING BELT ESPECIALLY DESIGNED FOR STATIONS

fare boxes is manufactured by the Dayton Fare Recorder Company of Dayton, Ohio, a description of which follows:

The general appearance of the combination fare box is about the same as the cash fare box of the manufacturer that has been on the market for some years, the size and weight of the two boxes being practically the same. A view is shown in the first engraving. Cash fares and ticket fares are deposited in the same receiving box by the passengers, where they are examined by the conductor. When the handle at the front of the box is turned, the coins are separated from the tickets, and the total amount of money is computed in dollars and cents. The coins, after they are registered, pass into a money till, where they are immediately available for use by the conductor.

At the same time the ticket fares, as they are separated from the cash fares, are cancelled and delivered into the ticket box, from which they are removed at the end of the run or at the end of the day by an authorized employee of the company. The tickets are counted by means of a separate register contained in the fare box, the registrations being made by a small lever, which is pressed as each ticket is deposited in the fare box. A register bell is used to indicate the completion of each registration. An additional counter is provided when a register for transfers and other fares is desired.

In one type of the combination cash and ticket fare box a visual trip register and fare indicator are used to give greater prominence to the classification of fares as they are registered. The second illustration shows a combination fare box-register of this type, mounted on a rotatable base, adapted to change the position of the machine to suit the direction of travel of the car. The type of machine shown in the illustration is designed for use on center-entrance cars, and is provided with a two-way fare indicator, which shows the indications as fares are registered on both sides of the device so that the indications can be seen from all parts of the car. The machine is shown fitted with treadle mechanism for foot operation, but it may be operated by hand



CASH AND TICKET FARE-BOX, MANUALLY OPERATED, AND ON ROTATABL BASE WITH MOTOR DRIVE

as well. Various modifications of the combination fare box-registers are made to suit the variable local conditions of street railway operation. The machine illustrated in this second view is shown fitted with an electric motor, which is also one of the more recent improvements applied to the operation of fare boxes. All the different types of fare boxes may be fitted with small motors of, say, 1/25 hp for electrical operation, the current being supplied direct from the trolley circuit. Except under conditions where the traffic is exceedingly heavy, however, it is entirely practicable to operate these fare boxes either manually by hand or with a foot treadle.

Still another type of fare box manufactured by the Dayton company is shown in the third engraving. This device consists of the regular cash fare-box fitted with a special traveling belt, upon which the coins fall as they are paid by the passengers, and are then carried on the belt in full view a sufficient interval of time to enable the attendant thoroughly to inspect them before they pass within the fare box to be registered. This type of device is especially adaptable for elevated, subway and suburban railway stations, and its greatest value consists in the rapidity and accuracy with which the fares may be handled during heavy rush hour traffic. The device is fitted with a motor for electrical operation, but provision is also made for manual operation if that should be preferred. This variety of machines shows that manufacturers of fare register equipments are now able to furnish suitable fare boxes for every condition of operation where fare boxes are at all adaptable for use.

New Trolley Base and Headlight

The Trolley Supply Company, Canton, Ohio, has just placed upon the market two items of electric railway car equipment that possess a number of unique features. One of them is a roller-bearing trolley base which has been designed as a result of long experience in the manufacture of this type of equipment and it has the advantage of roller bearings on the side as well as around the center swivel pin. The roller bearings and their bushings are made of specially-treated, hardened steel, and they make the up and down as well as the sidewise motion as nearly frictionless as possible.

The tension bar is of solid steel, 1 1/4 in. in diameter. It is so placed that it takes up all the springs at the same time and thus prevents the possibility of adjustments that are not made evenly. One of the best features of the trolley base is that the tension increases as the



HEADLIGHT OF UNUSUAL LIGHTNESS

pole rises and the further the pole is pulled the less tension there is against the wire. This insures safety at railroad crossings. In general, the new base contains a minimum number of parts, and owing to its flexibility, it permits an unusually large mileage to be obtained from the trolley wheels. The height of the base is 5 1/2 in. and the weight is 100 lb.

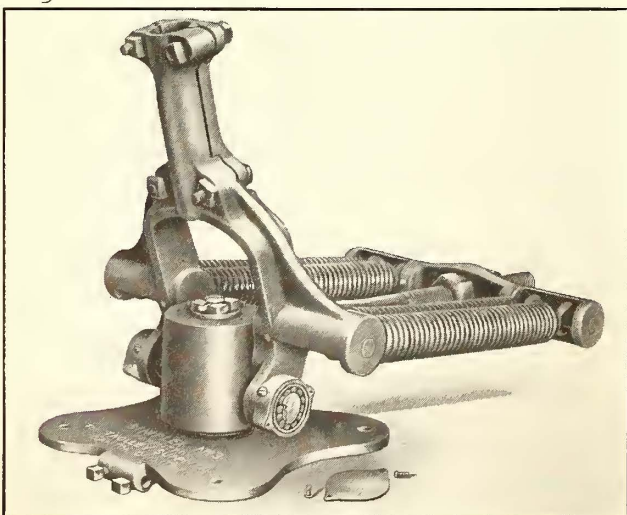
The new headlight that has been brought out by the same company is in line with the modern tendency to decrease weight in car equipment wherever possible. It is reported to be the lightest headlight ever designed, weighing but 7 lb. complete. However, strength and efficiency have not been sacrificed to attain this end, for the casing is constructed of No. 8 gage steel throughout, the front door being carried on an extra strong frame that is riveted in place. The head light is equipped with a triple-nickel-plated, polished brass reflector of special parabolic design which centralizes the rays of a concentrated-filament mazda bulb, throwing a strong beam of light far ahead of the car. The casing is absolutely dust and water proof, the front glass being fitted into a deep recess and the space between the glass and the door frame being tightly sealed with a special felt pad which serves also as an effective shock absorber.

This arrangement, although it renders the glass waterproof, provides for expansion and contraction. The front glass is 8 3/8 in. in diameter, and the headlight can be supplied with either a 23-watt or a 36-watt bulb as desired. The overall diameter is 11 1/2 in. and the depth from front to back is 6 in.

Spanish Bus Line Unsuccessful

The 37-mile motor-bus line between Huelva and Ayamonte, Spain, has been discontinued, after one year's service, owing to insufficient patronage. French cars were used, with a seating capacity of twelve passengers each.

A great obstacle to successful operation was the extremely bad state of the road. The line, in addition to serving the terminal towns, passed through Gibraleon, Cartaya and Lepe. It is understood that a line using Spanish cars is in operation between Cadiz, Medina Sidonia and Alcala de los Gazules, a total distance of about 35 miles.



ROLLER BEARING TROLLEY BASE

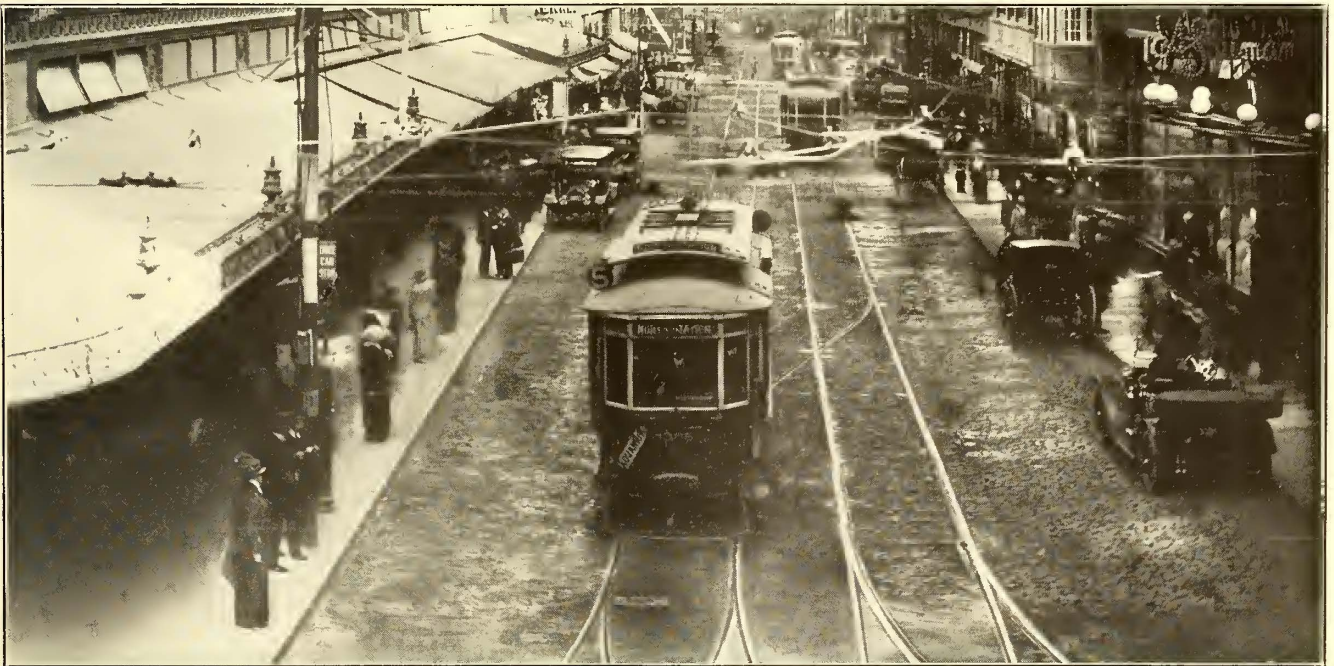
Non-Splashing Electric Track Switch

The savings in time and labor that are effected by electric operation of track switches in urban service are of such importance that the practice has become more or less general, notwithstanding certain mechanical disadvantages which have heretofore existed. Most prominent, perhaps, among the unfortunate features of the solenoid-controlled switch have been the splashing of muddy water when the switch point is shifted, giving rise to serious objections on the part of pedestrians, and, in addition, where no means for locking the switch-point in position is provided, there is always the possibility of derailment due to movement of the switch between the trucks of a passing car.

These two difficulties have been absolutely eliminated in the improved electric track switch that was developed during the past year by the Collins Switch & Signal Company, and was shown for the first time at the

If the trolley wheel passes under the starting contactor with motor current on in the car, current will be fed from the trolley wire through a low-resistance relay in the relay box and thence to the car because the contact strip is insulated from the trolley wire and the car is supplied with power only through the relay when the trolley wheel rides on the contact strip the relay being connected to the trolley wire through a contact finger in the stopping contactor.

As soon as this relay is energized, its armature moves up and in so doing makes up a contact which sends current through a high-resistance relay whose armature moves slightly upward, resting under the armature of the low-resistance relay, holding it up. Both of these armatures remain up, as a stick circuit is fed through the high-resistance relay as soon as the armature of either relay reaches its top position. Should the trolley wheel stand on this contactor for an indefinite period, it would not burn out anything, for the circuits are



NON-SPLASHING TRACK SWITCH—INSTALLATION AT SUMMER AND WASHINGTON STREETS, BOSTON

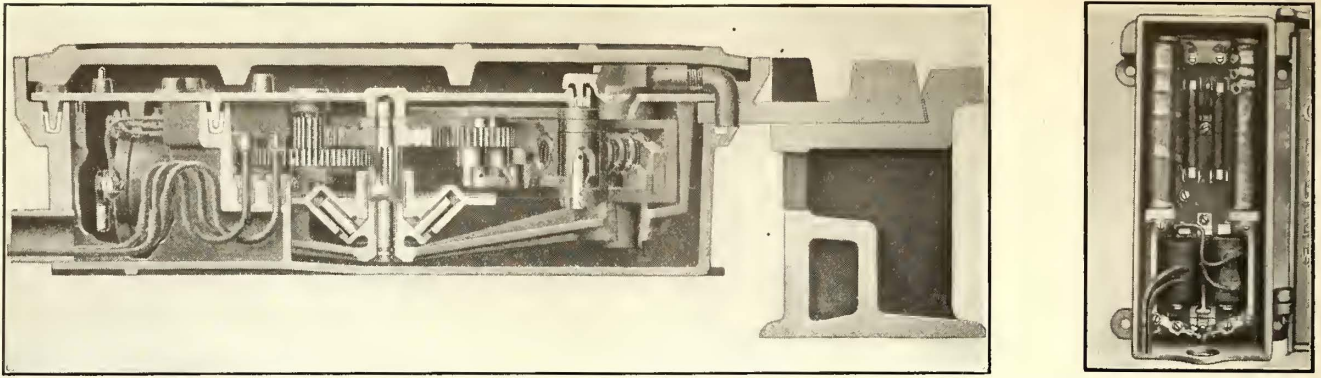
Atlantic City Convention last fall. The device is now being placed on the market by the manufacturers, the United States Electric Signal Company, West Newton, Mass. The results of service tests on ten electric railways during the past winter have proved to be most satisfactory in every respect. The changes that have been shown by the tests to be desirable are practically negligible notwithstanding that the new switch constitutes a radical departure from previous designs, the only point of similarity being the use of motor current to throw the switch in one direction and by the non-use of motor current to throw it in the opposite direction as the trolley wheel passes under a contactor in advance of the switch point.

The starting contactor has two contacts and is mounted on the trolley wire approximately 60 ft. ahead of the switch point. A stopping contactor is mounted in advance of the frog and it is located at a point such that the last wheel of the car must be on or beyond the switch point before the trolley wheel reaches the stopping contactor. A box containing the resistance and the relays is mounted on the trolley pole most convenient to the switch point and a conduit runs from this under the pavement to the street box.

made up only momentarily and as soon as the relays act the circuits are made up elsewhere.

This stick circuit, which holds up the armature of the relays passes on through resistance to ground and a 110-volt tap is taken off of this resistance to run to a motor in the street box. The current to the armature of the motor is always fed in the same direction. The current to the fields of the motor, however, is fed first in one direction or the other, depending on which relay armature is uppermost. If the armature of the low-resistance relay is uppermost, the motor revolves in such a direction as to throw the switch for the curve. The motor is connected to the switch point through a chain of gears and a shaft which passes through an inner cover and is made water tight by means of a mercury seal. As the motor is geared it causes the switch point to move slowly.

As soon as the switch point has finished its stroke, the gears cause a clover-leaf-shaped cam to revolve, rubbing a roller and compressing a rigid spring. At a certain point in the revolution of the clover-leaf cam the spring takes the load off the motor and speeds up the gears, causing the pins of a simple clutch to fly up by centrifugal force. This disconnects the motor



NON-SPLASHING TRACK SWITCH—INTERIOR VIEW OF STREET BOX; RELAY AND RESISTANCE BOX

from the gears and it remains disconnected so long as the motor runs. The disconnection is made so that the switch point can be thrown by the switch iron at all times, whether the motor is running or not. The same spring, which is a very positive one, acts as an anti-straddling device and holds the switch point rigidly in the position into which it is thrown.

As the trolley wheel leaves the starting contactor the motor is left running, and should a second car pass this contactor before the last wheel of the first car reaches the switch point, there will be no effect on the mechanism, for the circuits are already made up and the relay armatures are locked. Therefore, the motor could not be reversed to throw the switch between the trucks of the first car.

After the wheels of the car have all passed the switch point, the trolley wheel strikes the stopping contactor and raises for an instant a small lever. This temporarily opens the circuit that is feeding the motor and relays and allows the armatures of the relays to drop. As the circuit in the relay box is permanently opened when the relays drop, the opening of the circuit at the stopping contactor needs only to be temporary, and, although the contact is closed at the stopping contactor as the trolley wheel leaves it, there will be no complete circuit. The motor, therefore, will stop and the mechanism will be ready to operate again.

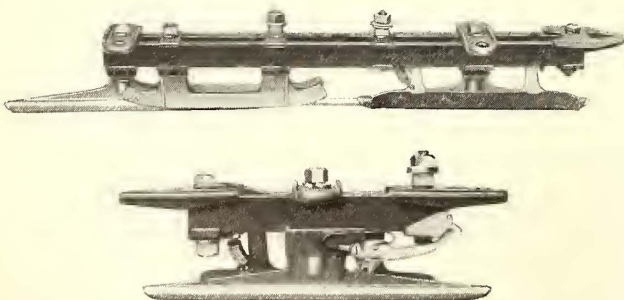
If a car approaches the starting contactor with the motor current off, there will be no action, as the trolley wheel crosses the first contact strip because only the low-resistance relay is connected to this first strip and this is so adjusted that the current consumed by the heaters, lights and compressor is not sufficient to lift its armature. As the trolley wheel reaches the second contact strip of the starting contactor, a circuit will be completed through the high-resistance relay and through a resistance to ground. This will complete the stick-circuit with the high-resistance relay armature above the other armature. The circuit will then be fed in the opposite direction through the motor fields and cause the motor to revolve in the opposite

direction, throwing the switch for the straight track.

The starting contactor is very simply mounted on standard cars without taking up any slack in the trolley wire. It is only about one-third the size of any previous contactor used on electric track switches. The stopping contactor is about one-half the size of the starting contactor, and is mounted on a standard car. The relay and resistance box is also small. It is provided with a cut-out switch for deadening all the connections in the box. The main street box, of course, is the most interesting part of the device. It is 2 ft. x 1 ft. x 7 in. in dimensions and provided with a loose-fitting street cover to take the street traffic. There is an inner cover which has a flange running all the way around it and this flange sets into a ditch cast in the box.

The ditch is partially filled with mercury, so that by setting this cover in place the box is automatically sealed and made water-tight without depending upon workmen to make up any pipe joints or gaskets. The shaft which comes through this inner cover and which is connected to the switch point is also protected by a mercury seal. The wires running through the pipe under the street are brought to a hand hole and are here connected to wires running through stuffing boxes into the mechanism box so that if the workmen should fail to make the pipe water-tight still no water could get into the box. These wires coming up through the stuffing boxes have exposed ends which connect with spring contacts. The spring contacts, as well as the entire mechanism, are mounted on the inner cover so that the inner cover with all the mechanism can be picked up and another one slipped in its place just as one would replace a fuse, this being done without any pipe or wire disconnections. This is most advantageous, as it eliminates working in the street and dodging back and forth between cars when any repairs are to be made. The fact that only 110 volts are sent into this box instead of the full 550 volts previously used with street boxes is a most important one, for it largely eliminates the liability of electrical troubles due to moisture.

Summarized, the most important new features of this device are as follows: It does not splash mud and water; the switch cannot be thrown between the trucks of a car by a following movement under the contactor; the street box is automatically sealed without dependence on the proper making up of pipe joints or gaskets; a most positive anti-straddling device is provided; only 110 volts is sent into the street box; the entire mechanism can be lifted out of the street box without making any disconnections; the contactors are exceedingly small and simply mounted on standard cars; standing under the contactor for an indefinite period has no damaging effect on any part of the mechanism.



NON-SPLASHING TRACK SWITCH—STARTING AND STOPPING CONTACTORS

LONDON LETTER

The Subjects Discussed Are Largely Those Growing Out of Conditions Imposed by the War

(From Our Regular Correspondent)

Owing to the increased cost of living due to the war, a spirit of unrest seems to have overtaken industrial workers in Great Britain. The tramways and electric railways, whether owned by municipalities or companies, have not escaped this general discontent.

The threatened strike of engineers and mechanical workers on the London electric railways has been averted by the decision of the companies to grant the demands of the men. The four companies affected, the District Railway, the London Electric Railway, the Central London Railway and the City & South London Railway, have agreed to withdraw the existing war bonus of 2s. a week to the trades affected, and to make instead a permanent increase of 3s. a week. The increases were obtained as the result of a joint trade movement, the principal unions affected being the Amalgamated Society of Engineers and the Electrical Trades Union.

Unfortunately the London County Council does not appear to have been able to meet the views of its employees and London is therefore suffering a strike involving about 7000 tramwaymen. For the last few days no cars have been run except a few in the vicinity of Woolwich, which carry workmen engaged in the manufacture of munitions of war. The men claim that 5000 tramwaymen have gone to the war and that for months past the remainder have had to make up for the deficiency in drivers and conductors by working as much as fifteen hours a day. They demand shorter hours, a war bonus of 15 per cent to meet the extra cost of living, the abolition of certain penalties for lost mileage, etc. The strike fever has also extended to the employees of the Metropolitan Electric Tramways, Ltd., so that London for a day or two past has been tramless except in a few cases. At its regular meeting the London County Council confirmed the offer of the chairman of the highways committee of early arbitration if the men would resume work immediately.

The threatened strike of the Newcastle tramwaymen has been averted. Last month the Board of Trade was asked to intervene and Sir George Askwith has delivered his award as arbitrator. He gives 2s. 6d. per week extra to employees who are householders; 1s. 6d. to employees who are single men; and 1s. to employees who are eighteen years of age or under. This is less than the men demanded originally.

The Salford tramways committee, which faced a strike, has agreed to accept the suggestion of the men that the subject of an advance in wages to meet the increased cost of living due to the war should be referred to arbitration. The original demand of the men was for a 15 per cent advance in wages. The tramways committee offered a bonus of 2s. a week on wages less than 28s. The threatened strike has thus been averted, but there is still resentment against the action of the committee in employing women as conductors on the tramcars.

The British Electric Traction Company, which operates many tramways, especially in the Midlands, is also threatened with strikes in the South Staffordshire area. The men there are asking for an increase of a halfpenny an hour in wages and are protesting against the employment of women. No definite action, however, has yet taken place.

At a recent meeting of the Plymouth Corporation Tramways committee it was reported that an agreement had been entered into with the Devonport & District Tramways for the sale by the company to the Corporation of the company's undertaking on Tramway Act terms. Under the agreement, it was stated, the company would transfer its lines to the Corporation on Oct. 2, 1915. The price to be paid for the property is to be fixed by arbitration, the payment of the purchase money to be made within a month of the Corporation obtaining the necessary borrowing powers.

An appeal has been issued for electrical engineers and others with technical knowledge of electrical matters to give spare time to an emergency service which is being organized to maintain the efficiency of the electric lighting, power, and tramway stations. Only men ineligible for military service are asked for, and they are required to make up the

shortage of labor which at present exists in many electricity works in consequence of the war. Many switchboard attendants and other workers have enlisted or were called back to the reserve at the outbreak of hostilities, and this has left some of the stations with no margin for emergency and illness. Moreover, many young men are unable to join the colors because they cannot obtain immediate substitutes. Volunteers will be required to work four hours a day or four hours midnight service on alternate nights. They will be remunerated in accordance with the existing rates at the works at which they are to be employed.

The consulting electrical engineer of the Bristol Corporation, the city valuer, the city engineer and the city electrical engineer, have been instructed to value that portion of the Bristol Tramways which is purchasable by the town under Sec. 22 of the Tramways Act. The purchasable part includes 25 route miles out of a total of 31 route miles, and includes also the St. George and the Counterslip power stations and the depots of the company. It is reported that the general valuation amounts to £610,981, based on the present prices of material.

Cardiff tramwaymen have passed a resolution protesting against the employment of women as car conductors, and warning the Corporation that if it persists in the policy of hiring women the men will not work with the new members of the staff.

The highways committee of the London County Council reports that the number of fatal accidents caused by the working of the electric tramways in 1914 was twenty-five, as compared with thirty-seven in 1913. The proportion was one to every 21,391,734 passengers carried, as against one to every 13,802,000 in the previous year. The improvement is regarded as especially encouraging in view of the traffic conditions that arose on account of the war. The life-guard on the cars was brought into operation in seventy-four cases, and in not a single instance did it fail to act. The total traffic receipts from the tramways for the year ended March 31, 1915, were £2,323,053 from lines worked by electric traction, and £10,261 from lines worked by horse traction, or a grand total of £2,333,314. The receipts for the previous year under the same heads were £2,181,344, £21,146 and £2,202,490 respectively. The Council is recommended not to apply, at present, for powers to run trail cars north of the Thames, the Commissioner of Police having pointed out that in present circumstances it is not likely that the Council could secure delivery of the necessary additional cars from the manufacturers for some time to come.

As announced in the *ELECTRIC RAILWAY JOURNAL* of May 22, the Right Hon. Sir Edgar Speyer, chairman of the Underground Electric Railways, Ltd., London, has resigned his seat on the board. The directors have since appointed the Right Hon. Lord George Hamilton, the deputy chairman, to act as chairman of the company.

The companies under the control of the Underground Electric Railways, London, propose to deposit a bill in Parliament giving them power to bring the companies of the group into still closer association as regards their working and finances. The most important part of the scheme is the provision for payment into a common fund of the whole or part of the balances of the revenues of all the companies for each half-year after providing for interest on debentures, guaranteed stocks, preference shares or stocks (other than the second preference stock of the Metropolitan District Railway), depreciation, and reserve, and any other payments which may be specially provided for in the agreement. Another clause provides that the common fund may be used to make up any insufficiency in the net revenue of any of the companies to meet fixed and other charges.

For the last two months experiments have been in progress at certain tube stations where escalators are not in use with the object of evolving a means of saving passengers' time in getting from the trains out into the street. A new lift system has now been introduced at three important tube stations, Picadilly Circus, Euston and Great Central. These new lifts are electrically controlled, and carry no liftman, the gates opening and closing and the lift starting automatically. Men are stationed at the top and bottom of the lift to direct passengers. Similar lifts will be introduced at several other important centers in the near future.

A. C. S.

News of Electric Railways

NEW YORK'S PUBLIC SERVICE COMMISSIONS

Divergent Views Regarding Regulation Expressed Before Constitutional Convention

The proposal of Senator Foley to the Constitutional Convention of New York for an amendment making public service commissioners bi-partisan, constitutional officers, removable only by the Senate was attacked at a hearing on May 12 by Frank W. Stevens, former chairman of the Public Service Commission for the Second District of New York. Mr. Stevens said that bi-partisanship assumed that the Democrats were going to do something iniquitous and that they needed watching by the Republicans, or vice versa. Mr. Stevens also objected to the provision to give the Senate the right to confirm the appointment of public service commissioners. He did not believe that the qualifications of the commissioners were improved because the men nominated for appointment were approved by the Senate. It was his idea that public opinion should be brought up to a point where it would be difficult to put into the office of public service commissioner a man not fully qualified to do the work. He did not take kindly to the suggestion of making Supreme Court justices members of the public service commission. In this connection he said that a public service commissioner must often ignore precedent and not be afraid to reverse himself. This was opposed to the attitude of the judiciary on most questions.

On May 19 William R. Willcox, formerly chairman of the commission for the first district, advocated making commissioners constitutional officers removable only by the Legislature or the Senate, on recommendation of the Governor. He also suggested that the term of office of the commissioners be made ten years instead of five as at present. He favored commissions of five members, but said they should be bi-partisan. He rejected the suggestion that the commission for New York City should be selected by the Mayor. He also opposed the transfer of subway construction from the commission to the Board of Estimate. There should be no review of commission orders by the courts except as to questions of law. The power of the commissions to regulate the issue of stocks and bonds should not be curtailed. John N. Carlisle, former member of the commission for the second district, also urged constitutional protection for the members of the commissions.

Seymour Van Santvoord, chairman of the commission for the second district on May 26 advocated that the public service commissions be made constitutional bodies and that the office be surrounded with all the safeguards afforded justices of the Supreme Court. There was no department of the state government in which personal integrity and moral courage were so necessary as in the public service commissions. The terms of office of the commissioners, their powers and duties, their method of removal, and perhaps their salaries should be fixed in the constitution. The salaries should be large enough and the office so secure and honorable that no member could be tempted to act otherwise than in the public interest. Mr. Van Santvoord opposed the inclusion of the bi-partisan idea in the statute. This automatically injected politics into the commission. Mr. Van Santvoord expressed himself in favor of a court review of the commission's decisions and in favor of the removal from the Legislature of the power to regulate rates by enactment. Corporations and individuals should feel that they do not have to "tend their fences" in the Legislature in order to secure justice in the matter of rates. Chairman Van Santvoord's views were generally concurred in by Edward E. McCall, chairman of the first district commission, and by Martin S. Decker, who has just finished his second term as a member of the up-state board.

On the other hand an amendment to the constitution that would abolish the present two public service commissions, and replace them by two public utilities commissions, with the same powers but a different status, has been recommended to the Constitutional Convention by W. M. K. Olcott. Mr. Olcott would leave intact the organiza-

tions built up by the present commissions, and would pass them over with all the records and unfinished business of the commissions to the two new public utility commissions he would create. These would have the same jurisdiction, scope and authority as the present commissions, and the new commissioners, like the existing ones, would be appointed for five years at \$15,000 a year. Mr. Olcott's board would be a bi-partisan one.

MEXICO TRAMWAYS A WAR VICTIM

How the Mexican Reign of Terror Has Affected the Mexico City Utilities

The directors of the Mexico Tramways have issued a circular to the bond and shareholders of that undertaking, together with those of the subsidiary concerns in which it is interested—namely, the Mexican Light & Power Company, the Mexican Electric Light Company and the Pachuca Light & Power Company. According to the London *Financial Times* the condition disclosed is serious in the extreme. The control of the tramways has been taken out of the directors' hands, and the board sets forth the events which have led up to the present position. First of all, however, the directors emphasize the fact that the existing situation has not arisen from any financial weakness on the part of the companies affected, all of which have been prosperous from inception, and but for successive political crises should still be earning their bond interest and satisfactory dividends.

The frequent changes of administrative control of the country have each been accompanied by large issues of paper money, with the result that the exchange rate of the peso is now not more than 5d., as against the normal rate of 25d. As further emissions of paper money are expected, it is anticipated that exchange will continue to decline. Unfortunately the company was obliged to accept this paper currency for fares, with the result that a large proportion of its gross receipts was useless for buying exchange on London and Toronto for the purpose of paying coupons or purchasing materials for maintenance and current operations. Matters appear to have come to a crisis in October last, for the circular states that, after the capture of the city of Mexico by General Carranza some eight months ago, labor unions were formed by the employees of the tramways company, and the following demands made upon the management: An increase of 25 per cent in wages; recognition of the unions; an agreement that all changes in employees must be approved by the unions; various operating conditions which would have had the effect of subjecting the company to the control of the unions. The company was given only forty-eight hours in which to accede to these demands, and as the conditions would obviously have ruined the business a refusal was returned to the men; thereupon a strike was immediately proclaimed and the operation of the tramways ceased in consequence. The company maintains that it could have found plenty of independent employees to operate the cars had it been provided with protection, but this could not be obtained.

After a few days the authorities took over the operation of the system themselves, on the ground that the service must be maintained for the convenience of the public. They then doubled the salaries of many of the staff employed by the month, and gave to the remainder of the employees a 25 per cent increase in wages. The tramways have since been in the hands of and operated by officials appointed by the leaders temporarily in power. As a result of this procedure operating costs rose speedily, while the character of the service and the condition of the equipment deteriorated rapidly, the new officials having had no experience in tramway operation or the handling of men. In addition, the maintenance of the cars was badly neglected, so that a very considerable proportion of the rolling stock is now laid up awaiting repair. For a short time the receipts were paid to the company's bankers, but subsequently the authorities directed that the earnings should be paid to the Government treasury. It is now practically impossible to communicate

with the company's officials in Mexico, but the latest information states that when Carranza's representative was recently driven from the city of Mexico by Zapata he took with him the controllers of the cars, thereby rendering them unfit for service, and all traffic has, consequently ceased.

So far the authorities have not taken over control of the business of the Mexican Light & Power Company, the Mexican Electric Light Company and the Pachuca Light & Power Company, and the property of these undertakings has, therefore, been very little injured. The employees have, however, had to be given higher wages, while, as receipts are to a large extent in paper, there remains no available surplus after providing for the maintenance which is absolutely necessary to keep the plant in operation. The board is conferring with the trustees for the bondholders as to what further steps should be taken to protect the bondholders' interests, but the members feel that the future of the enterprises they control must necessarily depend upon the development of political conditions in Mexico and the attitude of the United States towards that country.

CHICAGO WORKING AGREEMENT TO BE ARBITRATED

Refusal to grant the employees of the Chicago (Ill.) Surface Lines an increase in wages has closed the first stage of the negotiations. This was followed by a poll in which 96 per cent of the employees voted to support their leaders in obtaining a satisfactory wage and working agreement. Although this was essentially a strike vote the possibilities of such a move are considered remote, because both the employees and the company have expressed themselves as ready to accept arbitration.

Similar steps have been taken by the employees of the elevated railroads. A delegation met President Britton I. Budd, who offered to renew the old contract despite diminished income and voluntarily agreed to make concessions with respect to working conditions. In view of the decreased patronage and the general business depression, however, Mr. Budd refused to consider an increase in wages at this time. The result of this conference has been submitted to the employees and they also have voted on the matter. Arbitration will be employed to reach a final agreement.

PROPOSED RESERVE CORPS OF ENGINEERS

Early in the present year an informal conference was held in New York at which the establishment of a volunteer reserve corps of engineers for the United States Army, representing all branches of the engineering profession, was discussed. The following five national engineering societies were represented: American Institute of Consulting Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Society of Civil Engineers, and the American Institute of Electrical Engineers.

The matter was considered at the meeting of the board of directors of the A. I. E. E., held on Feb. 19, and resolutions were adopted at that time to the effect that the board was in hearty sympathy with the proposed movement, and with a view to giving enthusiastic support and cooperation in any plan or method of procedure proposed by the war department, President Paul M. Lincoln was authorized to appoint a committee to represent the institute in connection therewith. In accordance with this action, President Lincoln has appointed the following committee: Bion J. Arnold, chairman, Chicago, Ill., John Harisberger, Seattle, Wash., Ralph D. Mershon, New York, A. M. Schoen, Atlanta, Ga., and Charles W. Stone, Schenectady, N. Y.

The other national engineering societies named previously have also appointed committees with the following chairmen: A. I. C. E., Ralph D. Mershon, New York; A. S. M. E., Maj. William H. Wiley, New York; A. I. M. E., Dr. Henry S. Drinker, South Bethlehem, Pa.; A. S. C. E., William Barclay Parsons, New York.

These various committees will, it is understood, form a joint committee representing the entire engineering profession, to co-operate with the war department, which is now giving careful study to the matter with a view to formulating a comprehensive plan of a permanent nature, whereby the services of the members of the profession, who so desire, will be available if needed.

THE CLEVELAND CARHOUSE CONTRACT

The committee on street railways of the City Council of Cleveland, Ohio, spent May 20, 21 and 24 hearing the evidence on the charge of favoritism in making contracts by the Cleveland Railway Company and the alleged connivance of Peter Witt, street railway commissioner, in the matter. This charge, made by Roderick D. Grant, a contractor, was filed in writing with the City Council on May 10 by Councilman Fitzgerald. On the third day the Cleveland Railway submitted a tabulation of all the building contracts that have been made during the last four years. This showed that every contract had been awarded to the lowest bidder. The committee expects to have its report ready for submission to Council at the next regular meeting. In commenting on the case Councilman Reynolds expressed the opinion that the whole matter was the outcome of competition between contractors and the natural bitterness that a defeated contractor might entertain.

On May 25 the Council approved an additional allowance of one-half of 1 cent per car mile to cover the increase of 2 cents per hour in the wages of motormen and conductors which was agreed upon some time ago. This will amount to about \$150,000 a year.

The company received a franchise for a line on West Thirty-fifth Street from the West Twenty-fifth Street line to the city limits.

TOLEDO FRANCHISE DISCUSSION

A conference of the special franchise committee of the City Council of Toledo, Ohio, and representatives of the Toledo Railways & Light Company was held on May 27. Several phases of the tentative twenty-five-year franchise prepared by the committee were discussed. One of the questions was that the city shall have an appraisal of the property if the franchise should run twenty-five years. Attorney Thomas H. Tracy, representing the company, insisted that the city should pay half the expenses of such an appraisal. This was passed over, but he also argued that if any other company should purchase the property at that time, it must pay the appraised value and that any other company receiving a franchise must take over the present company's properties. No definite agreement was reached on this point. It was agreed that some changes, mostly relating to phraseology, should be made in sections 18, 19 and 23. No agreement has been reached as to the amount of interest earnings to be allowed the company during a twelve-month try-out period and as to whether this period shall be an uninterrupted one.

SUPPLEMENTARY ARBITRATION IN DETROIT

The agreement made at the time of the decision to arbitrate the Whaling case provided that any grievances the members of Division No. 26 of the Amalgamated Association might have against the Detroit United Railway would be considered at the close of the Whaling case. In consequence the union has presented several requests to F. W. Brooks, general manager of the company. The most important request, perhaps, is that questions of discipline in which the union is not satisfied with the decision of the general superintendent shall be referred to a representative of the company and a representative of the union for adjustment and, failing agreement, shall be referred to the state commissioner of conciliation.

CLEVELAND TERMINAL PROJECTS

The application of Cleveland, Akron & Canton Terminal Railroad for a franchise for a subway under East Fifty-fifth Street at Cleveland was discussed at an open meeting at the Chamber of Commerce on May 26, and again before the committee of the whole of the Council on May 28. O. C. Barber, who is at the head of the movement, said that he did not know who would furnish the funds for construction. Both he and Attorney W. M. White declared that no railroad had anything to do with the proposition, but that they hoped to interest the railroads in the service the new terminal will furnish. The construction of the line would involve the expenditure of about \$15,000,000. The four-track line would be operated by electricity from a power house located in the southern part of the city where it is proposed to have the road come to the surface.

Council as a committee of the whole also heard arguments of the Cleveland & Youngstown Railroad for the vacation of forty streets between East Ninth and East Thirty-fourth Streets in order to give it sufficient ground for its right-of-way. Several property owners objected to the plan. They contend that it would cut their property off and damage it in other ways. The company, however, has purchased 700 parcels of ground and 800 houses, all valued at about \$1,500,000, in the section where it desires to build its terminal, and it is believed that it will be able to force its way through under existing laws. Attorney John L. Cannon, representing the company, said he had no intention of attempting this, as he believed the company and the city would be able to arrive at an agreement satisfactory to both.

This company will operate an electric railway reaching Shaker Heights, an elegant residence district, but it will also be in position to bring the cars of all the roads that cross it into the city at one point where it is believed a combined steam and interurban passenger station will be constructed. A law was recently enacted that will allow steam and electric roads to co-operate in the construction of union stations, but Mr. Cannon refused to say whether any of the steam roads will be financially interested in the terminal project.

The case to test the right of the city, under its new charter, to build a street railway without the consents of owners of abutting property was filed in the Supreme Court on May 27. This is the case involving the section of Euclid Avenue between East Twenty-second and East Fortieth Streets, or "Millionaires' Row." The hearing for a temporary injunction was set for June 3.

Pasadena Considers Municipal Railway.—A committee of fifty citizens of Pasadena, Cal., to be known as the advisory transportation committee, was appointed on May 18 to obtain data on the proposal to build a municipal railroad from Pasadena to Los Angeles.

Massachusetts Compensation Lost.—The Massachusetts Senate has killed by a voice vote the six bills attached to the report of the special commission appointed by Governor Walsh to consider workmen's compensation. This ends any further attempt to secure workmen's compensation legislation in Massachusetts this year.

Interurban Consolidation Bill Passed.—The interurban consolidation bill permitting the consolidation of interurban lines in Texas has been passed by the Legislature. The object of this bill is to allow the interurban lines from Denison to Dallas, and from Dallas to Waco, controlled by the Strickland interests, to be merged under one management.

Richmond Blanket Franchise Proposal Withdrawn.—Henry W. Anderson, representing the Virginia Railway & Power Company, Richmond, Va., in a short statement, supplemented by a personal talk, recently withdrew the petition and tentative ordinance introduced in the City Council by the company, asking for a blanket franchise, and left the entire proposition to the street committee of the Council.

Toledo Newspaper Case.—The Toledo Newspaper Company and Negley D. Cochran, editor of the *Toledo News-Bee*, which were fined for contempt of court by Judge John M. Killits of the Federal District Court in connection with news items and editorials relating to the street railway injunction suit, have appealed their case to the United States Circuit Court of Appeals at Cincinnati on May 26. It is said that the case may not come up until May or June of next year unless there is a request from the appellants to advance it for hearing.

Brooklyn Marginal Bill Signed.—Governor Whitman has signed the Brooklyn marginal railroad bill. The bill makes possible the conclusion of a contract between the city and the trunk line railroads under which the road, when constructed, will be operated jointly by all the railroads. Plans for the railroad call for an electrically operated elevated line to cost \$15,000,000, including the property acquired. The road will link together terminals along the South Brooklyn waterfront such as those of the Bush Terminal Company and the New York Dock Company.

Public Utilities Commission for Alberta.—The Alberta

Legislature has passed an act for the creation of a public utilities commission for the Province. It provides for the appointment of three commissioners to hold office for ten years, one of whom shall be chairman. The commissioners are to devote their whole time to the commission's work and may be reappointed upon the expiration of their ten years' term, but no commissioner may remain in office after attaining seventy years of age. Otherwise a commissioner can be removed only by the Lieutenant-Governor upon an address of the Legislature.

Right to Compel Extension Lacking.—The Public Service Commission of Pennsylvania declared recently that it had not the power, under the act creating it, to compel a public service company to extend its facilities beyond the territory covered by its charter or amendments thereto. The city of Scranton passed an ordinance authorizing the extension and operation of the lines of the Scranton Railway from the present end of the tracks on Luzerne Street to other localities. The company refused to accept the ordinance or make the extension and the city of Scranton filed a complaint with the commission.

Terminal Talk at Columbus.—H. M. Daugherty, well-known attorney, stated recently that all the land needed for the proposed electric railway terminal bounded by Front, Rich and Town Streets is now owned in fee simple by the projectors of the improvement. He said that the terminal building will be connected to High Street through a building on High Street and Wall Alley. An office building will be erected on this site. The franchise requires that work on the terminal structure be begun by Jan. 1, 1917. The Scioto Valley Traction Company, the Columbus, Delaware & Marion Railway and two or three other electric railways are expected to be tenants of the terminal structure.

Bus Bids in New York.—Three bids were submitted on May 31 for new motor bus routes in New York. The Fifth Avenue Coach Company, which operates the existing bus service, made an alternative proposal, suggesting that the city might enter into a contract with it for the extension of its present lines on the same principle as has been followed in the extension of the elevated roads. The People's 5-Cent Bus Line failed to make any offer, but its place was taken by a new company, represented by O. C. Brunner and W. T. Ridley, who want to run buses on the zone plan, with the city divided into three zones in each of which 3 cents would be charged. The third bid was received from the New York Motor Bus Company.

Governor's Charge to the Pennsylvania Commission.—Governor Brumbaugh of Pennsylvania has laid down a definite policy to be followed by the reorganized Public Service Commission. In the course of his remarks the Governor said: "The commission must be fair to the corporations, but it must not be fair to them at the expense of the public. It must take the place of that competition which has virtually ceased to exist in public utilities and see that public service companies charge no higher rates than they would if they had direct competition. You have a great opportunity for service to the people of the Commonwealth. You are expected to act as regulators of conditions in public utilities. It is my desire that business of the body be attended to with promptness and dispatch. It is to be a full-time commission and will, although it has judicial functions, sit like a business board."

Service Abandoned in Alexandria.—Receivers have been appointed for the Southern Traction & Power Company, Alexandria, La., and the company has abandoned the operation of its lines. This action followed the failure of negotiations for the sale of the property to the city and the imposition by the city of requirements with respect to improvements considered by the company to be too onerous. In a statement which he issued I. B. White, vice-president and general manager of the company, said: "We dealt with the city in good faith, believing that it would take over the property. At a considerable loss to the stockholders we continued to operate it. Now since all hopes of the city taking it at the price and upon the terms named have been abandoned, and since it is called upon to make expenditures which it is utterly unable to meet, there is nothing left for us to do, except to cease operation."

PROGRAMS OF ASSOCIATION MEETINGS

National Electric Light Association

At first it was proposed to crowd the work of the convention of the National Electric Light Association, beginning June 8 at San Francisco, into three days, but various reasons forbade limiting the sessions to Tuesday, Wednesday and Thursday; and the extra sessions will therefore allow the subject-matter to be treated in a more leisurely way, favorable to fuller discussion. Moreover, as the special trains do not pull out on their return trips until Saturday and Sunday, good use will be made of some of the intervening time. Another feature of interest is the proposed shifting of the public policy meeting from Wednesday to Thursday evening, owing to the difficulty in securing a suitable hall for Wednesday night. Usually at the conventions there have been no sessions on Wednesday afternoon, because of the objection to holding the delegates together for sessions morning, afternoon and evening. With the public policy meeting on Thursday evening, the afternoon recess will also fall on that day, and the afternoon will be devoted to an official visit to the electrical exhibits at the Panama-Pacific Exposition.

Central Electric Railway Association

Arrangements have been made for the movement of two special cars from Indianapolis, Ind., to Cleveland, Ohio, and return, for the summer meeting of the Central Electric Railway Association, on the S. S. *City of Erie*, leaving Cleveland on the morning of June 17. The cars will be moved on the following schedule on June 16, 1915:

INTERSTATE PUBLIC SERVICE COMPANY

Leave Indianapolis, Ind.	6:00 A. M.
Arrive Columbus, Ohio	12:35 P. M.
Arrive Marion, Ohio	2:35 P. M.
Arrive Bucyrus, Ohio	3:15 P. M.
Arrive Cleveland, Ohio	7:35 P. M.

FORT WAYNE & NORTHERN INDIANA TRACTION COMPANY

Leave Indianapolis, Ind.	7:00 A. M.
Arrive Muncie, Ind.	9:15 A. M.
Arrive Fort Wayne, Ind.	11:50 A. M.
Arrive Lima, Ohio	2:15 P. M.
Arrive Cleveland, Ohio	7:50 P. M.

Returning, these cars will leave Cleveland Saturday, June 19, 1915, shortly after the arrival of the boat. No provision has been made in these schedules to stop for lunch, but arrangements will be made for box lunches at Columbus, Ohio, and Fort Wayne, Ind.

These cars are available for railway and supply members, their families and invited guests. The program of papers for the meeting was published in the *ELECTRIC RAILWAY JOURNAL* of May 29.

Central Electric Railway Accountants' Association

The twenty-seventh meeting of the Central Electric Railway Accountants' Association will be held at the Severin Hotel, Indianapolis, Ind., on June 11 and 12. The executive committee will meet on the morning of June 11. Following the presentation of the report of the executive committee and the address of Charles L. Henry, president of the association, the following papers will be presented:

"The Relation of the Accounting Department to the Mechanical Department," by R. N. Hemming, superintendent of motive power of the Union Traction Company of Indiana.

"Analysis of the Balance Sheet," by L. T. Hixson, auditor of the Terre Haute, Indianapolis & Eastern Traction Company.

After the reading of these papers the compiling committee and the standard passenger and freight committee will report.

The program of papers for the session on June 12 follows:

"The General Principles of Accounting as Between Common Carriers and Manufacturers," by P. C. Johnson, general auditor of the Prest-O-Lite Company, Indianapolis.

"Electric Light & Power Accounting by Combined Railway and Light Property," by Oren A. Small, auditor of the Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich.

"The Small Electric Line Handling Carload Freight," by James S. Clark, auditor of the Marion & Bluffton Traction Company, Bluffton, Ind.

Financial and Corporate

ANNUAL REPORTS

Portland Railway, Light & Power Company

The comparative statement of income, profit and loss of the Portland Railway, Light & Power Company, Portland, Ore., for the calendar years 1913 and 1914 follows:

	1914	1913
Gross earnings	\$6,273,171	\$6,723,742
Operating expenses	2,695,356	2,856,981
Net earnings	\$3,577,815	\$3,866,761
Taxes	\$568,527	\$441,329
*Bridge rentals	45,198	46,936
Interest	2,127,480	1,961,666
Total fixed charges	\$2,741,205	\$2,449,931
Surplus	\$836,610	\$1,416,830

*Additional bridge rentals amounting to \$16,267 in 1914 and \$16,903 in 1913 are included in operating expenses.

The record for 1914 shows that the gross earnings decreased \$450,571 or 6.7 per cent as compared to 1913. The operating expenses decreased \$161,625 or 5.7 per cent, so that the net earnings decreased \$288,946 or 7.5 per cent. Fixed charges increased \$291,274 or 11.9 per cent, mostly on account of an increase of 28.8 per cent in taxes and 8.5 per cent in interest, with the result that the surplus showed a decrease of \$580,220 or 41 per cent.

The report states that this unsatisfactory showing is due to a continuation of the depressed business conditions prevailing in 1913, and to the competition of the Northwestern Electric Company. The effect of the general depression in business is shown by a decrease of 6 per cent in railway earnings, passengers carried having fallen from 94,014,368 in 1913 to 89,934,644 in 1914. Only one small part of the railway system, the Mt. Hood line, showed any increase in passenger earnings. The electric sales were affected both by the business depression and the competition of the Northwestern Electric Company, the number of customers being reduced from 42,062 to 37,938 and the earnings 7.8 per cent. The operating expenses were cut as low as consistent with good service and proper maintenance of the property, so that, in spite of the heavy decrease in gross earnings, the operating ratio for the year stood at 43 per cent, compared with 42.5 per cent in 1913.

Since the first of 1915, it is said conditions have not improved, and the company is now facing further losses in its railway department, owing to competition from jitney automobiles and motor buses, which have increased rapidly in this part of the country. Relief by ordinance compelling fair competition, however, is expected. The company does not anticipate further material losses of existing business on account of its electric competitor. Moreover, by reason of greater economy in public expenditures and the lowering of the tax levy, taxes payable in 1915 will be materially less than in the year 1914. The capital expenditures required in 1915 will be the smallest in ten years. The Willamette Valley Southern Railway, controlled by the Portland Railway, Light & Power Company, started operation Jan. 31, 1915. This line, thirty-two miles in length, should build up a large business both in passengers and freight.

Very little new construction work was undertaken in 1914 except railway work required by the city authorities or to connect up new light and power customers. The total of \$531,130 was only slightly more than one-sixth of the average annual capital expenditures made during the years from 1906 to 1913, inclusive.

Utah Securities Corporation

The Utah Securities Corporation, New York, N. Y., which controls the Utah Power & Light Company and the Utah Light & Traction Company, has issued an unusually complete sixty-page report containing detailed financial data for each of the companies and a consolidated profit and loss statement and balance sheet for all the companies. The report also gives descriptions and photographs of the properties owned. The street railway property in Salt Lake City has 145 miles of track.

Since the incorporation, in 1912, the company's manage-

ment has been largely occupied in acquiring additional properties, retiring underlying securities, clearing titles, re-arranging rates and readjusting franchise conditions. The construction period for the immediate future and the work of readjustment and reorganization is now practically completed, and the company finds itself for the first time in position to proceed along ordinary operating lines. From now on President S. Z. Mitchell expects an improvement in operating results.

The total gross earnings from all sources of the operating properties now controlled, intercompany charges eliminated, for the twelve months ended March 31, 1915, were \$4,640,126, as compared with \$4,474,261 for the previous twelve months. The net earnings were \$2,284,477, as compared with \$2,361,320 for the previous twelve months. Earnings were affected by the depressed condition of the copper and other mining industries in the territory served, occasioned by the European war. These industries are now resuming operations along normal lines and an improvement in business conditions and power output is expected.

The consolidated income statement of the Utah Securities Corporation and subsidiaries, after including the profit on the redemption at a discount of ten-year 6 per cent notes, shows a balance of \$987,659 after all charges. The consolidated balance sheet shows total reserves of \$2,935,905 and a total surplus of \$2,813,997.

Republic Railway & Light Company

The Republic Railway & Light Company, New York, N. Y., and subsidiary companies report consolidated earnings for the year ended Dec. 31, 1914, as follows: Gross earnings, \$3,001,461; operating expenses and taxes, \$1,856,467; net earnings, \$1,144,994; interest charges, \$679,987; net income, exclusive of depreciation, \$465,007; previous surplus, \$1,180,099; total surplus, \$1,645,106; other deductions, including preferred dividends, \$738,328; final surplus, \$906,778. The gross earnings increased \$31,443 for the year.

The amount expended during the year for improvements was \$602,127. The report states that the directors are now working upon plans for refunding on Jan. 1, 1916, \$3,000,000 of 5 per cent secured gold notes of the Republic Railway & Light Company and \$4,844,000 of first consolidated refunding mortgage 5 per cent gold bonds of the Mahoning & Shenango Railway & Light Company, which mature on that date.

During the year steps were taken to consolidate as many properties as possible to save taxes, facilitate operation, reduce expenses and improve conditions for refinancing. Thus far six companies have been eliminated. The Mahoning & Shenango Railway & Light Company absorbed by purchase the Sharon & New Castle Railways and the Youngstown-Sharon Railway & Light Company, and by merger the Sharon & Wheatland Street Railway, the Valley Street Railway and the Wheatland Street Railway. The Youngstown & Sharon Street Railway purchased the Youngstown Consolidated Gas & Electric Company.

The J. G. White Companies

The J. G. White Companies has issued its report for the ten months ended Dec. 31, 1914. As the company has changed its fiscal year to conform with the calendar year instead of the year ending Feb. 28, no comparison of earnings is available. Following is the surplus and undivided profit account as of Dec. 31: Balance March 1, 1914, \$780,268; written off for depreciation of securities acquired prior to Jan. 1, 1914, or March 1, 1914, and for doubtful accounts contracted prior to that date, \$120,820; balance, \$659,448; profit for ten months from March 1 to Dec. 31, 1914, all companies, \$44,817; total, \$704,265; preferred dividends, \$145,363; profit and loss surplus, \$558,902.

A revaluation of securities owned on April 24, 1914, on the basis of sales prices agreed for those sold but not delivered, market prices for a few other large blocks and balance-sheet prices for the remainder would show an increase in surplus of more than \$250,000, bringing this actual present surplus to more than \$800,000.

The report states that the amount of cash of all companies on hand on Dec. 31 last was \$509,668, and bills and accounts receivable, after having made ample provision for doubtful accounts, \$516,300, making total current assets of

\$1,025,969. The total debts of the company on the same date, exclusive of dividends on the preferred stock declared and since paid, were \$629,602.

It is stated that general financial and business conditions, intensified by the European war, made it impossible to secure large engineering or construction work, and even more impossible to arrange any large flotations or promotions of either new projects or consolidations of existing business. During the last few months, however, new business in encouraging, though not large, volume has been arranged and prospects are more encouraging.

INTERBOROUGH-METROPOLITAN PLAN APPROVED

Consolidation Will Bring Capital of New Company Into Conformity with Net Value of Assets of Old Holding Company

Stockholders of the Interborough-Metropolitan Company, New York, N. Y., the holding corporation of the subway and elevated lines, on June 1 approved the readjustment plan providing for the consolidation of the company with the Finance & Holding Corporation, the new company to have a nominal capital of about \$50,000,000. The vote on the plan stood 1,106,527 shares for, of which 355,445 were preferred and 751,082 common, and 5635 shares against.

Under the plan the present 5 per cent cumulative preferred stock will be replaced by a 6 per cent non-cumulative issue. New common stock is to be issued in shares without par value. The project as outlined by the directors is to permit the restoration of dividends as soon as possible on the preferred stock in lieu of the sacrifice by the stockholders of their claims on back dividends of the present cumulative 5 per cent issue, now amounting to about 40 per cent.

Prior to this stockholders' meeting the Public Service Commission had decided that the proposed consolidation was not in violation of Section 54 of the Public Service law. This section prohibits a street railroad corporation from acquiring the capital stock of a similar corporation without the consent of the commission. Theodore P. Shonts, president of the company, wrote to the commission stating that neither the Interborough Rapid Transit Company nor the New York Railways formed a contracting party in the consolidation, which would in no way affect the relation of these roads to the public. He said the plan had the hearty support of the bankers who had purchased the bonds of the rapid transit company, and added:

"With respect to the proposed consolidation, it is proper to bear in mind that the necessary effect will be to place the declared capital of the new company at a sum in conformity with the net value of the assets of the Interborough-Metropolitan Company over and beyond its debts. For a long period the company has recognized the desirability of taking this course, and thereby writing off upon the books of the company the very large depreciation which has ensued in its original investments in the stocks of the Metropolitan Street Railway and the Metropolitan Securities Company."

The Interborough-Consolidated Corporation has been incorporated with a capital of \$50,403,634 to succeed the Interborough-Metropolitan Company and the Finance & Holding Corporation, operating in the counties of Greater New York and Westchester. The directors include August Belmont, T. P. Shonts, Andrew Freedman and Edward R. Bacon.

SAN FRANCISCO-OAKLAND VALUATION

The California Railroad Commission on May 24 issued its findings upon the value of the properties of San Francisco-Oakland Terminal Railways, Oakland, Cal. These properties consist of the Oakland Traction Company, owning the street railway system in Oakland, and the so-called "Key Route System," which owns the interurban railway and ferry system between San Francisco, Oakland and Berkeley. The valuation of the commission included also the property of the Oakland Terminal Company, which is a large land-owning corporation owned by the San Francisco-Oakland Terminal Railways.

The commission finds the reproduction cost of all of these

properties, with all allowances, to be \$26,912,865. These allowances include land multiples, etc., amounting to approximately \$900,000. The reproduction cost less depreciation amounts to \$23,641,893. The net indebtedness of the railways and the Oakland Terminal Company, including all outstanding bonds, notes, etc., amounts to approximately \$21,000,000. A large portion of the lands owned by the San Francisco-Oakland Terminal Railways and by the Oakland Terminal Company are non-operative property. In its report the commission states that the reproduction cost of the properties actually used in the operation of the railways amounts to \$20,354,746 and that the reproduction cost less depreciation of these operative properties amounts to \$17,314,213.

The engineers of the railways and of the commission came to a practical agreement on all of the physical properties. The differences, when the case was finally submitted, amounted to only a few thousand dollars. The chief remaining item of difference was the matter of lands. The company had claimed the value of its lands to be \$17,687,000, but the engineers of the commission had estimated these lands at \$6,843,000, the chief difference being in the appraised value of the company's tide lands. The real estate expert for the railway estimated these lands to be worth \$21,780 per acre, while the engineers of the commission had estimated \$7,500 per acre. The commission finally found a value of \$12,500 per acre for these lands for the purpose of the present proceeding. No value has been fixed on the property of the entire system as a "going concern."

NEW YORK MERGER AUTHORIZED

The Public Service Commission for the Second District of New York has approved the corporate merger of the New York, Westchester & Boston Railway and the Westchester Northern Railroad. The New York, Westchester & Boston Railway at present operates over the Harlem River & Port Chester tracks from Harlem River to 174th Street, New York, and thence over its own tracks to North Avenue, New Rochelle. It also operates a branch from Mount Vernon to White Plains and is to construct a road to Port Chester. The Westchester Northern Railroad is to be built from the New York, Westchester & Boston Railway terminus at White Plains, forming a continuous line of road, through Westchester County to Danbury, Conn., with a branch to Brewster. The Westchester Northern Railroad is to construct its line in Connecticut under the Connecticut statute. The time within which it must expend 10 per cent of its capital stock and complete the construction in New York State was extended by the last Legislature to five and ten years respectively from March 1, 1915.

The consolidated road will connect with the New Haven lines at various points, including a connection with what is called the Poughkeepsie Bridge Route, thus affording the New Haven a new New York tidewater point for coal. It will also open up to commuters new sections of northern Westchester County. The capital stock of the new company, the New York, Westchester & Boston Railway, will not exceed in amount the sum of the stock of the two present companies at par. No bonds or other evidences of indebtedness are to be issued in consideration of the merger. More than two-thirds of the capital stock of each company has consented to the merger. No stock or other securities will be issued without the further approval of the commission.

Bay State Street Railway, Boston, Mass.—At a recent hearing before the Massachusetts Public Service Commission on the application of the Bay State Street Railway to issue \$1,500,000 of preferred stock, as noted in the *ELECTRIC RAILWAY JOURNAL* of May 8, counsel for the company stated what work has been done in the way of new construction and improvements and what the financial standing and requirements of the company are. The commission took the petition under consideration for the purpose of making an independent valuation of the new property before passing on the issue.

Calumet & South Chicago Railway, Chicago, Ill.—The Calumet & South Chicago Railway has petitioned the Illinois Public Utilities Commission for authority to issue \$500,000 of additional first mortgage 5 per cent bonds.

Carolina Power & Light Company, Raleigh, N. C.—W. C. Langley & Company, New York, has sold at 93½ a block of first mortgage 5 per cent bonds of the Carolina Power & Light Company, dated 1908 and due in 1938. Of an authorized issue of \$5,000,000, \$2,582,000 is outstanding.

Chicago (Ill.) City Railway.—The Chicago City Railway has applied to the Illinois Public Utilities Commission for permission to issue \$3,050,000 of first mortgage bonds.

Chicago (Ill.) Railways.—The Chicago Railways has applied to the Illinois Public Utilities Commission for authority to issue \$3,145,000 of first mortgage 5 per cent bonds.

Cincinnati (Ohio) Traction Company.—The Ohio Supreme Court by affirmation recently held that the Cincinnati Traction Company under its 1896 franchise is accountable to the city for 6 per cent of its gross earnings from all traffic within the city limits, including the part retained by the interurban lines. A judgment was awarded to the city for \$5,410 for additional tax on fares collected in 1905, and it is reported that a demand for a similar tax in later years will be made.

Columbus Railway, Power & Light Company, Columbus, Ohio.—E. W. Clark & Company, Philadelphia, has sold at 99½ and interest, to yield 5½ per cent, \$1,200,000 of 5 per cent one-year gold coupon notes, series B, of the Columbus Railway, Power & Light Company. These notes are dated June 1, 1915, and due on June 1, 1916. They are a direct obligation secured by a deposit of first refunding and extension mortgage 5 per cent gold bonds of the company at 80 per cent of their face value.

Electric Short Line Terminal Company, Minneapolis, Minn.—The Electric Short Line Terminal Company is offering for sale \$500,000 of full-paid stock. The proceeds will be used for the improvement of the terminal properties and the extension of the Electric Short Line Railway. Besides this line the Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company operates into the terminal.

Fairmount Park Transportation Company, Philadelphia, Pa.—The property of the Fairmount Park Transportation Company will be offered for sale on June 22, subject to the first mortgage of \$750,000. Previous reference to this sale was made in the *ELECTRIC RAILWAY JOURNAL* of May 15.

Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company, Minneapolis, Minn.—Three-year 6 per cent notes of the Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company to the amount of \$750,000 have been bought jointly by the J. G. White Engineering Corporation and the General Electric Company, New York, and Stevens, Chapman & Company, Minneapolis. The money secured will be used to complete the "Dan Patch" line into the Minneapolis terminal and to furnish new equipment.

Pacific Gas & Electric Company, San Francisco, Cal.—The California Railroad Commission has issued a supplemental order in the matter of the application of Pacific Gas & Electric Company for authority to issue 19,226 shares of common capital stock. The commission's original order provided that the company should make certain adjustments as to depreciation accounts, and also that it should present in writing to the commission an agreement that the authorization of this stock should not be used as a basis for the determination of rates. The company has now complied with these conditions. Announcement is made that from the date of the initial offering on June 3, 1914, to April 30, 1915, a period of eleven months, 4,430 subscriptions, aggregating \$9,895,200, have been received for the company's new issue of first preferred 6 per cent cumulative stock. Of this amount \$6,039,600 (60 per cent) was taken by stockholders under the original offering and \$3,855,600 (40 per cent) has been subscribed for by employees and customers of the company, and others. Since Jan. 1, 1915, \$1,089,800 has been sold, little or none being disposed of outside of California.

People's Railway, Wilmington, Del.—The Wilmington & Philadelphia Traction Company is reported to have purchased the People's Railway property, including the lease on Brandywine Springs Park. The consideration is not stated.

Southern Traction & Power Company, Alexandria, La.—On the application of the City Savings Bank & Trust

Company, trustee, I. B. White and C. F. Crockett have been appointed receivers for the Southern Traction & Power Company. An explanatory statement of the management is noted elsewhere in this issue.

United Railroads, San Francisco, Cal.—A discussion of some tentative plan for the reorganization of the affairs of the United Railroads of San Francisco to comply with the recent order of the California Railroad Commission is current in financial circles. President Lilienthal said that since "the State has told us how it expects us to handle our affairs, we may have to work out a definite plan to carry out its directions." It has been reported unofficially that there may be a reduction of from 25 to 40 per cent in the face value of the outstanding 4 per cent bonds, which at present total about \$23,000,000. The bondholders would be partially compensated by an increase in the interest rate to 5 per cent. These bonds are quoted in the market at about 46½. A readjustment of the outstanding stock might also be undertaken.

United Railways of St. Louis, St. Louis, Mo.—The Board of Aldermen on May 21 voted in favor of appointing a committee of five to confer with officers of the United Railways of St. Louis in an endeavor to compromise the mill-tax cases now pending in the courts.

DIVIDENDS DECLARED

Arkansas Valley Railway, Light & Power Company, Pueblo, Col., quarterly, 1¼ per cent, preferred.

Brooklyn (N. Y.) Rapid Transit Company, quarterly, 1½ per cent.

El Paso (Tex.) Electric Company, 3 per cent, preferred.

Frankford & Southwark Passenger Railway, Philadelphia, Pa., quarterly, \$4.50.

Louisville (Ky.) Traction Company, quarterly, 1 per cent, common.

Second & Third Streets Passenger Railway, Philadelphia, Pa., quarterly, \$3.

Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis., quarterly, 1¼ per cent, preferred.

ELECTRIC RAILWAY MONTHLY EARNINGS

CITIES SERVICE COMPANY, NEW YORK, N. Y.

Period	Operating Revenues	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '15	\$342,337	\$15,298	\$327,039	\$40,833	\$286,206
1 " " '14	337,223	8,963	328,260	29,167	299,093
12 " " '15	3,946,539	137,607	3,808,932	466,667	3,342,265
12 " " '14	3,076,962	93,863	2,983,099	239,729	2,743,370

EL PASO (TEX.) ELECTRIC COMPANY

1m., Mar., '15	\$78,329	*\$45,188	\$33,141	\$4,230	\$28,911
1 " " '14	88,469	*49,945	38,524	4,669	33,855
12 " " '15	1,020,918	*559,699	461,219	50,672	410,547
12 " " '14	925,120	*505,657	419,464	50,921	\$376,999

GALVESTON-HOUSTON ELECTRIC COMPANY, GALVESTON, TEX.

1m., Mar., '15	\$160,200	*\$101,329	\$58,870	\$35,409	\$23,461
1 " " '14	195,536	*113,739	81,797	38,931	42,866
12 " " '15	2,327,395	*1,268,159	1,059,236	434,574	624,662
12 " " '14	2,423,574	*1,375,477	1,048,097	431,326	616,771

HOUGHTON COUNTY TRACTION COMPANY, HOUGHTON, MICH.

1m., Mar., '15	\$21,699	*\$13,057	\$8,642	\$5,456	\$3,186
1 " " '14	24,039	*13,952	10,087	5,635	4,452
12 " " '15	269,991	*177,431	92,560	66,884	25,676
12 " " '14	291,847	*176,352	115,496	67,316	48,200

JACKSONVILLE (FLA.) TRACTION COMPANY

1m., Mar., '15	\$53,498	*\$37,426	\$16,071	\$15,644	\$427
1 " " '14	64,342	*38,965	25,377	12,901	12,476
12 " " '15	688,368	*463,721	224,647	156,522	68,025
12 " " '14	704,689	*448,701	255,988	149,532	106,456

NORTHERN OHIO TRACTION & LIGHT COMPANY, AKRON, OHIO.

1m., Apr., '15	\$279,281	*\$183,537	\$95,744	\$51,423	\$44,321
1 " " '14	287,718	173,321	114,397	50,331	64,066
4 " " '15	1,101,351	709,451	391,900	204,437	187,463
4 " " '14	1,080,883	668,301	412,582	200,155	212,427

PADUCAH TRACTION & LIGHT COMPANY, PADUCAH, KY.

1m., Mar., '15	\$23,307	*\$15,166	\$8,141	\$7,796	\$345
1 " " '14	25,237	*16,236	9,001	7,679	1,322
12 " " '15	299,729	*191,946	107,783	91,683	16,100
12 " " '14	298,017	*195,434	102,583	90,976	11,607

PENSACOLA (FLA.) ELECTRIC COMPANY

1m., Mar., '15	\$19,183	*\$11,339	\$7,843	\$7,268	\$575
1 " " '14	23,051	*14,536	8,515	7,238	1,277
12 " " '15	255,205	*162,205	93,000	86,951	6,049
12 " " '14	284,206	*180,930	103,276	83,712	19,564

*Includes taxes. †Includes non-operating income.

Traffic and Transportation

THE JITNEY BUS

New York Commission on Recent State Measure—Dallas, San Antonio and Youngstown Developments

The State law in New York governing the operation of the jitney bus went into effect immediately upon its being signed by Governor Whitman. The Public Service Commission of the Second District received so many requests for an expression as to the effect and enforcement of the provisions of the statute that the following unofficial statement was made at the commission's offices on May 28:

"It appears that the auto bus law which has been in effect for the last two years has been repealed by the enactment of the jitney bus law, and that it is no longer necessary for persons and corporations desiring to operate auto bus lines on State highways to come to the commission for certificates of approval. It will be necessary, however, for all persons and corporations owning and operating stage routes, bus lines or motor vehicles carrying passengers for a fare of 15 cents or less upon any street, avenue or public place in any city of the State, except the city of New York, to procure first the consent of the local authorities and next a certificate of convenience from the Public Service Commission. The commission is not prepared to announce any general policy in considering such applications in advance thereof."

The Board of City Commissioners of Dallas, Tex., has passed an ordinance regulating jitneys in lieu of the ordinance passed by the previous administration which was to have become effective a few days ago. The new ordinance eliminating the bond feature went into effect on May 25. Under the new ordinances the applicant for a jitney license must submit to an examination by the City Health Officer before the license is granted; he must run his car continuously not less than six hours each day except Sunday; he must follow a stipulated route; must be examined by the city automobile inspector as to his knowledge of running an automobile. A license good until May 1, 1916, is to be issued upon payment of \$75. Violation of the regulations of the ordinance is punishable by a fine of \$200, and the Judge of the Corporation Court has authority to forfeit licenses without any refund on unearned portions. A protest has been made to the commissioners requesting the license be reduced to \$50 a year.

Judge S. G. Tayloe of the Forty-fifth District Court at San Antonio, Tex., announced recently that he would render a decision sustaining the general demurrers of the City of San Antonio in the jitney case. As a result the ordinance regulating the operation of jitneys passed several months ago by the City Council is declared constitutional. Application for a temporary injunction to restrain the enforcement of the San Antonio ordinance was filed in the Forty-fifth District Court on March 27 by R. P. Green, president of the Jitney Owners' Association. The ordinance was to have gone into effect on March 28, but Judge Tayloe granted a temporary restraining order and set a hearing on the plea for perpetuation of the writ for April 9. The case, however, was continued from time to time, awaiting the decision of the Court of Criminal Appeals of Texas in the Fort Worth case, decided against the jitney as noted in the ELECTRIC RAILWAY JOURNAL of May 22, page 1005.

A regulatory ordinance was passed recently in Youngstown, Ohio, to go into effect on June 1. An indemnity bond in the sum of \$5,000 is required for each machine operated. There is also a provision fixing a license fee of \$25 a year for each car. In Youngstown the regular eight and twelve hour jitneys have been dropping out fast after a little experience, but the cars operated for only a few hours have remained as a source of trouble. These machines are operated mostly between 5 p. m. and 8 p. m. by people with other means of livelihood. With stipulations requiring a bond demanding a premium of \$200 a year and a license fee of \$25 it is expected that the ordinance will eliminate the rush-hour jitneys.

In Vancouver, B. C., the City Council was scored on May 15 by the grand jury for its neglect in not passing suitable regulations for the control of the jitney traffic, and for allowing jitneys to enter into unfair competition with the British Columbia Electric Railway.

ILLINOIS COMMISSION ON JITNEY

Following Hearing Jitney Company Is Restrained from Operating Without Certificate of Necessity

Jurisdiction over jitney buses was assumed by the Illinois Public Utilities Commission in a ruling made on June 2 by Judge Owen P. Thompson, one of the commissioners, following a hearing on the petition of the Jacksonville (Ill.) Railway and W. B. Miser versus L. F. O'Donnell et al., doing business as the Motor Transportation Company of Jacksonville. The hearing was held in the commission's office in the State Capitol at Springfield.

The defendant company is restrained from operating motor buses on the jitney plan until it has obtained a certificate of convenience and necessity from the utilities commission. In his oral ruling, which will be the basis for a ruling by the full commission to be issued within a few days, Judge Thompson held that motor buses attempting to do the same sort of transportation business as is done by street railways are amenable to the same restrictions and come within the jurisdiction of the commission under the State Utilities Act. Furthermore, he expressed the belief that the commission will not grant permits to jitney companies to operate along streets in any city where there is adequate street railway service. The jitney owner must also incorporate his business under the laws of the State and come to the commission armed with the proper franchise or other permit from the city in which he expects to operate.

T. J. Condon, an attorney of Springfield, represented the O'Donnell company at the hearing. He argued that a jitney was nothing more nor less than a bus. It had no established line from which it could not deviate and had no established system. For this reason it should not be classed as a public utility unless buses operated by transfer companies and others were to be so classed.

H. I. Green, Champaign, attorney for the Jacksonville Railway, declared that the jitney was a bidder for the business of the street railway, and that it operated cars at regular intervals along designated streets and for the same fare as was charged by the street railway. He said it was in every respect a public utility.

C. J. Sero, of the Tri-City Railway, Rock Island, attended the hearing and assisted the Jacksonville company in its arguments.

The text of Judge Thompson's decision, announced after the hearing, is as follows:

"Just what degree of control should be exercised by public utility commissions having jurisdiction over those engaged in public service similar to that conferred upon this commission by the Legislature of this State has not been passed upon by this commission or any other body of like jurisdiction or by any of the courts of the State. In other words, this question is a new one, and must be governed by the act relating to the supervisory control over public utilities by State authority.

"From general information obtained through newspapers and periodicals, we learn that some of the cities in the United States where the so-called jitney buses are in use have passed various ordinances restricting such use by requiring the payment of a license fee for the use of the streets and in some instances requiring the entering into a bond by the company to indemnify against property loss or for personal injury on account of the negligence of the operators of such vehicles.

"It seems clear from the reading of the law under which this commission acts that the use of the jitney bus as shown by the evidence in this case brings the character of business within the jurisdiction of this commission. This commission has jurisdiction over common carriers, and where the service rendered is to the public generally, or where the person or corporation holding himself or itself out as offering to the public transportation from place to place for hire and with an established route and a fixed schedule, such facts are amply sufficient to bring the business of that character under the law and require their regulation and control.

"While the means of transportation is other and different from that furnished by the ordinary street car, it is of the same general character. Street cars operating upon the streets are subject to regulation and control by law. This commission has authority under the law to inquire into the

character of the service rendered and the rates or charges made for such service. They are required to furnish a schedule as to the rates and also as to the movement of the cars.

"A street railroad is necessarily a monopoly along the streets where it operates. So long as it can furnish adequate service at reasonable rates no other street car company would be authorized to invade the territory where it renders service. Public corporations, like street railroads, have no means by which to obtain money for the operation of their business except such as is obtained from the public. The public are interested in a public utility for the reason that they rely upon it for service. The public utility can render that service only through the support that is given it by patronage. The public's interest goes to rates and service and is not concerned as to the individual or what the corporation is that renders the service.

"It follows, therefore, that if the jitneys enter upon the use of the streets to carry people for hire and ply their business along streets occupied or used by street railroads engaged in the same general class of business, the result must necessarily be that the operation of the jitney bus will reduce the income or revenues of the street railroad in proportion to the business it takes from the railroad, and if the service being offered by the utility already organized and operating in the field is adequate and reasonable in rates, there would be no necessity for another public utility to operate in that field.

"Prior to the enactment of the public utility law of this and other States, the only means for the regulation of the service and rates of public service corporations rested in competition. With such comprehensive law for the regulation of public utilities as exists in this State, competition is no longer essential to the protection of the public, but that protection is found in the authority granted the commission to investigate all matters concerning rates and service and make such rules concerning the same as are found to be just and equitable.

"We do not wish to be understood as holding or intimating that cases may not arise where it would be a public convenience and necessity to have the so-called jitney buses in operation. A certificate of convenience and necessity might be granted for the transaction of such business along streets and avenues of the cities and villages where no adequate or sufficient transportation is offered by any other public service corporation, and when such a case is presented to this commission, and if it is held that such certificate should issue, the commission will do so upon the condition that the company wanting to conduct such business shall first obtain all necessary licenses or permits which the local authorities shall require.

"In what is here said with reference to this case, we are simply following the law concerning public utility companies and giving renewed expression to the principle that this commission will not favor granting the right to any new public utility to invade the field where another utility operates and is able to render adequate service at reasonable rates.

"Since the law authorizes this commission to say what rates are reasonable and what character of service is adequate, it must go a step farther and make such rules as will protect the life of the public service corporations which are required under its control to serve the public."

RAILWAYS ENTER THE BUS FIELD

W. H. McGrath, vice-president of the Puget Sound Traction, Light & Power Company, Seattle, Wash., announced recently that the company, beginning on June 1, would place three twelve-passenger stages in operation between Auburn and Buckley, a distance of 21 miles. The business will be conducted under the name of the Washington Auto Bus Company, for which incorporation papers have been filed in Olympia. The new corporation is capitalized at \$25,000, and the trustees will be the managers of the Stone & Webster properties in the various cities in the State. These are: L. H. Bean, Tacoma; A. L. Kempster, Seattle; D. C. Barnes, Everett; and L. R. Coffin, Bellingham. Mr. McGrath is quoted as stating that if conditions warrant the company may extend its field from the long hauls in the comparatively sparsely settled sections to the cities.

Some of the officers of the Southwest Missouri Railroad, Webb City, Mo., have organized the Auto Transportation Company and have purchased two Indiana and two Packard trucks. Each of these cars has a capacity of twenty passengers. One of these cars is being operated from the terminal of the electric railway in Carthage to Jasper, a town of about 2000 inhabitants, 12 miles away. Another is being operated from the terminal of the electric railway in Galena, Kan., to Baxter Springs, a town of about 1000, 9 miles away. The other two are being operated between Joplin and Neosho, a town of about 4000, 20 miles away.

JITNEY AN ELECTION ISSUE AT LOS ANGELES

On June 1 the citizens of Los Angeles elected a new administration and voted on a number of referendums. Among the latter was one on the jitney bus, fathered by the Jitney Bus Association. The ordinance proposed by the association contained no provision for franchises, taxes or indemnity and even proposed a cut in the license fee from \$2.50 to \$1 a month. It also proposed to transfer traffic regulation from the police department to the Board of Public Utilities.

At the election the voters rejected the jitney men's ordinance by a majority of 8100. The ordinance of the Common Council, against which an injunction had been obtained, will now come up before the Superior Court of Los Angeles County, which has already decided in favor of an exactly similar ordinance in Venice. Splendid campaign work was done voluntarily by the railway employees.

To expose the worthlessness of this ordinance, the employees of the Los Angeles Railway organized voluntarily a trolley men's welfare league. One work of this organization was the preparation of a pamphlet entitled "The Street Car and the Jitney Bus," in which the economics of the problem were discussed from every angle. This pamphlet was distributed among the employees of the company and among a number of outsiders.

One of the circulars used in the campaign was headed "Vote 'No' June 1." It said in brief that the proposed initiative ordinance fostered by the autobus owners and operators association would repeal the city's present ordinance, passed unanimously by the City Council; eliminate the \$5,000 bond required of jitney bus operators for the protection of the public; make it possible for the jitney operators to charge any price they choose; fix a monthly license tax of only \$1; reduce the distance prescribed to govern jitney stops, and eliminate the requirement that jitneys operate all the way between advertised terminals.

The pamphlet by Norman Sterry, "The Street Car and the Jitney Bus," distributed by the Trolley men's Welfare League, was concluded as follows:

"Is it fair that the condition described should prevail? We leave it to the sober and intelligent judgment of the people of this community, confident in the sense of justice and of fair play that we believe pervades the minds and sentiments of a great majority of the people of this wonderful commonwealth, and we respectfully urge that as the first step in settling this question you vote against the adoption of the initiative jitney bus ordinance at the election next Tuesday."

In addition the Los Angeles Railway placed its attitude on the initiative jitney ordinance before the public. It sent a letter dealing with the curtailments forced upon it by the jitney, to all manufacturers and supply houses in Los Angeles, with whom it has commercial dealings and to large manufacturers generally. This letter was signed by C. A. Henderson as purchasing agent. A similar letter, except that it began "Since you are interested financially with us in the welfare of the city," was sent to all banks and large business interests generally. This letter was signed by Mr. Henderson as treasurer. One of the significant statements contained in the letter follows:

"Because of the competition to which we are subjected through unregulated jitney bus sniping, it has been necessary to reduce our shop work to five days a week instead of six, and to seven hours a day instead of eight, with consequent decrease in the amount of supplies purchased, and a decrease of about \$430,000 a year in pay rolls, which money eventually would find its way through the business channels of the city. This decrease in the payroll is equal to laying off 477 men."

Seattle Service Order Modified.—The Public Service Commission of Washington recently filed a second order against the Puget Sound Traction, Light & Power Company, Seattle, relative to service on the Fauntleroy and Alki Point lines, a previous order to the commission requiring cars sufficient to seat all passengers having been declared unreasonable by the Federal District Court. The commission now proposes to require seating capacity equal to about 90 per cent of the traffic during the rush hours of the late afternoon.

Handling Informal Complaints.—Upon motion of Commissioner William Hayward, the Public Service Commission for the First District of New York has appointed a committee of two on informal complaints. The chairman appointed Commissioners Hayward and George V. S. Williams as the committee. At least once in two weeks this committee will review all informal complaints and the correspondence connected therewith, and report to the commission what action should be taken to obtain effective results.

New Rules for Baggage.—The new rules for checking baggage made necessary by a recent amendment to the Interstate Commerce Act went into effect on June 2. Hereafter persons checking baggage for interstate transportation will be required to sign a declaration of its value on a form which the baggage master will provide. The new act makes it a misdemeanor to misrepresent the value of baggage or any interstate shipment. It will not be necessary, however, for owners of baggage to sign these declarations in person.

Standard Seating Space Fixed.—The Public Service Commission for the First District of New York has established the standard seating space for each passenger to be allowed on the longitudinal seats of street surface railroad cars as 17.78 inches. This is the average space occupied by each passenger upon such cars according to 800 different cases observed by the commission's inspectors. The establishment of a standard by the commission is mainly for the guidance of the transit bureau in determining the loading and overloading of cars.

Five-Cent Fare Within City.—In the case of the City of Seattle against the Puget Sound Electric Railway the Public Service Commission of the State of Washington hold that the company is required to carry passengers from Yesler Way to all points within the city limits of Seattle for a 5-cent fare. At present the 5-cent fare extends only as far as Spokane Street. The charge from Yesler Way to Davis Station is 12 cents and that to Floraville 14 cents. The order of the commission does not affect the rate to The Meadows, which is just outside the city limits.

Rhode Island Booklet Issued.—The Rhode Island Company, Providence, R. I., has issued an official timetable covering all lines under its operation, which is to be distributed free to the public. The book also contains the closing time and receiving stations for the electric railway express service. The timetable and guide was authorized by the trustees of the company and prepared for distribution by President A. E. Potter. The booklet contains thirty-two pages, with an index for the guidance to the various tables. Placards have been placed in a conspicuous place for the benefit of the public, informing them where the timetables may be obtained.

Traffic in Toronto.—On account of the reduction in receipts the Toronto (Ont.) Railway has found it necessary to reduce expenses, and the company has laid off seven men from the blacksmith shop, three from the fender room and twenty-five shedmen. One hundred other men are to be used as extra crews on the extra runs during the rush hours. R. J. Fleming, general manager of the company, says that the receipts for April were about \$35,000 less than for April last year, and that during the first seventeen days of May they were \$30,000 less than for the same period a year ago. Mr. Fleming admitted that the business has been affected somewhat by the jitneys, but he attributed the decrease in the traffic to conditions generally, to the number of soldiers who have gone to the war, and to the closing of factories and laying off of hands by manufacturing concerns. The city solicitor has been instructed by the Board of Control to take immediate action to prevent the company from reducing the number of cars in commission.

Personal Mention

Sir Edgar Speyer, who resigned recently as chairman of the Underground Electric Railways, Ltd., London, England, arrived at New York on the *America* on June 3. He expects to spend the summer at Bar Harbor, Maine.

Lord George Hamilton, deputy chairman of the Underground Electric Railways, Ltd., London, England, has been elected chairman of the company to succeed Sir Edgar Speyer, resigned.

Mr. Freeman T. Eagleson, Akron, Ohio, special counsel in the office of Attorney General Edward C. Turner, has been designated as counsel for the Ohio Public Utilities Commission to succeed Mr. Lawrence K. Langdon, whose appointment as a member of the commission is referred to elsewhere in this column.

Mr. Allen F. Edwards, vice-president in charge of purchases of the Detroit (Mich.) United Railway, was elected treasurer by the board of directors at a meeting held May 27 to fill the vacancy caused by the death of George H. Russel. Mr. Edwards will add the duties of treasurer to those of his present position. The board did not elect a director to succeed Mr. Russel.

Mr. C. O. Jenks, general manager of the Spokane, Portland & Seattle Railway at Portland, Ore., has been elected also a member of the board of directors and vice-president and general manager of the Spokane & Inland Empire Railway, Spokane, Wash., succeeding W. D. Scott, deceased. He has been elected also vice-president and general manager of the Pacific & Eastern Railway, with jurisdiction over the operating, mechanical and purchasing departments, succeeding Mr. William Gerig, resigned.

Mr. Lawrence K. Langdon, of Warren County, Ohio, was appointed a member of the Ohio Public Utilities Commission on May 27 to succeed Mr. Charles C. Marshall, resigned. Mr. Langdon was a member of the seventy-eighth and seventy-ninth General Assemblies. During the latter session, in 1911, he virtually prepared the original public utilities law. When Governor Willis assumed the reins last fall, Mr. Langdon was appointed counsel for the commission. His term as member of the commission will expire on Feb. 1, 1917.

Mr. L. O. Vesper has been appointed electrical superintendent of the works of the Aluminum Company of America at Massena, N. Y. Mr. Vesper is a graduate of Cornell University and until recently was electrical engineer for the Northern Ohio Traction & Light Company, Akron, Ohio. He had for a number of years been associated with the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, in the capacity of superintendent of construction and chief engineer, and was also with the West Penn Traction Company as assistant superintendent of transmission.

Mr. Herbert L. Harries has become general manager of the Washington-Oregon Corporation, with headquarters at Vancouver, Wash. He was until recently assistant operating superintendent of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., having been theretofore assistant general manager of the Louisville Gas & Electric Company, Louisville, Ky., of which his father, Gen. George H. Harries, is president. Like his father, Mr. Harries was enrolled at West Point. He is a first lieutenant in the ordnance department of the District of Columbia militia under presidential appointment.

Mr. Francis H. Dewey, president of the Worcester (Mass.) Consolidated Street Railway, has been elected president of the New England Investment & Security Company to succeed Mr. J. T. Harmer, resigned. Mr. Dewey was born at Worcester, Mass., on March 23, 1856, and was graduated from Williams College in 1876 with a degree of A. B. In 1879 Williams College conferred upon him the degree of A. M. Meanwhile, in 1878, he received from Harvard the degree LL.B. He has been solicitor and a trustee of the Worcester Mechanics' Savings Bank and the Mechanics' National Bank since 1880. He has been president of the Mechanics' National Bank since 1888, of the Worcester Consolidated Street Railway since 1898, and is also vice-president of three other street railway companies. He is a

director of the Norwich & Worcester Railroad, the Worcester Gas Light Company, Massachusetts Bonding & Insurance Company and the New England Telephone & Telegraph Company. He is president and treasurer of the Bay State House, a trustee and vice-president of the Worcester Railways & Investment Company and an officer of other corporations. He is a trustee, vice-president and treasurer of Clark University and Clark College, vice-president of the Worcester Art Museum, a director of the associated charities of Worcester, chairman of the commission for city hospital funds of Worcester, a trustee of the Memorial Hospital at Worcester, and a member of the Worcester County Bar Association.

Mr. Clark V. Wood, vice-president of the Springfield (Mass.) Street Railway, has been elected president of the company to succeed Mr. J. T. Harmer, resigned. Mr. Wood



CLARK V. WOOD

has also been elected a vice-president of several small roads in the Springfield system, these including the Milford, Attleboro & Woonsocket Street Railway, the Attleboro Branch Railroad and the Webster & Dudley Street Railway. Mr. Wood was born in Woodstock, Vt., on June 8, 1863. He was graduated from the Woodstock High School with the class of 1881 and at once entered the service of the Grand Trunk Railway as a telegraph operator. After serving on the Grand Trunk at various points between Montreal,

Can., and Portland, Maine, he took a more important position with the Boston & Maine Railroad as agent and then shifted to the New York & New England Railroad. He worked with this railroad, now a part of the New York, New Haven & Hartford, first as freight cashier and later as agent at Providence, R. I. The Pittsburgh & Lake Erie Railroad offered Mr. Wood its general passenger agency, and he went to Pittsburgh and made his office there during his period as passenger agent. He was later appointed private secretary to Mr. J. G. Odell, the vice-president of the road, and next became superintendent of the West Side Belt Railroad and the Pittsburgh Terminal Railway & Coal Company. Later he accepted the superintendency of the Wabash Railroad with supervision over the operation of the whole system consisting of more than 400 miles of track and coal and iron ore docks at Cleveland and Toledo. In 1900 at the request of Judge James H. Reed, president of the Philadelphia Company, Mr. Wood assumed the task of developing freight traffic on the lines of the Pittsburgh Railways. This Mr. Wood showed remarkable ability in doing. Having completed this work satisfactorily he resigned from the Wabash System, which he had temporarily left, and became connected with the electric railways in Springfield, Mass., then under the control of the New York, New Haven & Hartford Railroad. In 1906 Mr. Wood assumed charge at Boston of all traffic on the lines owned and controlled by the New England Investment & Security Company. His success in the operating department led the directors to create a new office for him, and Nov. 1, 1913, he was made vice-president in charge of the operating and traffic departments of the Worcester (Mass.) Consolidated Street Railway, Springfield Street Railway, Milford, Attleboro & Woonsocket Street Railway, Interstate Consolidated Street Railway and the Attleboro Branch Railroad. In this position he took over part of the work done previously by President J. T. Harmer, who has just resigned.

OBITUARY

Thomas Green, superintendent of transportation of the South Covington & Cincinnati Street Railway, Covington, Ky., is dead at his home here after an illness of several months of dropsy. Mr. Green had been in the employ of the company for twenty-eight years, rising from the post of driver of a horse car to motorman, inspector and finally superintendent.

Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (*) indicates a project not previously reported.

FRANCHISES

Bangor, Maine.—The Bangor Railway & Electric Company has received a franchise from the Council to double-track its line on Union Street, Bangor, for a distance of about 1200 ft.

Baltimore, Md.—Application will be made to the Council by the United Railways & Electric Company for a franchise to divert its Mount Washington line from Calvert Street to Charles Street between Center Street and German Street, Baltimore.

East Boston, Mass.—The Bay State Street Railway has asked the Council for a franchise to alter its tracks on Walley Street, East Boston, from Gladstone Street to Waldemar Avenue.

Kansas City, Mo.—The Metropolitan Street Railway has received franchises to lay a single track on Prospect Avenue from Forty-seventh Street to Seventy-second Street and to make the following extensions in Kansas City: Thirty-first Street south of Indiana Street; Twenty-fourth Street from Hardesty Street to Brighton Street; Twelfth Street east from Winchester Avenue and Broadway from Twenty-fourth Street to Southwest Boulevard.

Buffalo, N. Y.—The International Railway has asked the Council for a franchise to double-track its line on West Ferry Street and to extend this line through Gelston Street to a junction with Niagara Street, Buffalo. The company has also asked for a franchise to build a line on Michigan Street from Elk Street to Ohio Street and westerly along Ohio Street.

North Columbus, Ohio.—The East Linden Traction Company has asked the Council for permission to present a request for a franchise to build a cross-town line in North Columbus. The proposed route will be west on Hudson Street from Atcheson Pike to Neil Avenue, north to Dodridge Street and west to the east bank of the Olentangy River. Philip B. Gaynor, New York, president. [April 17, '15.]

TRACK AND ROADWAY

Fort Smith Light & Traction Company, Fort Smith, Ark.—New rails have been delivered along North Thirteenth Street, Ft. Smith, for use on that division. The double-track construction on the Electric Park Division is about completed.

British Columbia Electric Railway, Vancouver, B. C.—The Town Council of South Vancouver has offered to pave the center strip and to lay the tracks on Victoria Road and the unfinished portion of the line on Main Street.

Fresno, Coalinga & Monterey Railway, Fresno, Cal.—This company reports that on account of financial conditions it has not been decided when construction will be begun on its line between Fresno and Monterey. A construction company is being organized to build and equip the entire road. Ernest R. Shaw, 704 Mutual Bank Building, San Francisco, general manager.

Pacific Electric Railway, Los Angeles, Cal.—Plans are being made by this company to spend at once \$75,000 in improving its double track on American Avenue from Anaheim Street to Sixth Street, Long Beach, 3 miles. The improvement will consist of laying 127-lb. grooved or Trilby rails, paving between and at the sides of the rails from Anaheim Street to Sixth Street, reballasting the entire road-bed and repaving other portions of the street where necessary. The company has recently made improvements in Long Beach amounting to \$25,000.

Municipal Railways of San Francisco, San Francisco, Cal.—Plans are being considered by the Public Utilities Committee of the Supervisors for an extension across Golden Gate Park, San Francisco. The proposed line is to extend from Tenth Avenue and Fulton Street through Golden Gate Park to Fourteenth Avenue and Lincoln Way. Its terminus will be at Fourteenth Avenue and Judah Street. The roadway through Golden Gate Park will be depressed.

Norwalk & New Canaan Street Railway, Norwalk, Conn.—This company reports that owing to financial conditions construction has not been begun on its proposed line between Norwalk and New Canaan, 7 miles. The charter has been renewed by the Legislature of 1915 and efforts will be made to have the road built. James T. Hubbard, Norwalk, is interested.—[Aug. 15, '14.]

Alton, Granite & St. Louis Traction Company, Alton, Ill.—Preliminary arrangements are being made by this company to build an overhead crossing at the Chicago, Burlington & Quincy Railroad tracks and a subgrade crossing under the Chicago & Alton Railroad tracks so that the electric line may be extended to the site of the proposed hospital, 1 mile east of Upper Alton.

Southern Traction Company of Illinois, East St. Louis, Ill.—Plans are being made by this company to resume construction on its line across the municipal bridge. The company proposes to operate an electric line through the coal fields of Illinois to Du Quoin, passing through several important cities. The line between East St. Louis and Belleville is almost completed.

Aurora, Plainfield & Joliet Railway, Joliet, Ill.—Plans are being considered by this company to double-track its line on North Chicago Street between Webster Street and Ruby Street, Joliet.

Murphysboro & Southern Illinois Railway, Murphysboro, Ill.—Plans are being made to begin at once the construction of this company's 8-mile line between Murphysboro and Carbondale. A. B. Minton, Murphysboro, president. [Feb. 27, '15.]

Gary, Hobart & Eastern Traction Company, Hobart, Ind.—Plans are being made by this company to extend its line in Gary from Broadway east to Virginia Street and north to the mill gates.

***Vincennes, Ind.**—Plans are being considered to build a railway from Bicknell, via Bruceville and Aliceville, to Vincennes. John T. Oliphant, Vincennes, is interested.

Keokuk-Jefferson City Electric Railway, Keokuk, Ia.—Surveys have been made of this company's line from Keokuk to Newark. It is proposed to build an electric railway between Keokuk, Ia., and Jefferson City, Mo., via Wayland, Williamtown, Labell, Newark, Bethel, Shelbyville, Shelbina, Paris, Mexico and Fulton. H. W. Knight, Chicago, is interested. [March 6, '15.]

Mexico Investment & Construction Company, Mexico, Mo.—Plans are being made by this company to begin construction on its Molino-Sante Fe division about June 10. It is proposed to extend the line 14 miles southwest of Mexico if a bonus of \$30,000 can be secured from the citizens.

Trenton & Mercer County Traction Corporation, Trenton, N. J.—The Colonial Civics Club of Trenton is circulating petitions to the effect that an extension of this company's line on Hamilton Avenue and Olden Avenue be made to the Municipal Hospital.

Brooklyn, N. Y.—The Public Service Commission for the First District of New York has awarded the contract for the construction of section No. 2 of Route No. 49 to Oscar Daniels Company for \$863,775. This section is a part of the Culver rapid transit railroad in Brooklyn, which will connect with the Fourth Avenue subway. The route runs through Gravesend Avenue and Shell Road to Coney Island. The part just placed under contract extends from Bay Parkway (Twenty-second Avenue) through Gravesend Avenue and Shell Road to Avenue X. The road will be an elevated line, and the contractor must complete it within 18 months. The new road will be operated by the New York Municipal Railway Corporation in connection with the Fourth Avenue subway.

International Railway, Buffalo, N. Y.—This company will double-track its line on Virgil Avenue from Hertel Avenue to Kenmore Avenue, Buffalo.

Wallkill Transit Company, Middletown, N. Y.—This company is considering plans to extend its line to connect with the Orange County Traction Company's line at Walden. Surveys have been made of the proposed extension.

Northern Ohio Traction & Light Company, Akron, Ohio.—This company has recently purchased from the Algoma Steel Company of Canada 500 tons of steel rails.

***Custaloga, Ohio.**—Plans are being considered to build an electric railway from Custaloga to Big Prairie, 1½ miles. John C. Lake, Big Prairie, is interested.

***Bristow, Okla.**—Surveys have been begun by St. Louis capitalists for a railway to be built from Bristow to Drumright and from Bristow to Okmulgee. W. Mathews, St. Louis, is among those in charge of the engineering work.

Berlin, Ont.—Ex-Mayor W. D. Euler, Berlin, district vice-president of the Ontario Hydro-radial Union, has sent to the municipal councils of the cities of Berlin and Guelf and the townships of Waterloo and Guelf resolutions for endorsement, requesting that the hydro-electric commission make a survey for a hydro-radial railway from Berlin, via Bridgeport, Bloomingdale and New Germany, to Guelf.

Sudbury-Copper Cliff Suburban Electric Railway, Sudbury, Ont.—Plans are being made by this company to resume construction this month on its line between Sudbury and Copper Cliff. All of the grading has been completed, most of the ties placed and some track laid. J. H. Mackey, Sudbury, president. [Dec. 19, '14.]

Toronto (Ont.) Suburban Street Railway.—Track has been laid on this company's line from Islington almost to the west bank of the Humber River and a temporary bridge erected over Mimico Creek. The piers and abutments for the bridge across the Humber River are practically completed and it is expected that the material for its construction will be delivered soon. Ballasting has been begun along the line to Georgetown and tracklaying has been begun west of Georgetown.

Portland, Eugene & Eastern Railway, Portland, Ore.—This company plans to spend \$15,000 this summer on improvements to its line.

***Huntingdon, Pa.**—Plans are being considered to build an electric or steam railway between Huntingdon and McAlevys Fort. H. G. Tussey, McAlevys Fort, is interested.

Conestoga Traction Company, Lancaster, Pa.—At a recent meeting of the Lancaster Chamber of Commerce announcement was made that within the next few weeks work will be begun on a \$300,000 underground conduit system to be used exclusively for the wires of this company and the Edison Electric Light Company.

***Milford, Pa.**—Residents of Milford are making a united effort to secure a railway from Milford to Port Jervis, N. Y. The Business Men's League of Milford have received a proposition for the town to pay a part of the cost of the improvement. Solicitors of Milford are now canvassing for the money.

Phoenixville, Valley Forge & Strafford Electric Railway, Phoenixville, Pa.—Plans are under consideration by this company to extend its lines into Montgomery County from Phoenixville.

Reading (Pa.) Transit Company.—During this year this company plans to expend \$180,000 in Reading for track renewals and paving. About \$100,000 will also be spent on improvements at Lebanon and other places along the company's lines.

West Chester (Pa.) Street Railway.—New ties are being laid by this company and its overhead system renewed in West Chester.

Quebec Railway, Light, Heat & Power Company, Quebec, Que.—A by-law to compel this company to extend its lines to St. Malo and Belvedere Wards will shortly be voted on.

Three Rivers (Que.) Traction Company.—Construction has been begun on this company's line in Three Rivers and the suburban extension to Cap de la Madeleine, 7 miles. It is expected that the line will be completed by Sept. 1. T. McDougall, president. [Mar. 20, '15.]

Regina (Sask.) Municipal Railway.—The Council of Regina has authorized the expenditure of \$10,000 to build an extension of the Young Street line to connect the new power house in Regina with the Canadian Pacific Railroad line.

Savannah, Piedmont & Western Railway, Columbia, S. C.—Financial arrangements are being completed for the construction of this company's line between Greenwood and Augusta, 60 miles. Preliminary surveys have been made and rights-of-way obtained for practically the entire line. J. Peyton Clark, 43 Cedar Street, New York, is interested. [April 3, '15.]

Carolina, Greenville & Northern Railroad, Greenville, Tenn.—Plans are under consideration by this company to extend its line from Kingsport to Bristol, 25 miles, and from Newport to Knoxville, 40 miles. The proposed main line is from Kingsport via Greenville to Newport, 75 miles. This would make the entire line 140 miles. It is expected that construction will be begun soon. H. S. Reed, 205 Grant Building, Los Angeles, Cal., president.

San Antonio & Austin Interurban Railway, San Antonio, Tex.—Plans are being made to resume construction on this proposed line between San Antonio and Austin. About 60 per cent of the right-of-way has been obtained and it is expected that it will be possible to begin work late in the summer or early in the fall. V. P. Brown, San Antonio, is interested. [April 3, '15.]

Ogden, Logan & Idaho Railway, Ogden, Utah.—Grading has been begun and track laid on this company's extension to Huntsville.

Gray's Harbor Railway & Light Company, Aberdeen, Wash.—An extension of its North Hoquiam branch from the present terminus at the Lytle Mill to the Little Hoquiam Bridge, 1 mile, is being considered by this company. The franchise for the right-of-way was granted the company some time ago.

Walla Walla (Wash.) Valley Railway.—This company is reconstructing some of its track in Walla Walla. The rails are 72 lb., and the ties and rails are being laid in concrete.

Princeton (W. Va.) Power Company.—The construction of track has been begun on this company's line from Princeton to Bluefield, 12 miles, and the work will be steadily continued to completion.

Southern Wisconsin Railway, Madison, Wis.—In connection with improvements which the city is expecting to make before Nov. 1, 1915, this company plans to reconstruct and pave its roadbed between Park Street and Mills Street and to pave the roadbed on Williamson Street between Blair Street and Jenifer Street.

SHOPS AND BUILDINGS

Shore Line Electric Railway, Norwich, Conn.—This company expects to build a new carhouse on Montauk Avenue, New London. The structure will be 75 ft. x 220 ft., one story with basement. The trim will be limestone, granite and terra cotta and the sashes and doors will be steel. The floors will be reinforced concrete. The structure will eventually replace the present wooden carhouse, but the initial construction will be that of a building at the south of the present carhouse. Plans for the new carhouse will be ready in the office of Cudworth, Woodworth & Thompson, Norwich, in about two weeks.

Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind.—Fire early on the morning of May 19 destroyed the carhouse of this company at Twenty-sixth Street and Kossuth Street, Lafayette, as well as eight closed cars, five summer cars, a snow sweeper, a sand car and the \$10,000 electric brake test car "Louise." The loss is estimated at \$75,000.

Boston (Mass.) Elevated Railway.—Plans have been completed by this company for the erection of a concrete and steel transfer station at Lake Street, Chestnut Hill, to be placed in service by the fall of 1916. The station will supersede an umbrella-type open-air station at the junction of the Boston Elevated Railway and Middlesex & Boston Street Railway. The new installation will include platforms at two levels, with loops and inclines providing for the separation of in-bound and out-bound traffic, with quick transfer between parallel lines. The new station will do away with the present shelters and eliminate two of the four tracks now in service. The cost is estimated to be \$60,000.

Worcester (Mass.) Consolidated Street Railway.—This company has completed its freight and trolley express station at Adams Street, Leonminster. Connecting tracks from the Union Street branch of the cross-town line have been laid.

Toronto (Ont.) Civil Railway.—A temporary carhouse has been built by this company on its Bloor Street line between Dorval Road and Indian Road to accommodate the cars now operating on that line. It is a frame structure, 85 ft. by 21 ft. with a pit track.

Manufactures and Supplies

ROLLING STOCK

Toronto (Ont.) Civic Railway will receive tenders up to June 8 for four city cars for its Lansdowne Avenue extension.

Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind., at a recent fire which destroyed its car barns, lost eight closed cars, five summer cars, a snow sweeper, a sand car and an elaborately equipped electric brake test car. It is reported that the cars will be replaced at once.

TRADE NOTES

Sangamo Electric Company, Springfield, Ill., has removed its office at Rochester, N. Y., to the Mercantile Building.

Ohio Brass Company, Mansfield, Ohio, has received an order for Tomlinson M. C. B. couplers for ten cars of the Wilkes-Barre & Hazleton Railway and automatic air couplers for ten cars of the Lehigh Valley Traction Company.

Esterline Company, Indianapolis, Ind., manufacturer of "Golden Glow" headlights, has received an order from the Pressed Steel Car Company for thirty SR-95 headlights for the new cars of the New York, Westchester & Boston Railway.

Pyrene Manufacturing Company, New York, N. Y., is reciprocating with the automobile trade by motorizing its sales department. The company recently bought six Ford automobiles, which are in use in several different branch offices and which will be used entirely by salesmen and not for deliveries. Each automobile will be equipped with a Pyrene fire extinguisher.

Ohmer Fare Register Company, Dayton, Ohio, on May 20 held its twenty-fourth semi-annual distribution of prizes to the employees in the company who had made the best suggestions during the past six months for improvements in fare registers, for more efficient practices of manufacture or for the betterment of the employees and the business in general. After a talk by the president, John F. Ohmer, eighteen men received cash prizes for their suggestions.

Standard Railway Supply Company, Cincinnati, Ohio, has purchased the manufacture, sale and ownership of the "Kisinger (K-I)" patented splicing sleeve from the Standard Pulley Company of Cincinnati. This sleeve is made in various lengths and for all types of trolley wires and cables, and with it an effective and permanent splice can be easily and quickly made, requiring only the insertion of two small tempered steel wedges into the sleeve. No soldering is necessary. John D. Berger is manager of the Standard Railway Supply Company.

Sanderson & Porter, New York, N. Y., report that the first four sections, comprising about 47 miles, of the oil pipe line for the Valley Pipe Line Company, a subsidiary of the Shell Royal Dutch Company, which was designed and is being built by Sanderson & Porter, was placed in successful operation on May 15. This line is 170 miles long, extends from the Coalinga oil fields to a tidewater terminal near Martinez in San Francisco Bay, and will have a carrying capacity of 25,000 barrels per day. In order to comply with the wishes of the Shell Company for prompt completion, the constructing engineers, Messrs. Sanderson & Porter, have pushed this work through in what is believed to be record time.

ADVERTISING LITERATURE

Walter A. Zelnicker Supply Company, St. Louis, Mo., has issued a folder on its tank-car tanks.

Pressed Asbestos Products Company, New York, has issued a catalog describing its Papco products for various uses as an electrical dielectric and heat-resisting material.

Trolley Supply Company, Canton, Ohio, has issued two folders, one on the McLain No. 25 extended dash headlight and the other on the Simplex roller-bearing trolley base No. 3.

Chicago Pneumatic Tool Company, Chicago, Ill., has issued Bulletin No. 34-U, which contains instructions for controlling and operating its class N-SO fuel-oil-driven compressors.

Robert W. Adams, Providence, R. I., has issued a folder describing the new "Engineers' Edition" of his transmission line calculator for determining voltage drop and power loss in a.c. circuits.

Westinghouse Traction Brake Company, New York, N. Y., has received an order for air-brake equipment with emergency feature for the two trailer and two motor cars recently ordered by the Alabama Power Company from the Southern Car Company.

Ohmer Fare Register Company, Dayton, Ohio, has issued a card on its fare registers. The card announces an order from the Albany Southern Railway to equip its entire system with fare registers of this company as a result of satisfactory trial service.

Trussed Concrete Steel Company, Detroit, Mich., has issued a catalog illustrating the Kahn Pressed Steel type of building construction for industrial plants. In floors these pressed steel beams eliminate inflammable wood joints, giving a permanent construction of great strength. Upon these beams which are placed 23½ in. on centers, is laid ¾ in. Hy-Rib and concrete applied. Where wood floor is desired wood sleepers are attached to the pressed-steel beams by nailing between the channels. For the ceiling under the beams the ¾-in lath is readily attached by means of prongs on the underside of the beams.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued two switchboard publications, DS 1439 and 1456, which give unusually complete information on this subject, the former covering a.c. switchboards with hand-operated switchboard-mounting oil circuit breakers, and the latter rotary-converter panels. Complete detailed information is given on these types of boards, including a number of diagrams, and suggestions as to the best method of assembly. Another publication has been issued by this company entitled "The Relation of Trolley Feeder Taps to Machine Flash-Overs," which is a reprint of an article which recently appeared in the ELECTRIC RAILWAY JOURNAL. This article discusses the above-mentioned subject, giving the reason for the application of the tap and the various conditions affecting the flash-over, quoting numerous instances where rotary converters had flashed over.

General Electric Company, Schenectady, N. Y., has issued Bulletin No. 41,013, giving a detailed description of its type RC d.c. commutating-pole motors. These motors are built with a frame of cast steel of medium weight with symmetrical section. They can be used with a sliding base which maintains a correct driving alignment, and which, with the adjustable shields, permits the installation of the motor on either the floor, wall or ceiling. As these motors may be equipped with covers rendering them semi-enclosed, totally-enclosed, or self-ventilated, they are wound for 115, 230 and 550 volts d.c. circuits, with permissible voltage range of 110 to 125, 220 to 250 and 500 to 600 volts. Bulletin No. 44,406 describes and contains characteristic curves of the GE-247 ventilated commutating-pole railway motor, for city service. By the adoption of the box type of frame and a specially effective system of ventilation and by the use of pressed steel for certain parts, it has been made sufficiently light in weight for use in light cars without any sacrifice of strength or reliability. This motor has hourly rating of 35 hp on 600 volts and 30 hp on 500 volts.

The Northwestern Elevated Railroad, Chicago, Ill., has recently issued a booklet which contains an illustrated description of its line and the character and extent of its service. An interesting comparison is made of the urban and suburban transportation problems of Chicago with those of other large cities. New York, London, Paris, Boston, it is shown, are cities which have in a measure become set along certain lines, making the providing of transportation a determinable problem. Chicago, however, has been free to grow in all directions save one. With this enormous and rapid growth in a territory which offered no impediments, the open prairie of Illinois, there has always been "plenty of room to spread out." The transportation problem has, therefore, been to serve an urban population only slightly less than that of Manhattan Island, but occupying a very much larger area.