

Electric Railway Journal

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The Electric Railway a "Regular Gold Mine"

ELECTRIC railways have often been likened to gold mines in the popular version, but the defenders of the industry have not appreciated how truthful the analogy was in some respects. One of these is that they have been required by statute to sell their product at a uniform price, for the electric railway at 5 cents per ride, and for the gold mine, \$20.67 an ounce. Both the electric railway corporation and the gold mining corporation are faced with greatly increased operating costs, they have not been able to change the price of their product to conform with changes in cost of production.

It has been hard to find another industry suffering from the same malady as the electric railway industry which has usually been pointed out as the lone sufferer. But now we learn from a statement made to Congress by Harold N. Lawrie, economist for the American Mining Congress, that gold mines are being closed down at an alarming rate because of the fixed price of that which they sell and the greatly inflated price of that which they buy—labor, tools, materials, etc. The gold producer finds the actual purchasing power of an ounce of gold is now \$9 instead of \$20.67. The result of this condition is shown by the figures covering gold production in the United States. It has fallen from \$101,000,000 in 1915 to \$58,500,000 in 1919, a loss of 42 per cent.

Having found a *camarade en misère*, perhaps the electric railway industry may find some consolation in the fact that, at least, to get an increase in the selling price of its commodity, it does not have to upset the whole monetary system of the nation and possibly cause international complications.

Don't Kill the Safety Car Goose!

JUDGING from a recent occurrence, the Reuben who killed the goose that laid one golden egg per diem in order to get the whole El Dorado at once left some progeny that blundered into the electric railway field! At any rate, this is what happened.

The company had put on a number of cars equipped with safety appliances. Imagine the general manager's astonishment, therefore, when the claims department told him that several severe accidents had occurred in connection with these cars. Incredulous, he asked for a detailed statement of accidents car per car. No sooner had this list been examined than it developed that the very cars that had been responsible for the worst cases were not equipped with the requisite safety appliances at all. It also proved that the transportation superintendent was so carried away by the platform savings of the safety cars that he had sent out quite a number of

the regular style of car at irregular intervals with but one man each. Of course, this was a most unwise proceeding, for not only did the accidents obliterate the platform savings, but they also gave a black eye to the cars which had been properly converted.

Another similar practice which is not to be commended is that of regularly mixing in service new safety cars and old one-man cars without any safety appliances whatever. Even if the company is lucky enough to escape accidents, it cannot escape deserved criticism. In one instance, this policy has afforded an unreasonable labor element to agitate against any and every class of car having a single operator. Thus, exceeding haste to achieve the economies which electric railways so sorely need is in danger of defeating its purpose. With the right way, the popular way and the successful way made so clear by the experience of scores and scores of electric railways, there is no worth while excuse for policies of the kinds criticized.

The Railway Power Substation Is Developing Rapidly

PARTLY by coincidence and partly by intention this issue of the ELECTRIC RAILWAY JOURNAL contains an unusual aggregation of articles on substations. Two important associations, the A.I.E.E. and the C.E.R.A., met during the past few days and spent much of their time discussing this topic. The fact simply illustrates the prominence of the substation in the minds of railway people today. No subject of recent years involves more interesting and important technical questions, and the substation plays an important part also in operating economy.

Consider for a moment how vital the substation is to economical distribution. In the good old days of direct current power generation the area over which current could be distributed was limited and the required amount of feeder copper was frightful. Alternating current distribution simply had to be developed, for the people had to have better transportation. Motor-generator sets were naturally used first, but the invention of the rotary converter followed as a matter of course. Then began a marvelous development in both of these pieces of equipment and in the apparatus for controlling them, which continues to this day. The rotary forced for a time the installation of 25-cycle generating machinery, for inherently the synchronous motor is a low-frequency machine. But other forces have been at work to counteract this, especially the necessity for making provision to utilize the same power plants for railway, industrial power and lighting services. Of these all but the first-named demand higher frequency, preferably 60 cycles. Now the tendency is towards 60 cycles for all purposes and the railway substation has been modified to meet the times.

Within the past few years have come all sorts of radical improvements in the substation. Automatic control is possibly the most spectacular, but this is only one of many; some at least were partly made necessary by the advent of automatic control, others not. For example, there is the use of load-limiting resistance. This is a feature of automatic control, but it is useful almost anywhere. In the same category come the devices for preventing flashing at the converter commutator. And the improvements in starting qualities of converters must not be forgotten either.

But the subject is too large to permit here more than the pointing out of the high spots. The articles scattered through this issue give the details. They are worthy of careful study. They indicate that modern substation progress is something to be proud of.

The St. Paul Locomotives and Standardization

IT IS of exceptional interest to compare the locomotives which have been produced by the two electrical concerns manufacturing electric locomotives in the country, both to fit or satisfy the same general specifications and to meet the requirements of the Chicago, Milwaukee & St. Paul Railroad. How, we inquire, can we even expect standardization of design in heavy electric traction when such different machines will satisfy similar requirements and both be based on good engineering? And well may the question be asked. Here are two products, each of them a wonderful conception and accomplishment in itself. In neither of the locomotives is any really new practice present. The designing engineers state that they have followed proved theories of design in new combinations, to be sure, but not departing much from trails already blazed. Yet, on the surface and actually in many major details, the final products differ widely although each will undoubtedly prove thoroughly satisfactory in the service required. It is not unlikely, however, that time will show some weak points as well as the strong points of each type.

But does the fact that it is possible to build two admirable machines, though different; for the same service militate at all against a study of the desirability of standardization? It may be and probably is too early now to settle upon any standards in this line. We are yet in the development stage. But, if we needed an example of duplicate engineering which could be obviated if standardization were effected, this, it appears, is one. Cannot the electric railway industry study the question with a desire to find out if such standardization, not only in locomotives but in other equipment, is not desirable. Who would have said, years ago, that it would be possible to have a standard telephone transmitter and receiver which would be universally useful for communication between any two points on the earth? And yet that goal is almost reached. From the illumination field, take a leaf and with all the different reflectors and fixtures on the market, who would have thought standardization possible? And yet, the R.L.M. standard has been evolved for one field.

On the other hand, it is quite conceivable that these two locomotives are a step toward a realization of certain fundamentals of electrical locomotive design. The fact that these two companies are both producing equipment for one requirement and railway is of significance. The electric railway must look forward to the time when it has realized its every opportunity in the transportation

scheme, and when it has there will be much more nearly universal use of electric locomotives and other electric motive power. There will be much interconnection of electric lines and interchange of electric equipment. Now is no time to revive any so-called "battle of systems," but is rather one of opportunity to work ahead toward the solution of the many problems in the realization of electric traction's greatest opportunities.

Should the Electric Railway Brain Workers Organize?

THE great war has produced as many topsy-turvies in our economic as in our political relations. One of the most impressive and depressive reversals is the way the intellectual worker has failed to keep pace with the cost of living in contrast to the manual worker who in some instances has actually outstripped the rise in cost. However, as generalizing on this subject is not new, it may be well to submit some truly startling figures from the monthly records of a large eastern electric railway.

Beginning with "general administration," we find that all the executive officers themselves averaged less than \$14.50 per diem and their assistants less than \$3.00 per diem. In the way department, all engineers, draftsmen, office employees, etc., below the rank of chief engineer and sub-division executives averaged \$4.59 per diem, which princely stipend was just 3 cents more than that of the lyric, though illiterate tenors, who do their tamping, spiking, etc., in death march rather than jazz time. In the electrical department, the insiders, counting from the chief down, did a little better, but at that they were only 47 cents above the \$5.40 a day averaged by the overhead linemen and similar workers. In the equipment department, we find that the men who do the planning, directing, testing and recording are stopped from enriching the alumni funds of their one-time universities because they average but \$5.23 a day—just 7 cents more than is paid to the graduates of the Horny Hand Elementary School in the repair shop for their more personal researches in the nature of steel, iron, copper, oil, etc., before and after being railroaded. But our *piece de resistance* is in the transportation and traffic department. Dismissing the handful of superintendents and other higher officials with their lobster-diet pay of \$7.84 a day, we note that the remaining supervisory officials, such as inspectors and dispatchers and the clerical staff, are an unlucky 13 cents a day below the \$4.97 paid to the motormen and conductors.

The real inequality in the pay of brain versus brawn employees is much greater than the foregoing figures indicate. The brawn-worker is paid for an average of nine to ten hours a day. Overtime means more pay and often at a higher rate and he can't take his work home. The brain-worker's hours may nominally be less, but actually they are more for any man who likes his work, and most brain-workers are afflicted that way. Unpaid overtime whether in the office or in his home is a matter of course.

A further point to consider is that any increase in pay to the brain-workers means far less to the payroll than a like increase to the brawn-workers. On this particular property, the *intelligentia* are but 20 per cent of the total employees, even when all executives and departmental heads are included. The platform men alone constituted 57 per cent of all employees (there is no

power house staff) and commandeered 50 per cent of the payroll. Great is the power of organization for a common purpose.

Some may say that the answer to this is organization among the salaried workers. We do not think so, though to the company the spectre of a rapid deterioration and discouragement of the men who can do more to make or break their employer's interests than any other group whatever should be no less dangerous than that of organization. This much, however, is possible where these conditions prevail. For its own protection the company should bring these salaries as nearly as it can to an adequate standard and make the rest of the increase when its finances permit. The employees, on their side, should realize that their pay must not be gaged dollar for dollar with that of the track laborers and such other workers as have practically reached the limit of remuneration possible to them in railway work. The salaried man has a future before him and there is no limitation to the amount which he can earn if he demonstrates ability. The track-pounder is practically at the maximum of his earning capacity. The blame for the present state of affairs rests, of course, largely on the public which has not permitted rates sufficient to permit railway companies adequately to recompense their salaried employees. In many cases, we believe, it would be worth while for these men to bring their plight before the public at large for the reason that public understanding of and co-operation with electric railways will thereby be widened far more than by controversies concerning platform wages alone. It bodes ill for any industry when specialized training, experience and loyalty have to be so poorly rewarded as they are in the electric railway field at this very moment.

A Real Opportunity for Service to the Utilities

AT THE Cleveland meeting of the executive committee of the American Association an interesting presentation of the work of the Illinois Committee on Public Utility Information was made by its director. The executive committee took action which indicated practical interest in this movement which has already spread beyond the confines of Illinois. The Illinois committee is performing a useful function in supplying utility data to newspapers and other agencies for public enlightenment. The aim of the committee is to furnish simply the plain, unvarnished facts. The way in which city editors have used the material sent them, and a city editor is an eclectic individual, shows that the committee is rapidly ensconcing itself in their favor.

One of the latest enterprises is the issuing of a monthly speakers' bulletin, the first number of which is mentioned in our news notes this week. The bulletin is newsy and interesting. It can serve a useful purpose in stimulating good public speaking. If kept free from bias, as we understand is the plan, it will be of great assistance in promoting that condition so greatly desired—good public relations.

The cordiality of the reception of this work of the Illinois committee suggests the desirability of capitalizing the comparatively active public interest that has been awakened during the war and armistice period in the fate of the transportation utility. Good will is a company's best asset. It will pay to cultivate it, first by good service, then by good salesmanship.

Get Closer to Your Customers

A DEPARTMENT store proprietor who has been conspicuously successful in his business was asked recently to what factor he was most indebted for his prosperity. Was it because his prices were lower or his advertising so telling? As to prices, he replied that they were not always lower but that the goods were always exactly as described—a fact which bred confidence. So, too, his advertising had been a big factor in his success, not alone in the direct offering of his wares but also in the opportunities it gave him to talk to the public as a man of civic spirit on topics of general welfare. But there was still another factor, and that was his system of determining what complaints people had to offer against his service. The usual way of others in securing such information was to get it during the heat of the misunderstanding and to settle the argument on the basis of "The customer is always right." Of course the customer was not always right and would realize that fact on sober, second thought but too late to take the initiative in compensating the merchant or doing the right thing for the injured employee.

Feeling that the time to get at the truth is when the subject can be seen in perspective, this merchant has evolved a system of letters and personal calls through which past or prospective patrons are requested to suggest improvements in service or standards of quality in merchandise, or to mention incidents that led to their discontinuance of patronage. In this way he secures a large amount of dispassionate and constructive criticism that enables him to adapt his store to the standards set by the kind of customers he desires and to attain a much better relationship between his customers and his employees than would otherwise be possible.

If an electric railway were to follow the same policy, not necessarily in a house-to-house canvass but before groups of different classes of the population, it would be sure to learn much that would be beneficial. For example, it might be astonished to find that some of the business men know very well that the headways haven't been changed in years or the routes altered 1 in. despite the growth of the city. Here, then, is an opportunity to explain to them why it has not been possible to make such changes. Another man will ask why the community can't have faster and more reliable cars. He has had the impression all along that the local management was too fast asleep to know that such cars were to be bought. Here, again, is an opportunity to explain that if you can't pay interest on money borrowed in the past, you can't get anybody to loan you new money now.

In contrast to the numerous occasions where it is possible to show the other fellow that he has been unfair, it is likely enough that the outsider can point to many a fault that rarely if ever comes to the manager's attention by direct complaint. A man who has been passed up by a heedless motorman, may swear and grumble about the matter, but he is not likely to take his pen in hand to write a letter about it if he can get to his destination by walking. The railway is out a profit-bringing rider and there's an end to it. In one case, these heart-to-heart talks brought out the fact that nearly all complaints of this particular character came on the lines where only hand-brake cars were used, thus indicating that the use of the air brake would do more to settle the most frequent source of complaint than any number of admonitions and dismissals.

Noiseless Feature Is Effective in a Simply Constructed Substation

The Cooling Air Is Pulled Down Through the Converter and Muffled on Up-shoot Through the Transformers



NOISELESS SUBSTATION SHOWING TRANSFORMER ROOM VENTILATION OPENINGS AT FLOOR LINE AND HIGH-TENSION LINE ENTERING AT CEILING

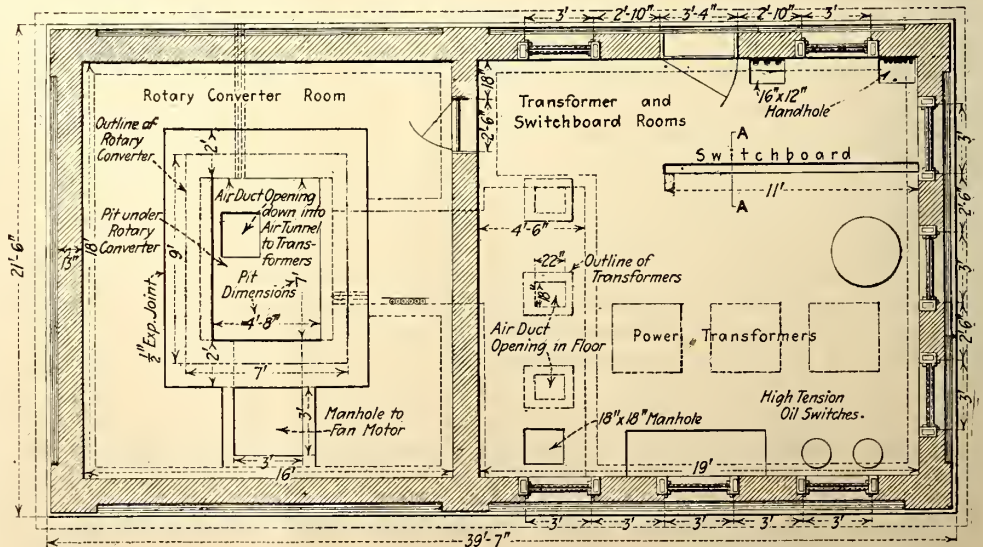
OPPOSITE SIDE OF SUBSTATION SHOWING OUTGOING FEEDER CABLES AND WAITING ROOM CONVERTED INTO CONFECTIONERY STORE

SOME time back the Birmingham Railway, Light & Power Co., found it desirable to install a 500-kw. railway substation at a point within the city where the Gate City, East Lake and Tidewater lines intersect. This intersecting point was very close to the actual load center of the section of the system it was desired to serve. A piece of property at this location was available and the company erected a substation and placed it in operation. This load center was also in a good residential section, and it was not long before the noise of the rotary converter brought such a protest from the surrounding neighbors that it became necessary to move the substation to another point. A point near the end of one of the intersecting lines was selected as the most desirable of the available locations, but this was so far removed from the load center that it made the line losses very heavy and the voltage regulation unsatisfactory. From an economic standpoint it was therefore decided that it was necessary to have a substation located at the load center previously chosen, and so the engineering department, of which L. L. Newman is the chief and H. E. Cox is assistant, set about the task of designing a noiseless substation. The desired result was simply yet most effectively attained in the new Woodlawn substation.

The substation was therefore built in two rooms, one room for the converter being sealed up tight except for an opening in the roof, and another room for the transformer, switchboard, etc., which has a door and windows, but these are kept closed. The cooling air for the transformers is drawn in through a cupola in the roof of the converter room by a motor-driven fan placed in the pit underneath the converter. The air is thus drawn down through the converter and forced down into a tunnel beneath the floor of the converter pit and thence through this tunnel to three openings in the floor of the other room, up through the three single-phase transformers and out through



Section A-A of Cable trough behind Switchboard



FLOOR PLAN OF THE WOODLAWN SUBSTATION SHOWING THE LOCATION OF THE VARIOUS PIECES OF EQUIPMENT

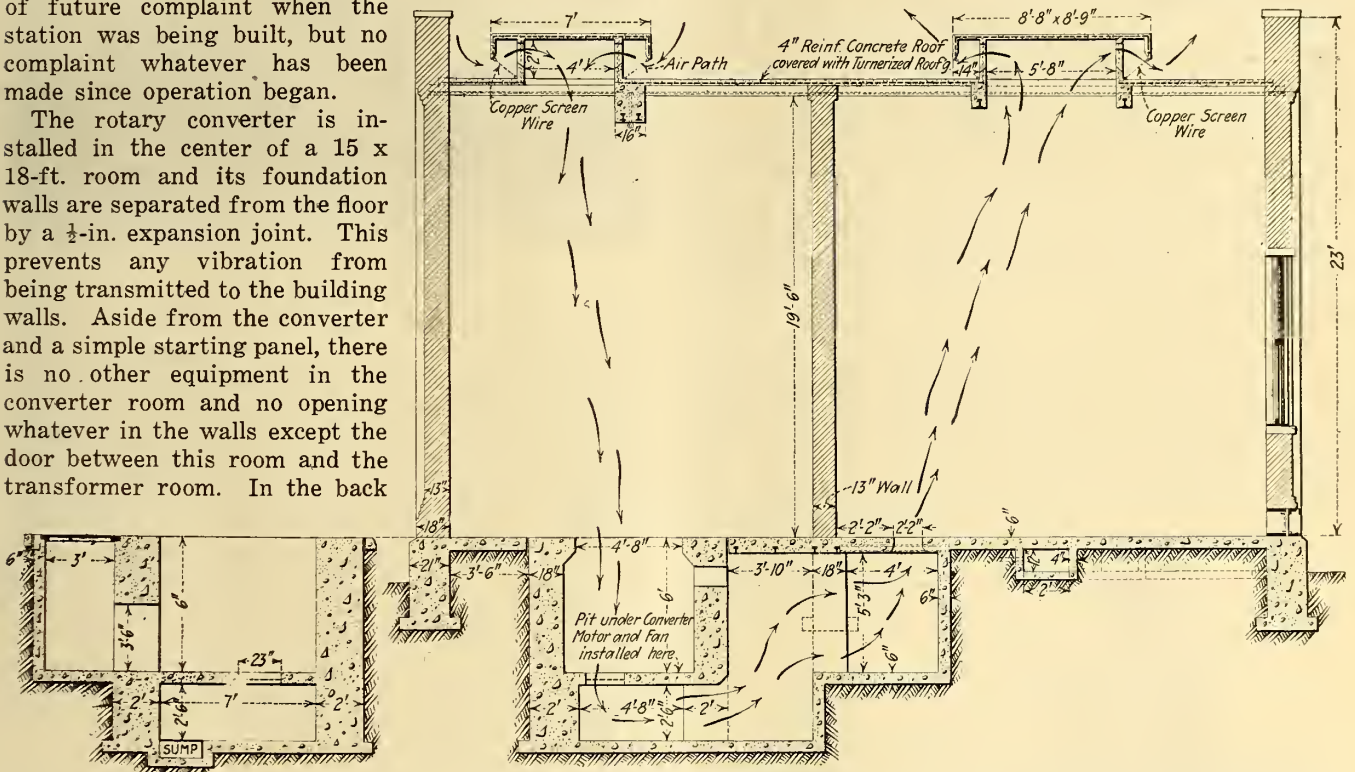
In working out the design it was assumed that the transformer cooling air leaving the building was largely responsible for transmitting the noise of the rotary con-

the cupola in the roof of this room. Passing the air through the station in this manner gives the noise of the converter carried with the air stream an opportunity to be diffused or muffled as it passes up through the transformers. And as the air leaving the cupola of the transformer room might still carry some noise, the roof of the cupola is so constructed as to deflect the stream of air down against the roof, and the coping, projecting 18 in. above the top of the roof, then reflects it upward. The transformer coils have apparently made a most effective muffler, or if the noiselessness cannot be attributed to this alone, at least the scheme as a whole has been a complete success.

The 1,000-kw. rotary now installed in the station cannot be heard at all 15 ft. away from the building walls. The people in the neighborhood gave warning of future complaint when the station was being built, but no complaint whatever has been made since operation began.

The rotary converter is installed in the center of a 15 x 18-ft. room and its foundation walls are separated from the floor by a 1/2-in. expansion joint. This prevents any vibration from being transmitted to the building walls. Aside from the converter and a simple starting panel, there is no other equipment in the converter room and no opening whatever in the walls except the door between this room and the transformer room. In the back

The cupola over the transformer room is built and equipped the same as that over the converter room except that it is larger. The transformer and switchboard room is also equipped with eight 12 x 18-in. openings in the walls at the floor level for ventilation purposes, in order that the doors and windows may be kept closed in warm weather to keep down the noise. These were equipped with grating so that the amount of opening could be regulated. They were placed at the floor line on the theory that the heat within the room would cause the air to enter here, rise and exhaust through the ventilators in the roof. However, it has been found that the transformers muffle the noise of the converter so completely that it is even possible to leave the windows and doors in this room open in summer without disturbing the neighbors.



CROSS-SECTION THROUGH NOISELESS SUBSTATION SHOWING PATH OF COOLING AIR THROUGH THE STATION

wall of the transformer room an opening was arranged for use in case it was necessary to remove the converter. This was done by placing a rail in the wall horizontally as a beam, and bricking in the space below so that the bricks can be readily knocked out.

The air intake openings in the cupola are covered with fine copper mesh to prevent water and dust from being drawn in. The construction of the pit underneath the converter and the air tunnel can be clearly seen in the accompanying drawing. Entrance to the converter pit for inspection of the fan and motor is made through a manhole at one side of the foundation and through an opening in this wall.

The starting panel for the converter is located in the converter room just inside the door between the two rooms, so that the operator can throw the starting switch over to the full voltage side at the moment he sees that the voltage has come up right as indicated by the voltmeter at the far end of the switchboard in the other room, the converter being started up with open field as an induction motor. There are no meters whatever in the converter room.

The location of equipment in the transformer and switching room is shown in the accompanying drawing. The transformers were logically placed along the wall between the two rooms in order to make the air tunnel as short as possible. The switchboard was placed near the front of the room so that the bracket-type voltmeter could be seen from the converter room during the starting of the machine. While the high tension oil switch was installed at the rear of this room where the high tension line enters the substation, the switch rod was extended through a 24-in. x 12-in. tunnel underneath the floor so that the operating lever and panel could be placed on the same line as the switchboard. Provision for a second oil switch similarly installed and three power transformers was also made.

A small waiting room was built at each end of the substation for the convenience of the car riders. One of these rooms has recently been converted into a small confectionery store and the sale of soft drinks and candies, etc., has made the construction of the waiting-room addition to the building a profitable investment.

The Two Designs for the C., M. & St. P. Locomotives*

A. F. Batchelder and S. T. Dodd of the General Electric Company and N. W. Storer of the Westinghouse Electric & Manufacturing Company Give Details of the Two Designs to Meet the Chicago, Milwaukee & St. Paul Railroad Specifications—Some New and Individual Characteristics Are Emphasized

THE Chicago, Milwaukee & St. Paul Railroad electrification of the 440 miles of line from Harlowton, Mont., to Avery, Ida., proved sufficiently successful to convince the railway of the economic advantages of electric operation. As a logical consequence, as has been previously noted in these pages, the company decided to equip an additional section over the Cascade Mountains between Othello and Tacoma, Wash., a distance of 212 miles. In the summer of 1917 the railway issued specifications covering the apparatus required on account of this additional electrification and a contract for part of the locomotives was given to the General Electric Company and for the others to the Westinghouse Electric & Manufacturing Company. These locomotives are being delivered and put into service.

Engineers of the two companies, men who had much to do personally with the development of the locomotives, presented details of the two locomotives with some analysis of the reasons entering into the designs at the Pittsburgh meeting of the A. I. E. E. The ELECTRIC RAILWAY JOURNAL has published† data and



CHICAGO, MILWAUKEE & ST. PAUL PASSENGER LOCOMOTIVE, GENERAL ELECTRIC CO.

power supply at 3,000 volts direct current. The load specified was a train of twelve steel coaches, making a total weight of 950 tons. The limiting grades are 2 per cent, compensated, for a distance of 20 miles from Piedmont to Donald on the east slope of the Rocky Mountains, and 2.2 per cent, compensated, for 17.8 miles from Beverly Junction to Boylston on the western division. The curvature of sharpest curve on the main line is 10 deg., but the locomotive must negotiate a 16-deg. curve in the yards satisfactorily. Speed requirements were set at approximately 25 m.p.h. up a 2-per cent grade, and approximately 35 m.p.h. up a 1-per cent grade, with a maximum speed of 65 m.p.h. for safety. Trains on down grades were to be held at speeds consistent with safe operation by means of regenerative braking.

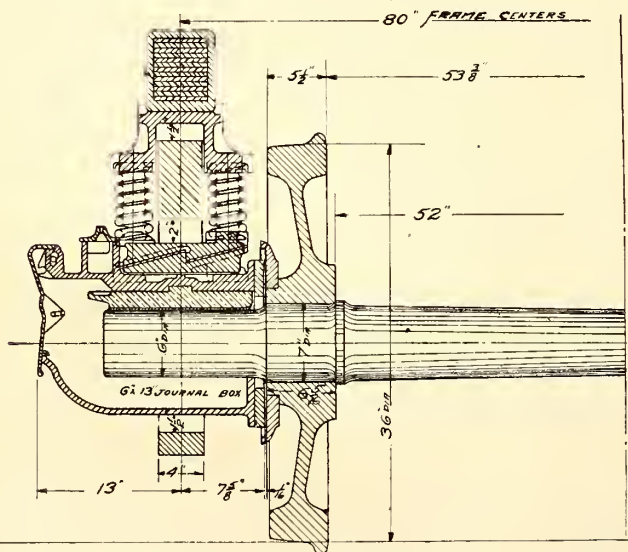
It was further provided that the locomotive be equipped with an oil-fired boiler to be supplied by the railway, to furnish steam for heating the train. Storage capacity was required for 30,000 lb. of water and 750 gal. of fuel oil. Apparatus was also required in the locomotive for lighting the train and charging the train storage batteries at a voltage of from 60 to 85.

With these general statements as an introduction, the abstracts will now be given:

The General Electric Locomotive

BY A. F. BATCHELDER AND S. T. DODD

THE locomotive as completed and delivered by the General Electric Company is shown in an accompanying illustration, while another shows an outline drawing of the side elevation, giving some general dimensions. It will be seen that the running gear is composed of four individual trucks, the two end trucks having three axles each and the two center trucks having four axles each. These trucks are connected by special articulation joints. The motor armatures are mounted on the axles and the motor fields are carried on the truck frames.



JOURNAL BOX SHOWING WEDGES TO GIVE RESISTANCE TO LATERAL MOVEMENT. GENERAL ELECTRIC LOCOMOTIVE

other information regarding both of these locomotives from time to time. The publication of the abstracts of the papers presented at Pittsburgh serves to complete the descriptions and at the same time affords an opportunity for a comparison of the two designs.

The Chicago, Milwaukee & St. Paul Railroad specifications required that the locomotives be built for a

*Abstracts of papers presented before the Pittsburgh Meeting of the American Institute of Electrical Engineers, March 12, 1920.
 †See issues for March 23, 1918, pp. 559 and 561; Nov. 1, 1919, p. 827, and Jan. 3, 1920, p. 36.

The superstructure is made in two sections of similar design, with a third section between them. The third or central section contains the train-heating equipment, which consists of an oil-fired steam generator, together with water and oil tanks. This unit is complete in itself and is carried over supports attached to the middle two trucks. It can be readily removed for repairs without interfering with any other part of the locomotive. It is placed between the two operating cabs in order to be easy of access to the engineer's helper or fireman, from either location.

The end sections are similar in appearance. The

replacement is necessary. The whole design and arrangement of this apparatus cab lends itself to economy of cost and material, as well as to convenience of inspection and repair of apparatus.

THE GEARLESS MOTORS ARE OF THE BI-POLAR TYPE

The motors are of the bi-polar gearless design which was adopted for the New York Central Railroad locomotives. To insure light weight per axle, flexibility in control and good truck arrangement for curving as well as for high-speed running, twelve motors were used, each of relatively small capacity. They are especially designed to withstand high temperature, being insulated with mica and asbestos.

The motor armature complete was built directly on the axle with the wheels pressed and keyed in place. The continuous rating of each motor at 1,000 volts and with 120 deg. rise, measured by increase in resistance, is 266 hp., corresponding to 3,500 lb. tractive effort at the rim of the drivers at a speed of 28.4 m.p.h. Forced ventilation is employed for cooling, and the armature core is provided with holes for the passage of ventilating air. Ventilating blowers are located above the motor armature. Air is delivered at the commutator end of the motor where it divides, a part passing through the armature and a part back through and around the field coils where it escapes upward and is afterward used for ventilating the starting resistors.

Besides having no journal bearings or gearing, this type of motor has the advantage of simplifying and making compact the locomotive design, as use is made of the frame to furnish the return path for the magnetic flux. With this construction the magnetic flux passes horizontally in series through all twelve motors, having a return path through the locomotive frame. Large surfaces in contact are provided in the articulation joints, thus giving an easy path for the flux. The polepieces are made flat to prevent them from coming in contact with the armature during its movements.

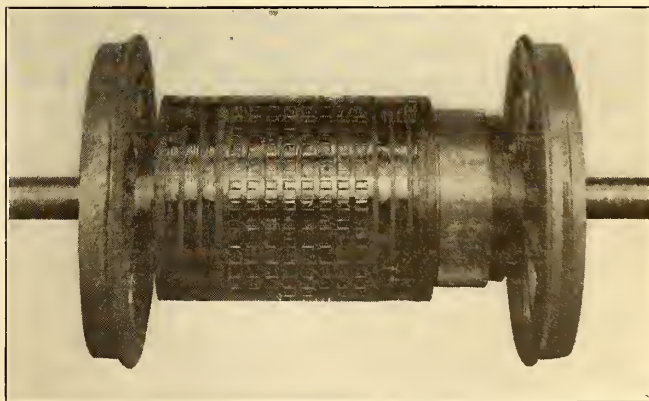
In the control equipment electro-magnetic control is



CHICAGO, MILWAUKEE & ST. PAUL PASSENGER LOCOMOTIVE, WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

operator's cab in either section is on the inner end next to the heater cab above described, having been so placed in order that the operator can be convenient to the heater and to allow a maximum space for apparatus in the apparatus cab or outer end section. Another advantage of this arrangement of cabs is that the operator can have access to any section of the locomotive requiring his presence without passing through a section containing high-tension apparatus. The engineer's or operating cab contains a main or master controller, the air-brake valves and handles and an instrument panel with air gages, ammeters and speed indicator. The engineer uses either of the two operating cabs, according to the direction in which he is running.

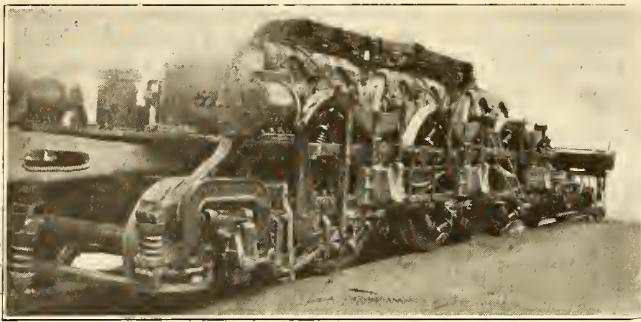
A door gives access from the operating cab to the apparatus section, which extends with a curved top to the extreme end of the locomotive. This construction adapts itself naturally to the protection of the apparatus included and, in addition, allows a clear view for the operator from his normal operating position. Contained in this apparatus section are the resistors and contactors for control of the power circuits of the locomotive. The starting resistors are placed in two rows on each side of the central passage just above the floor of the superstructure. They are covered at the sides by removable covers, which when opened allow the separate resistor boxes to be slid out upon the longitudinal running board outside the apparatus cab. The air compressor for the air brakes, the motor-generator set for the train lighting and the storage battery for marker lights and emergency control stand upon the same level as the resistors and can be removed or replaced in a similar manner. Above the resistors are located the contactors with their arc chutes facing a central aisle 2 ft. wide. This allows ample arcing space and room for inspection of contactors. Above the contactors is the curved roof of the locomotive with trap doors for inspection of the back connections and insulation and for removing the contactors in case



GEARLESS MOTOR ARMATURE AND DRIVING WHEELS, GENERAL ELECTRIC LOCOMOTIVE

used for single independently-operated switches, but electro-pneumatic cam control is used for operating banks of switches.

Four combinations of motors are provided for motor-ing. The first is with twelve motors in series, the second with six motors in series and two sets in multiple, the third with four motors in series and three sets in multiple, and the fourth with three motors in



ONE-HALF OF RUNNING GEAR, WITH MOTORS MOUNTED. WESTINGHOUSE LOCOMOTIVE

series and four sets in multiple. In each combination there is one tapped-field step in addition to the rheostatic steps, thus giving eight operating speeds exclusive of the thirty-one resistance steps.

For regeneration, some motors are used to excite the fields of the others, which in turn are used as generators to return power to the line.

As a provision against short circuits or extreme overloads, a quick-acting circuit breaker is provided in the apparatus cab which will protect the circuit in less than 1 of a second.

MECHANICAL CONSTRUCTION DESIGNED TO PROVIDE FLEXIBILITY

For flexibility in curving the running gear is made up of four trucks, each of a relatively short wheelbase. The middle two trucks have four driving axles each, and the two end trucks, two driving axles and one guiding axle each, making a total of fourteen axles. The trucks are connected together with articulation joints which allow of no relative lateral movement between them, so that each truck positively leads the following truck. This is for the purpose of reducing flange wear on curves and lateral oscillation on tangent track.

It is felt that with a wheelbase which is as long as the present one (67 ft.), the use of articulated trucks allows the locomotive to accommodate itself most satisfactorily to track curvature, at the same time minimizing lateral oscillations on tangent track.

To care for any lateral blow which might, however, be given against the rail head the leading and trailing axles are allowed a movement of 1/2 in. relative to the truck frame either way from their central position. This movement takes place against a resistance introduced by wedges above the journal boxes. This wedge construction is shown in an accompanying illustration. Further protection of the track from lateral displacement on the ties is provided by carrying the outer end of the superstructure on rollers, bearing on inclined planes upon the truck frames. By this construction

the leading and trailing trucks tend to maintain their central position and the weight of the superstructure is best distributed so as to increase the adhesion of an affected rail to its tie.

The Westinghouse Locomotive

BY N. W. STORER

Accompanying reproductions of pictures show views of the completed Westinghouse locomotive, and an outline cut-away drawing shows the general arrangement of the interior, as well as the exterior. The running gear consists essentially of two Pacific-type running gears coupled back to back. One half of the running gear is shown in another illustration. The side frames are steel castings, joined over the four-wheel trucks by a heavy A-frame casting; also by heavy cross-ties between the drivers, which also support the motors and carry the center pin and the coupling between the two running gears. Each half running gear has six spring-supported plungers on which the cab rests. There are two supports at each end and two in line with the center pin. By the use of shims, the distribution of weight between the two ends of each running gear may be adjusted as desired. The coupling between halves consists of a long bar of a box section.

The superstructure consists of one long cab built so strong and rigid that it can be lifted at the ends. It is light but stiff. The cab is divided by cross partitions into compartments, one at each end for the engineer and the others for the several parts of the cab equipment.

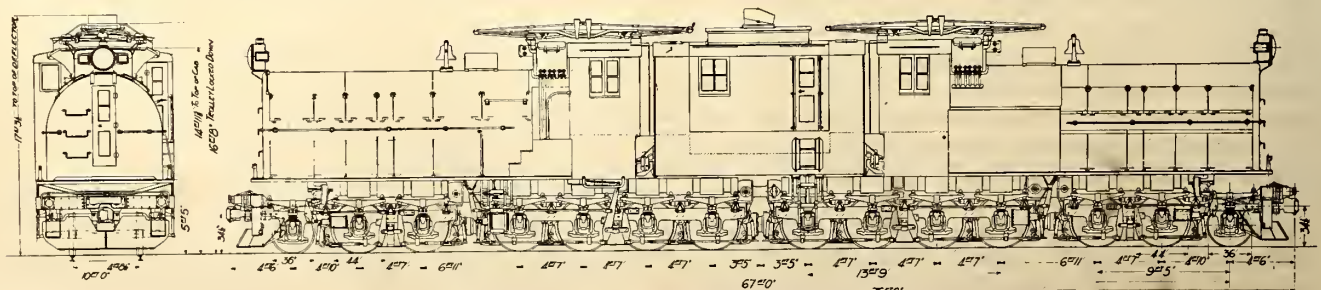
In the middle cab, and occupying relatively a large portion of space, are located the steam boiler and the water storage tanks. The fuel oil tank is located beneath the boiler and the two water tanks are placed just fore and aft of the boiler.

TWIN DRIVING MOTORS ARE USED

The six driving motors are of the twin-armature type. That is both armatures are contained in a single frame arranged to secure the maximum economy of weight. The fields are of the standard four-pole type with four salient poles and four inter-poles for each armature. Each armature is wound for 750 volts, but fields and armatures are connected permanently in series so that the rating of the complete motor is based on 1,500 volts.

The one-hour rating is 700 hp., based on the A. I. E. E. rules, and the continuous rating 567 hp., with forced ventilation and 400 hp. without blowers.

Twin motors were adopted to reduce space used by gears, to reduce locomotive weight, to make the most efficient use of available space and to secure the advan-



OUTLINE DRAWING OF GENERAL ELECTRIC LOCOMOTIVE

tage of low-voltage armatures. Motor capacity was fixed by the number of axles, six being selected as the smallest number that could be used under the limitation of weight on the drivers. This led to the adoption of the double Pacific type of running gear with its excellent riding characteristics. An illustration shows the pinion end of the twin motor.

Fans mounted on the motors give them a high continuous rating without the use of forced ventilation, and it is expected that the blowers will not have to be used with normal train load except on heaviest grades.

Quill drive, similar to that used on the locomotives of the New York, New Haven & Hartford Railroad was adopted.

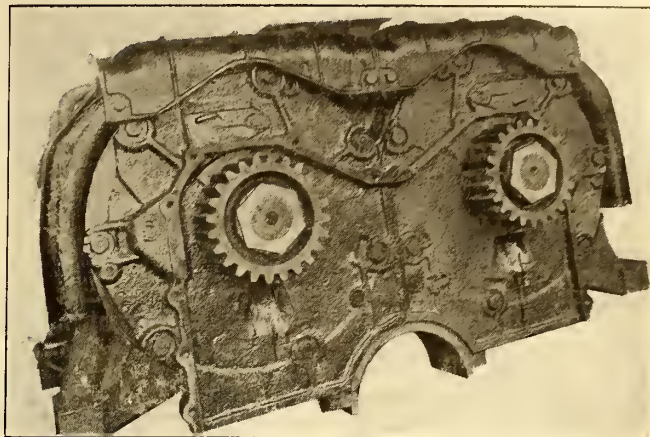
SOME FACTS REGARDING THE CONTROL SYSTEM

An accompanying illustration shows a schematic diagram of the main motor circuits and another diagram gives the details of a single motor with its exciter and resistance. Three combinations of motors are possible; first, six motors in series; second, three in series, two sets in parallel, and third, two in series, three sets in parallel. By the use of inductive shunts on the fields of all three of these positions nine running speeds are possible, in addition to the thirty-three resistance steps available. One feature of the resistance arrangement is that the same resistance groups and switches are used for all of the three combinations. All switches are electro-pneumatically operated, some individually and some in cam groups.

Illustrations are given, also, to show the master controller open and the top view with the control levers. An interlock in the controller prevents the line switches from closing when the motor connection is in the second or third position, unless the engineman knowingly pushes a button in the top of the master controller. When applying current with the locomotive at speed this button must be pressed when it is desired to go immediately into the second or third combination.

For regeneration, the motors are separately excited from two axle-driven generators carried on the inside axles of the two four-wheel trucks and geared to them like ordinary interurban railway motors. These generators are separately excited and the field strength of the main motors is controlled by varying the fields of the exciters.

The scheme used for regeneration includes the use of stabilizing resistance, which is connected in series with the exciter armature, with the main motor field

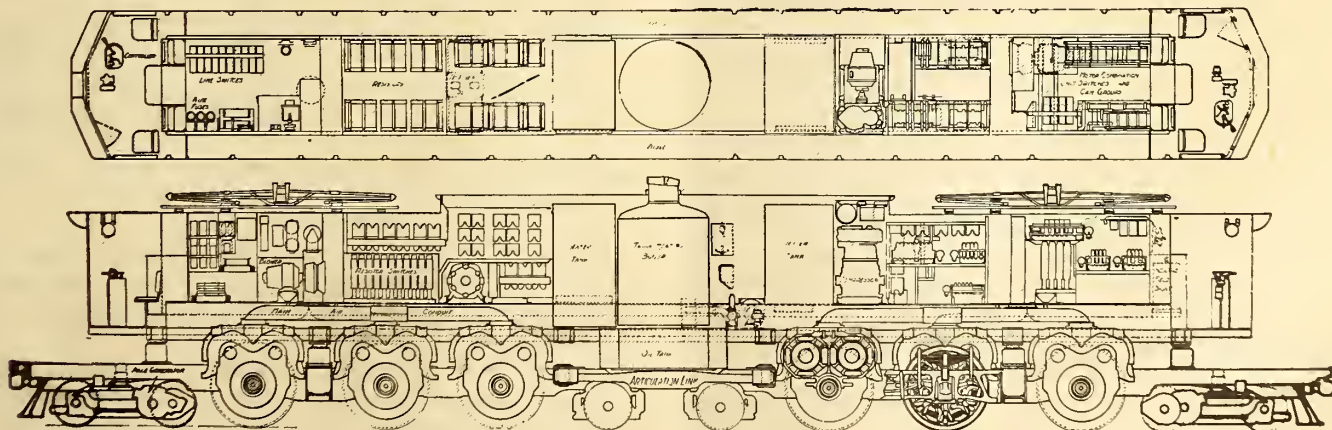


TWIN MOTOR FOR WESTINGHOUSE LOCOMOTIVE

circuit and also with the main motor armature circuit, so that the field excitation is dependent, to a certain extent, on the armature current.

One feature was to provide for beginning regeneration at any speed within the normal running range without having a heavy current in either direction that would produce a surge in the train. This was accomplished by providing that the motors should never be connected to the line without the maximum starting resistance in series between motors and the line. This, of course, is provided for in motoring, but is necessary also in regeneration to prevent undesirable surges. With the 17 ohms resistance provided on the first step, the maximum current that could flow from the line would be less than 200 amp. with no voltage generated in the motors. The resulting torque is negligible, particularly if this current is divided among two or three circuits, as would be the case in the second or third combinations.

The stabilizing resistance protects the motors against sudden changes in line voltage, while the axle generators protect against variations in grade, which would otherwise tend to vary the speed. In case of a sudden reduction in line voltage, which would be followed by a heavy increase in the regenerated current, the increased voltage drop in the stabilizing resistance resulting from this immediately cuts down the field current and the voltage generated by the main motor sufficiently to limit the increase in regenerated current to a safe value. Similarly the axle-generator regulation takes care of the passage of a train from a sharp curve to a tangent.

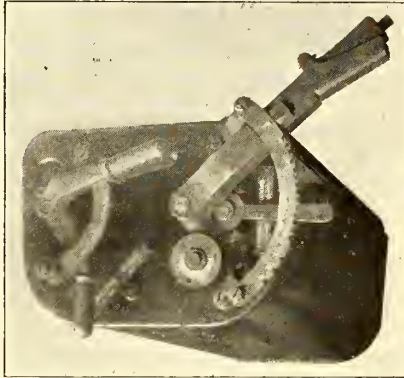


SIMPLIFIED PLAN AND LONGITUDINAL VERTICAL SECTION OF WESTINGHOUSE LOCOMOTIVE

The chief auxiliaries provided are a motor-generator set which draws current from the line and delivers current at a constant voltage of 85; a storage battery of thirty-eight cells with a one-hour capacity of 300 amp., and two axle-driven generators for the primary purpose of furnishing excitation for the main motors during regeneration.

STEAM LOCOMOTIVE EXPERIENCE APPLIED IN MECHANICAL DESIGN

In the design of this locomotive the attempt was made to obtain those mechanical features which have developed through years of experience with steam locomotives. The desirable features are location of the mass as close to the center as possible, high center of gravity of that part of the locomotive carried on the running gear, as long a rigid wheelbase as possible, guiding trucks located well outside the mass of the running gear, equalization to secure stability, mini-



TOP VIEW OF WESTINGHOUSE MASTER CONTROLLER

mum permissible restriction of free movement of each axle and portion of the running gear and large driver diameter. In the cab it is very advantageous to concentrate heavy equipment between the center pins. In the running gear the closer the weight is concentrated to the center pins the less tendency there is to nose and the easier the duty on the wheel flanges and track.

This locomotive embodies all the foregoing features to a remarkable degree. Particular attention was given to weight distribution. The cab has the boiler, water and oil tanks, storage batteries, air-compressor, resistors, motor-generator set and the heavier parts of the control equipment concentrated between the center pins. The driving motors are mounted above the axles on the running gear, thus getting the weight well inside the wheelbase, but placing it relatively high. The height of the center of gravity of the complete locomotive is 68 in., a value that compares well with that of a steam locomotive.

The Pacific type of running gear with its long rigid wheelbase and the guiding trucks is a particularly stable design and is especially good with the weight distribution that obtains on this locomotive. The height of the center of gravity of trucks with motors mounted is 43 1/4 in.

The quill drive, which is a further development of the one used on the New Haven locomotives, gives each driving axle perfect freedom to move vertically the full distance permitted by pedestal jaws without affecting the motors or frames, except through springs. The only "dead" weight carried is the weight of wheels, axles, journal boxes and spring clamps.

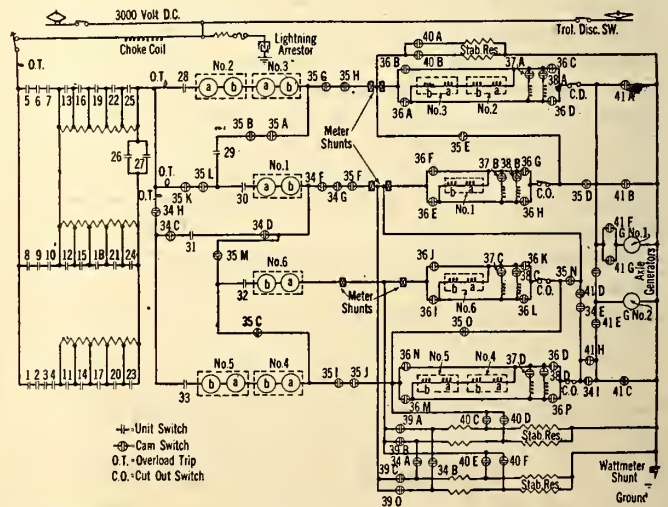
Great effort has been made to cushion the locomotive against shock, either while running or from bumping. The apparatus in the cab is especially well protected, since the cab rests on spring-supported plungers which are in series with the main semi-elliptic springs. The

cab is protected against bumping strains by floating center pins, which, while held rigidly against lateral motion, are cushioned against longitudinal motion by heavy springs. It has been the practice heretofore with this general type of locomotive to have one center pin rigid in the running-gear frame and to allow the other to move freely in a longitudinal direction. It was considered best in this machine to allow a slight relative motion between the two center pins, but to prevent the bumping shocks by spring cushioning.

NOTES ON THE ELECTRICAL DESIGN

The efficiency of the twin-motor unit with both armatures operating to drive the same gear has been shown by factory tests to be materially higher than that calculated by the A. I. E. E. rules from "no load" losses and the fixed percentage of losses for gears and other load losses. These tests show plainly that those losses assumed for the Institute rules are too high for large motors.

Past practice with direct-current motors has been to use the series-parallel arrangement, or at most, series, series-parallel and parallel, giving one-quarter, one-half and full speed. With six motors and twelve armatures on 3,000 volts the regular series-parallel control could have been obtained in several ways, but the method adopted gives as simple a control as any system for regular series-parallel arrangement and in addition has the great advantage of the three-speed locomotive for handling the service. The one-third and the two-third speed arrangements cover the range so much better than the one-half speed, or than the one-quarter and one-half speeds, that there is scarcely any comparison possible. The one-half speed is too low for a running speed and too high for switching. The one-third speed is an excellent switching speed, and the two-thirds speed is a good running speed, especially good for regenerating on heavy grades. Another advantage lies in the



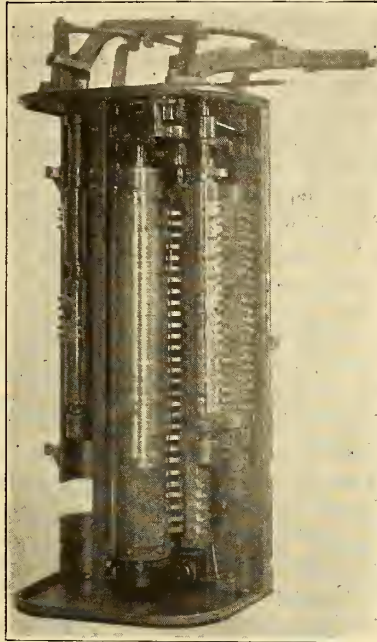
SCHEMATIC DIAGRAM OF MAIN MOTOR CIRCUITS, WITH RESISTANCES AND EXCITERS. WESTINGHOUSE LOCOMOTIVE

decreased rheostatic losses as compared with those in the ordinary series-parallel control. These losses are further reduced by two field shunting positions on each combination.

One of the fundamental principles on which this locomotive was designed was that the motor circuit should not be opened, either in normal operation or under emergency, until the current had been cut down

by the introduction of resistance. This is considered a very valuable, if not an absolutely necessary feature. The effect is not only to divide the arcs among a large number of switches and, therefore, to promote safety, but the generation of high voltages from suddenly rupturing a heavy current is prevented.

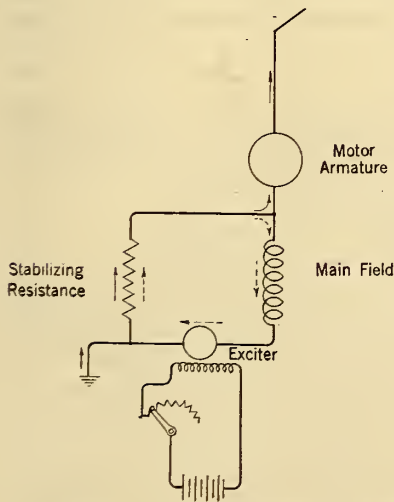
In order to avoid high-voltage troubles in the auxiliaries it was the policy on this locomotive to limit the high voltage to the minimum possible number of circuits and the minimum amount of apparatus. It was impossible to avoid it altogether on the moving apparatus, due to the fact that the train lighting must be supplied for hours at a time in case of any emergency when the train is held up by a wreck or storms. The motor-generator set, which is designed primarily for this purpose, is the only piece of moving apparatus among the auxiliaries



WESTINGHOUSE MASTER CONTROLLER

which has the high voltage applied to it. The voltage selected for the auxiliary circuits was primarily determined by the voltage required for train lighting. While 85 volts is lower than would otherwise be selected for the auxiliary motors, it is perfectly safe and is a voltage that is so low that the motors can be forgotten, as far as the questions of insulation and commutation are concerned. The auxiliary motors are, of course, very much smaller than they would be if the

high voltage were applied to them. A storage battery, from the standpoint of operation, is, of course, always a desirable thing on a locomotive. The combination of the storage battery and the axle-generators will furnish ample auxiliary power to take a locomotive to the end of a run, if the motor-generator set fails. The same combination will take a train safely down the longest and steepest grade with the air brakes, if power is for any reason cut off the line. If the train is going up a grade and power is cut off the battery will furnish air to hold the train with the brakes for a considerable time, so that it



SCHEMATIC DIAGRAM OF SINGLE MOTOR, EXCITER AND RESISTANCE. WESTINGHOUSE LOCOMOTIVE

will not be necessary to block the wheels, as is the ordinary practice, unless power is off for a considerable time.

In general, wherever possible on the locomotive standard industrial types of motors have been employed for the auxiliaries.

Comparative Characteristics of the Two Locomotives

The following table, which gives a summary of the principal dimensions and characteristics of the two locomotives, is of interest in indicating the manner in which the two manufacturers have met with their individual systems of design the general specifications of the railway for these locomotives:

DATA FOR THE ST. PAUL LOCOMOTIVES

	General Electric	Westinghouse	
Total weight.....	521,200 lb.	550,000 lb.	
Total weight on drivers.....	457,680	336,000	
Length over-all.....	76 ft. 0 in.	88 ft. 7 in.	
Height over cabs.....	14 ft. 11½ in.	14 ft. 6 in.	
Height over pantograph, locked down.....	16 ft. 8 in.	16 ft. 7½ in.	
Total wheelbase.....	67 ft. 0 in.	79 ft. 10 in.	
Max. rigid wheelbase.....	13 ft. 9 in.	16 ft. 9 in.	
Diameter of driving wheels.....	44 in.	68 in.	
Diameter of idle wheels.....	36 in.	36 in.	
Heater capacity.....	4,000 lb. steam per hr.	4,000 lb.	
Water capacity.....	30,000 lb.	25,500 lb.	
Oil capacity.....	6,000 lb.	750 gal.	
Compressor capacity.....	150 cu.ft. per min.	150 cu.ft. per min.	
Number of motors.....	12	12	
Type of motor.....	(Bi-polar) GE-100	(Twin) 4-pole Westinghouse	
Locomotive Rating:			
	Tapped Field	Full Field	
Total horsepower, 1-hour motor rating.....	3,480	3,380	4,200
Total tractive effort one-hour motor rating.....	36,000	46,000	66,000
Speed, miles per hour.....	36.2	27.5	23.8
Total horsepower continuous.....	3,200	3,200	3,360

Substation Operation for Street Railway Service*

The Author Gives the Results of Practical Experience with Three Types of Transformation Apparatus

BY W. T. BIVINS

Chief Engineer of Electrical Equipment United Railroads of San Francisco

SUBSTATION operation for street railway service should be placed in the heavy-duty class. The design of the building and equipment should be made with a view to economy and simplicity of operation, so as to minimize the necessary number of attendants. Due regard, however, should be given to possible future extensions.

For transforming high-voltage alternating current to direct current for railway work, the choice in converting apparatus usually narrows down to synchronous motor-generators, induction motor-generators and rotary converters. On this system all three kinds are used, the largest stations being equipped with motor-generator sets. Where high efficiency, overload capacity, compactness and low initial costs are of greatest importance, the synchronous converter is apparently the most desirable piece of apparatus available, it being understood that the alternating-current feeder-line conditions are favorable and free from severe surges, rapid fluctuations in frequency, excessive ohmic drops, etc.

*Abstract of paper read at Third Annual Electric Railway Night of Pacific Railway Club.

reason cut off the line. If the train is going up a grade and power is cut off the battery will furnish air to hold the train with the brakes for a considerable time, so that it

Where such unfavorable conditions obtain, however, the induction motor-generator is preferable.

On our system we find that there are times when the inherent characteristic of fixed ratio of alternating-current to direct-current voltage is objectionable, due to shifting of load centers. To cite an instance: In the Richmond district we have a small rotary substation supplying the major portion of energy to the Beach, Park and Cliff lines. This station is of ample capacity for all ordinary purposes, but for an occasion like the arrival of the "Fleet" in the harbor, when everybody in San Francisco wanted to go to the beach, this station would be overloaded, thus necessitating relief by some change in the direct-current feeders. If this substation equipment had consisted of motor-generator sets, we should simply have lowered the direct-current voltage and permitted other stations operating in parallel to feed in and help to carry the abnormal load occasioned by the close headway. At the same time a suitable trolley potential for operating the cars would have been maintained. This is a concrete instance where motor-generator sets would be preferable to the synchronous converter.

Voltage control can, of course, be arranged for by the use of extra apparatus for controlling the alternating-current voltage. I believe that the induction regulator is now being used more generally than any other means for voltage control in connection with synchronous converters. However, any such apparatus adds to the initial cost and some of it is dangerous to operate, owing to risk of short circuits.

On our system we have observed that the 60-cycle rotary converter will flash over from positive to negative brush arm, in case of a ground in proximity to the station, much more readily than the motor-generator sets. In fact, we have had considerable trouble from this source with broken trolley wires on the rail, and are now considering the installation of a new type of quick-acting circuit breaker, along with arcing screens.

Our experience has shown that the relation of trolley taps to the source of power is of great importance, for a "close-up" ground will invariably damage the circuit breaker even though the machines do not "buck" over. The line losses due to tap distances are immaterial, when compared with the loss through flashovers, including delays to the service and expense involved in repairing damaged apparatus.

While the rotary converter has somewhat less stability than the synchronous and induction-motor-driven sets, its efficiency, including transformers, is from 6 to 8 per cent better than that of a like motor-generator set without transformers. The motor-generator set, however, has some very desirable features not found in the synchronous converter, such as its possible use by over-excitation for power-factor control. The induction motor is not easily thrown out of phase, and accordingly is very desirable in some classes of work. However, it is at a disadvantage because it has no power-factor control. Comparing all three kinds of converting apparatus, my observations and experience have been that the synchronous motor-generator set is preferable for railway service.

A question which often arises is as to the choice in size of units for a substation. In my opinion, medium-sized units are preferable, space permitting, because better economy can be secured by cutting in and out machines to follow the load. Furthermore, with large

units if one becomes incapacitated, a serious overload is usually imposed upon the other machines. With the present high generating cost, it seems even more necessary than ever closely to watch the apparatus to see that no more units are in service than necessary.

In connection with troubles encountered in the upkeep of direct-current generators, the most bothersome are those connected with the commutator. Excessive sparking will usually be found due to some defect in the field or the armature, some external electrical trouble, or more likely a trouble in the commutator, where it is sometimes difficult to identify. Field troubles usually consist of partial short circuit in one coil, unequal air gaps, series fields connected by mistake so as to oppose the shunt fields, or an error in rewinding a coil. Any of these troubles electrically unbalance a machine and cause short-circuit currents with resultant sparking. The more common troubles in an armature causing bad commutation are partial open circuit and short circuit in some portion of the winding. We have also experienced sparking in a less degree due to high resistance between the end of a coil and the commutator riser. As for the commutator, sparking is usually caused by operation of brushes at wrong commutation points, incorrect brush spacing, spanning of too many bars by brushes, lack of parallelism of brush arms with commutator bars, and, last but not least, high mica.

On our system at one time we had a lot of commutator trouble from high mica, particularly in one 9,000-kw. substation, which was heavily overloaded during the Panama-Pacific Exposition. The so-called "skin" or hard finish of the commutators was burned off by overload, after which the commutator bars were soft and the mica hard, occasioning constant stoning to keep the machines operating. Some 1,500-kw. motor-generator sets were stoned two or three times a day. After trying all sorts of brushes we finally decided to undercut the mica, which we did with a tool designed and built in our own shops. This ended our troubles. The machine, which had always given commutator trouble and had been trued up by the manufacturer after installation has, as this paper is written, been running off fifteen months since it was slotted, during which time we have practically disregarded the commutator. Special brushes designed for use with slotted commutator are employed, and these require no oiling and, therefore, seldom need cleaning. These brushes have little or no abrasive characteristics and have worn but little in fifteen months, while the wear of the commutator is practically nil.

Statistics on H. C. of L.

According to reports received by the Bureau of Labor Statistics of the United States Department of Labor from retail dealers in fifty cities, the average family expenditure for food was 2 per cent higher on Jan. 15, 1920, than on Dec. 15, 1919. The cost in December was 2.6 per cent higher than it had been in any previous month. These figures show an increase of 9 per cent since January, 1919, and an increase of 104 per cent since January, 1913. The comparisons are based on the average retail prices of the following articles, weighted according to the consumption of the average family: Sirloin steak, round steak, rib roast, chuck roast, plate beef, pork chops, bacon, ham, lard, hens, flour, corn meal, eggs, butter, milk, bread, potatoes, sugar, cheese, rice, coffee and tea.

Symposium on Railway Substations

Four Papers Read at the Meeting of the American Institute of Electrical Engineers in Pittsburgh Summarize the Status of Converter Protection, Automatic Control and Related Developments

A FEATURE of the 385th meeting at the American Institute of Electrical Engineers, held in Pittsburgh, Pa., on March 12, was a group of papers by substation design experts on subjects which are uppermost in the minds of electrical engineers today. Abstracts of these are given below, and a summary of the discussion following will be printed in a later issue of this paper.

Short-Circuit Protection for Direct Current Substations*

A Résumé of Development of Flash Barriers and High-Speed Circuit Breakers With Special Reference to the St. Paul Electrification

BY J. J. LINEBAUGH

Engineer Railway & Traction Engineering Department, General Electric Company, Schenectady, N. Y.

THE investigation of means to prevent flashing of direct current machinery and the development of suitable equipment have been continued since the presentation of the paper on "Protection from Flashing for Direct-Current Apparatus" by J. L. Burnham and the writer, read at the Atlantic City convention of the Institute in 1918.†

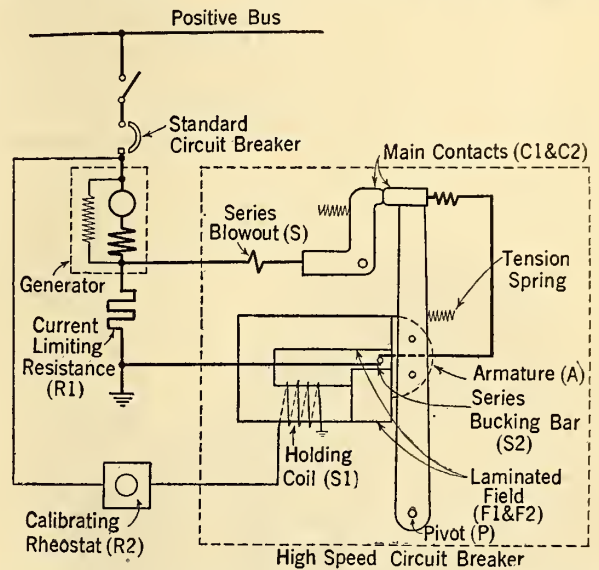
The study covered in that paper indicated that a special form of flash barrier without coolers and a new form of high-speed circuit breaker with current limiting resistance had proved the most promising development, and that tests showed that the two types of protection provided complete protection from a "dead" short circuit caused by short circuiting the terminals of a machine without external resistance. These two

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

†See issue of ELECTRIC RAILWAY JOURNAL for July 6, 1918, page 9.

types of protection have been further perfected and are now in regular commercial use. They are used either separately or together, and in many instances are considered standard railway practice.

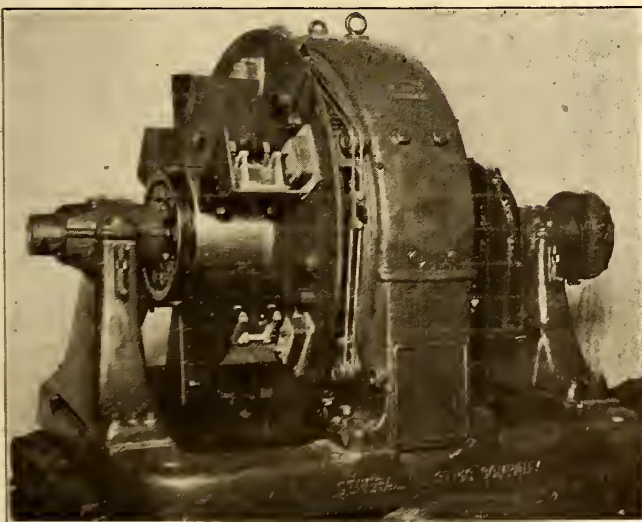
Thirteen of the improved breakers were installed by the Chicago, Milwaukee & St. Paul Railroad, as part



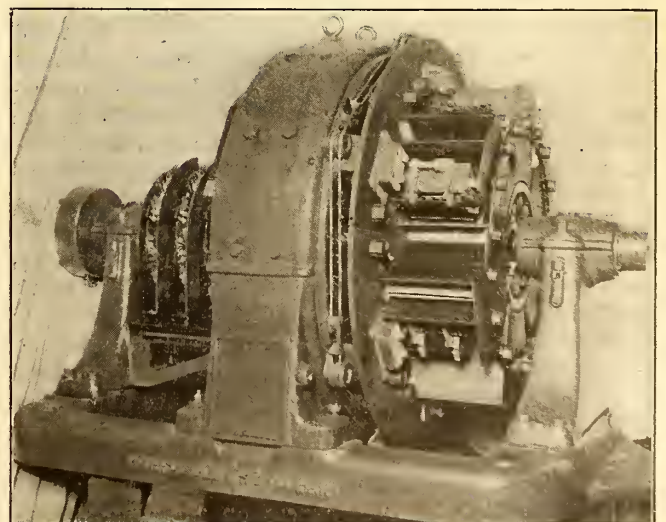
CIRCUIT DIAGRAM FOR CONNECTIONS OF HIGH SPEED CIRCUIT BREAKER

of the electrification of its Pacific Coast and Cascade Mountain divisions.

This breaker was used instead of the first type of circuit breaker, which has given successful operation during the past three years in the fourteen substations of the 440-mile original electrification of this road. The new breaker has the advantages of lower cost and



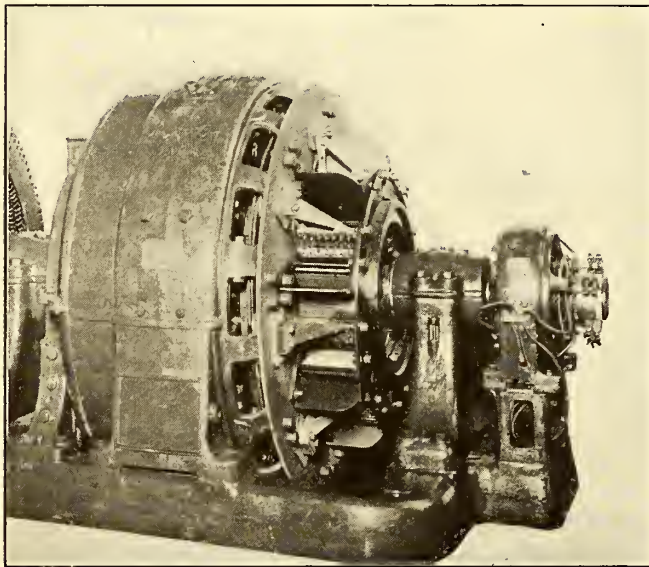
FLASH BARRIERS APPLIED TO SYNCHRONOUS CONVERTER



CONVERTER EQUIPPED WITH LATEST TYPE OF BRUSH HOLDER PROTECTION

greater simplicity. One of these breakers is used with each of the 2,000-kw. 3,000-volt synchronous motor-generator sets in the Tacoma, Renton, Cathedral Falls, Hyak, and Cle Elum substations, and the remaining five breakers are placed one each on the new gearless passenger locomotives. On account of the lower cost of these breakers and the advantages of using the "unit" system throughout, each of the sets is protected by its own high-speed breaker instead of one breaker per substation, the arrangement in the original installation. The general connections, location of circuit breakers, etc., are shown in an accompanying diagram.† The circuit breakers for the substations and locomotives are exactly alike, with the exception of interlocking and calibration for tripping points.

The circuit breakers were given a very exhaustive test in connection with one of the 2,000-kw. sets before shipment. It was found that the generators could be short-circuited with only sufficient cable in circuit to connect the different meter shunts, short-circuiting contactors and high-speed breaker, without damaging



GENERATOR OF ST. PAUL MOTOR GENERATOR SET EQUIPPED WITH FLASH BARRIERS

the machine in any way and with practically no flashing at the brushes.

A special reliability or endurance test was made as part of the acceptance test of the breakers, during which about sixty-five short circuits of different magnitudes, fifteen of which were "dead" short circuits, were applied at intervals of about two and a half minutes without cleaning the commutators or giving them any attention whatever. At the conclusion of these tests, five "dead" short circuits were thrown on the sets within ten minutes. At the end of these tests the commutators were in excellent condition without need of cleaning or attention of any kind.

The application of the high-speed circuit breaker to direct-current electric locomotives is another distinctive advance, as, in addition to protecting the apparatus on the locomotive, it prevents the short circuits from affecting the substations.

An incidental advantage of this type of protection is the elimination of disturbances on the alternating-

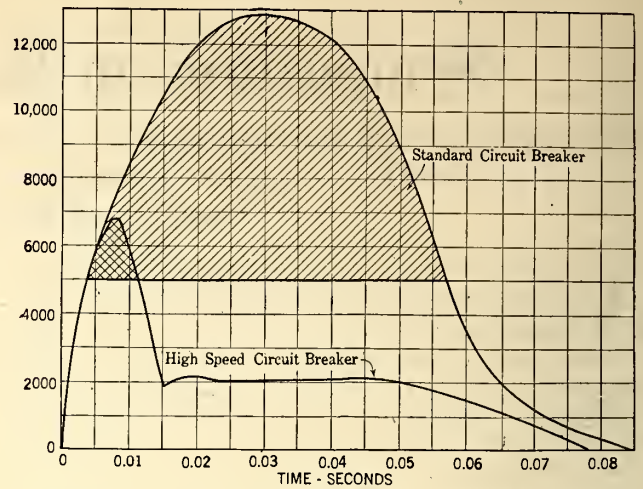


DIAGRAM SHOWING SHORT-CIRCUIT CURRENTS WITH STANDARD AND HIGH-SPEED TYPES OF CIRCUIT BREAKER

current side of synchronous converters or motor-generators sets ordinarily caused by direct-current short circuits, due to the fact that the load is decreased so quickly that momentum of the armatures supplies the energy and the load is not increased materially on the alternating-current side. The overload relays are therefore not affected, increasing very greatly the general operating efficiency of the substation, eliminating time required to start up a set from the alternating current side, etc. After the occurrence of a short circuit it is only necessary for the operator to close the high-speed circuit breakers and then the main switchboard breaker which is interlocked with the high-speed breaker, after which the main switch is thrown in following regular switching practice. If the short circuit still persists, the high-speed breaker will again open, but with no flashing or damage to brushes or commutators, and greatly increased duty on the regular breaker.

The flash barriers described in the original paper have not been changed in any essential details, improvements being along the line of simpler construction, ease of removal for inspection and improvement in appearance. An accompanying photograph shows the barriers as used on the generator of the Milwaukee electrification motor-generator sets, while another illustration shows barriers on a 600-1,200 volt, 60-cycle, 500-kw. synchronous converter.

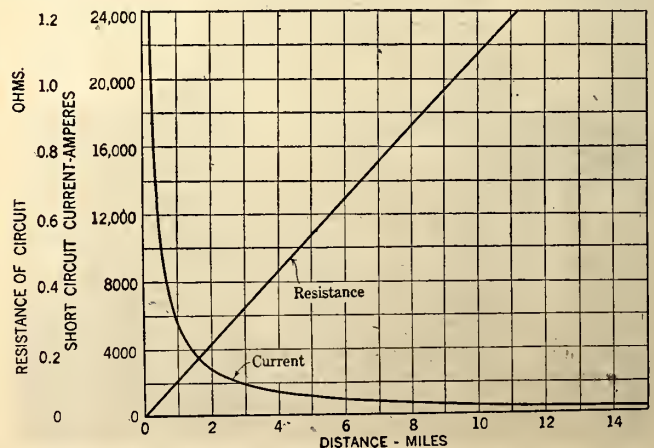


DIAGRAM SHOWING PROTECTION AFFORDED BY REMOTE TAP CONNECTIONS

†This circuit breaker was described in the issue of the ELECTRIC RAILWAY JOURNAL for Feb. 21, 1920, p. 394.

Another advance in short-circuit protection is the protected type of brush holder in which the brush rigging is protected on all sides where flashing might occur, by asbestos lumber, so that an arc cannot readily hold between brush holders of opposite polarity. This protection is shown in a third photograph. It prevents the formation of iron or copper vapor, which might cause a flash to the frame and damage to the brush rigging or commutator. A removable cover is provided for inspection and removal of brushes. It is made of an iron sheet for convenience, as there is no tendency for the arc to strike this part of the brush rigging during tests or in actual operation. This type of brush rigging has been standardized for all 600-volt, 60-cycle, synchronous converters.

The use of the high-reluctance commutating poles is a very promising improvement which has just been made in 60-cycle, 600-volt synchronous converters, and has been standardized for all 60-cycle machines. This raises the flashing point at least 50 per cent.

In conclusion attention should be called to the great protection afforded by tapping the feeder at some distance from the substation. This is undoubtedly the cheapest type of protection which can be used, but cannot be relied upon to prevent flashing over under extreme short circuits. Under ordinary conditions the distance to the first tap need not be greater than 2,000 ft. A greater distance than this causes an appreciable loss of energy and drop in voltage. An accompanying diagram shows very clearly the great benefit of a small amount of resistance in reducing the maximum possible current on a short circuit.

If complete immunity is desired from short circuits, the high-speed circuit breaker and barriers offer undoubtedly the best known solution. With this protection feeder taps can be connected to the overhead trolley directly at the substation, reducing losses to a minimum. Maintenance of the substation apparatus will also be decreased, as burning from short-circuits undoubtedly causes most of the wear and deterioration on brushes and commutator. Another particular advantage of this type of protection is that it can be applied to old generators or synchronous converters of any voltage without changing the machine itself.

Flashing of 60-Cycle Rotary Converters*

The Author Analyzes the Causes of Flashing,
Describes Experiments With a Number of
Anti-Flashing Devices and Suggests
Some Remedies for This Evil

BY M. W. SMITH

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THE protection of the 60-cycle converter from flashing is more difficult than that of commutating machines of any other class due to the inherent limitations of distance between neutral points on the commutator. This distance is fixed by the frequency and by the peripheral speed of the commutator.

The rate of increase of the direct current on short circuit is very rapid as compared with that in direct-current generators. Tests made of the generators of

the 2,000-kw. sets for the Chicago, Milwaukee & St. Paul Railroad showed the initial rate of increase in current on short circuit to be approximately 1,100,000 amp. per second. On the 500-kw. converter, however, the average initial rate was approximately 3,300,000 amp. This rapid rate of increase in short-circuit current, together with the limited distance between brush-holder arms, makes the 60-cycle converter particularly susceptible to flashing trouble.

Flashing does not appear to be entirely dependent upon the value at which the current is arrested. When a machine is on short circuit a large percentage of the voltage is consumed internally. The heavier the short circuit, the larger is the percentage of the voltage thus consumed. Then so long as the direct current breaker is closed the voltage between brush arms, and hence the tendency to flash, is a minimum. The voltage between neutral points on extreme overload and short circuit with the direct-current breaker closed, is also dependent somewhat upon the brush pressure. Assuming a reasonable brush pressure and contact drop, it is practically impossible for a machine to "buck over" and hang on between arms on dead short circuit so long as the direct-current breaker is closed, for the voltage on the commutator is practically "killed." It is usually the opening of the direct-current breaker that does the damage.

FLASHING DEPENDS UPON SEVERAL FACTORS

An ideal circuit breaker is not necessarily one which opens the circuit before the machine "bucks over" (for it usually does not "buck over" until the breaker opens) or before the current reaches a certain value, but one which opens the circuit before sufficient gas and volatile matter have been formed over the commutator to cause the machine to "buck over" when the voltage is restored by the opening of the breaker. It may be said that flashing is roughly a function of the voltage, the distance between neutral points and the amount of gas or volatile matter over the commutator.

It is the writer's opinion, in view of results of very extensive tests, that a moderately high-speed breaker is no better than an ordinary slow-speed breaker. A very slow-speed breaker may even be better than a moderately high-speed breaker, due to the fact that the voltage will have time to die down appreciably before the breaker opens, especially if the alternating-current supply is opened in the meantime.

Opening the alternating current breaker is of course undesirable, because the machine has to be synchronized again. However, this procedure minimizes the flashing considerably.

The relative strength of armature and commutating-pole fields has a considerable influence upon the commutation, and hence upon the flashing of a synchronous converter on sudden changes of load and extreme overload or short circuit. Under normal load conditions the alternating-current magnetomotive force opposes that produced by the direct current. In the inter-polar space the resultant armature action is only about 15 per cent of the direct-current armature reaction and is in the same direction. The commutating-pole field ampere-turns under this condition are just sufficient to buck down this resultant magnetomotive force, and in addition to force sufficient flux across the commutating-pole gap to generate the required counter-voltage for commutation. At the instant of short circuit the con-

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

verter acts largely as a direct-current generator, delivering the first rush of current from its own inertia, with the result that the machine is enormously under-compensated. The larger the proportion of the ampere-turns expended in the commutating-pole air gap, or its equivalent, the less will be the effect of the armature reaction upon the commutating-pole flux and hence upon the commutation and flashing of the machine.

Sudden changes in the frequency applied to the converter are equivalent to the machine being out of phase and produce similar results from the standpoint of flashing. In one case where flashing occurred with a 1,000-kw., 600-volt, 25-cycle converter, the trouble was eliminated by greatly increasing the strength of the commutating-pole flux.

DIFFICULTIES IN APPLYING THE FLASH SUPPRESSOR TO ROTARIES

The flash suppressor, as applied to converters, is simply a high-speed switch actuated by the short-circuit current, much in the same manner as a circuit breaker, which short-circuits either all or a part of the collector rings.¹ This reduces or "kills" the voltage on the commutator to such an extent that it prevents the machine from flashing over. This device has already been applied to generators of the motor-generator sets in the substations of the Chicago, Milwaukee & St. Paul Railroad.

In connection with the rotary converter the operation of the flash suppressor means practically a short-circuit on the alternating-current system through the converter transformers. In addition the machine has a tendency to fall out of step, requiring it to be resynchronized if it does so. Tests were made with inductance in the local suppressor circuit for the purpose of finding out the maximum value of inductance which could be used to limit the alternating current and still reduce the direct current voltage sufficiently to give protection on the direct-current side. It was found that in order to give such protection the value of this inductance has to be such that upon the opening of the direct-current breakers the direct-current voltage would not rise above the value it had dropped to due to the direct-current short circuit. The test showed that reasonable protection could be had at about eight times full direct current load without drawing over nine times full load alternating current.

With the idea of preventing the machine from dropping out of step, a three-pole oil circuit breaker was put in the local leads of the suppressor circuit in connection with the above test, so as to open this circuit and throw the machine back on the line. It was found that this could be done without any particular disturbance up to the point where the inductance in the suppressor circuit had to be decreased (for protection to the direct-current side) sufficiently to cause the machine to fall out of step. This was approximately ten times full load.

The tests showed clearly that the flash suppressor will give ample protection from flashing to the converter as far as the alternating-current side is concerned. However, there are several problems connected with the application of the device to synchronous converters, such as the increased duty on the collector rings, disturbance to the alternating-current supply

system and the falling of the machine out of step, which have not as yet been worked out.

Various forms of flash guards have so far proved to be unsuccessful. These consisted of two continuous end rings, one at the back of the commutator and one at the front with barriers between arms extending down to within approximately $\frac{1}{2}$ in. of the commutator. All tests indicated that these barriers should be of an open construction and as far away from the source of the arc as possible so as to give it sufficient room to expand and dissipate itself without becoming explosive. In other words, the barriers should be next to the parts to be protected (as the pedestal and leading side of brush holders) and as far away from the arc as possible. Best results have been obtained by protecting the pedestal with an arc shield and leaving as much space as possible on the commutator for the arc to expand. This also gives free access to the commutator, the lack of which is one great disadvantage in any form of flash guards.

Automatic Railway Substations*

An Account of Some of the Improvements Made During the Past Five Years and an Outline of the Present Status of Automatic Control

BY FRANK W. PETERS

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The use of automatic substations, as shown by several years of use, has resulted in decided economies and improved operating conditions, and as the subject has not been presented before the Institute since the account of the original installation† was prepared, a review of the modern automatic equipment seems desirable.

The individual devices comprising the first equipment were, with but few exceptions, those which had previously been developed by electrical manufacturers for use in other applications. This condition was a decided advantage to the operating companies since development charges were eliminated, rendering the equipment comparatively low in cost. This in addition to the successful operation of the early installations, made possible the rapid growth of automatic application to electric railways.

AUTOMATICS ARE USED IN CONSIDERABLE VARIETY

Shortly after the initial installation on the Elgin & Belvedere Electric Railway, the two remaining substations on that road were made automatic, followed by the Potomac Electric Power Company which made automatic a 500-kw. substation. About that time (1916) the Des Moines City Railway and Inter Urban Railway, two adjacent roads, outlined the now practically completed program involving automatic substations. These roads now have in operation a total of three 300-kw. and nine 500-kw., 600-volt automatic synchronous converter equipments. The confidence inspired in the minds of operating engineers and the rapid adoption of this comparatively new phase of electric railway operation was in no small measure accelerated by the successful performance of this rather broad application.

The range of requirement to which the new scheme

¹For a description of this device, see ELECTRIC RAILWAY JOURNAL, May 4, 1918, pages 858 and 891.

*Abstract of a paper read at the Pittsburgh meeting of the A.I.E.E., March 12, 1920.
†See ELECTRIC RAILWAY JOURNAL for Sept. 18, 1915, page 583.

could be successfully applied was demonstrated when in 1917 two 300-kw., 600-volt, 60-cycle synchronous converters operated in series on 1,200 volts by the Milwaukee Railway & Light Company were automatically equipped. Two automatic substations each containing one 600-kw., 1,500-volt d-c. induction motor-generator set were also installed in 1919 by the Salt Lake, Garfield & Western Railway. The Rhode Island Company has for some time been operating a station containing two 300-kw., 600-volt converters in parallel, while in other localities portable automatic substations have been functioning successfully. Railway converters now automatically equipped range in size from 200 to 1,500 kw. with motor-generator sets from 300 to 2,000 kw. The total capacity operating in this manner and including those in process of installation is estimated to be 32,000 kw. while the number of automatic equipments involved is approximately seventy-five, fifty of which having been applied to 300 and 500-kw. sizes, and the remainder cover the range of various types and sizes of installations briefly referred to.

Without question a direct reduction in operating expense has been the prime motive for the purchase by railway companies of automatic substations. The saving is effected in several ways, although it is variable and depends upon conditions under which a particular station is operated, as well as the number and capacity of machines in the station. The following are the principal items of saving: Labor, light-load losses, fuel for heating, building construction, saving resulting from improved load factor, feeder costs and reduction of electrolysis losses.

WHAT AUTOMATIC CONTROL ACTUALLY DOES

Under automatic control the functions of starting and connecting the machines to the line upon power demand and finally shutting them down after the demand for power has ceased are all carried on in their proper sequence without any assistance whatsoever from an operator. In present day practice the great majority of these stations are controlled entirely by the automatic equipment, but a few are, for specific reasons, remotely controlled by dispatchers with the aid of a pilot wire. A remote-control station may be considered in the same class with a purely automatic station since the control current merely replaces the automatic devices which determine when the station is to start or stop. The remaining apparatus which performs the actual switching operations is identical in both cases.

Protective devices having the following duties are provided to perform the functions ordinarily left to the discretion of the operator: (1) To limit the overloads. (2) To limit the temperatures. (3) To shut down the machine when a-c. or continuous d-c. short circuits occur, upon failure of alternating current, upon failure of any device, in case of excessive speed and upon reversal of direct current. (4) To prevent machine starting during low a-c. voltage and during single-phase a-c. supply periods.

In stations containing a motor-generator set, instead of a synchronous converter, certain modifications of the equipment are necessary to accommodate the starting operations, but the scheme of operation with few exceptions is similar to the converter equipments. Oil-immersed starting and running contactors are used because of the higher transformer secondary voltage and a certain amount of overload protection is obtained by

inserting one or two steps of resistance in the generator field circuit in addition to two steps of series resistance in the main d-c. circuit. This arrangement reduces initial cost since the field resistance and its contactors are of small capacity. An energy saving in resistor heat loss is also accomplished. The 250-volt generator on the drum controller becomes unnecessary in the case of a motor-generator automatic equipment.

IMPROVEMENTS THAT HAVE INCREASED RELIABILITY

The recent development in automatic equipments has largely consisted of perfecting and making more reliable the present type of station as well as arranging for and applying the principle in other applications such as lighting, mining and hydraulic generating stations. Among specific instances of improved design may be mentioned the elimination from the equipment of all disk-type interlocks and the substitution of substantial finger-type auxiliary contacts. Relay contacts element have been improved where necessary so as to provide a quick make-and-break action and on direct-current circuits blow-out coils have been added. An improved type of motor-operating mechanism for oil circuit breakers is now in use in which compactness and reliability are the outstanding features. Direct-current contactors having a rupturing capacity sufficient to handle any load conditions have been developed and are performing their function with complete success. Reverse current and under-load relays of substantial construction and capable of accurate calibration at low current values have been designed to accommodate the conditions of automatic substation operation.

The use of automatic control in railway substations has in a comparatively short time expanded to where it is firmly established in city and interurban railway operation. The successful experience of the past has resulted in larger capacity stations serving heavy traffic being made automatic. The adaptation of this type of control to electric trunk line service at 2,400 or 3,000 volts direct current as well as more extended use in the strictly industrial field is not far beyond the horizon.

Automatic Substations for Heavy City Service*

The New Method of Control Simplifies Distribution Problems and, Judicially Used, Saves Money and Improves Operating Conditions

BY R. J. WENSLEY

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IT IS very gratifying to those directly interested in the automatic substation that the larger city street railway systems are eagerly taking up the question of rebuilding their distribution systems by taking advantage of the savings made possible by automatic operation of converting equipment.

The earlier street railway systems made little or no attempt to lay out the distribution lines with economy or efficiency. Any location available was seized on as a power-house site. Cables were run the shortest possible distance to the trolley wire and from that point the trolley wire was usually the only means of carrying current. As service demands increased the voltage

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

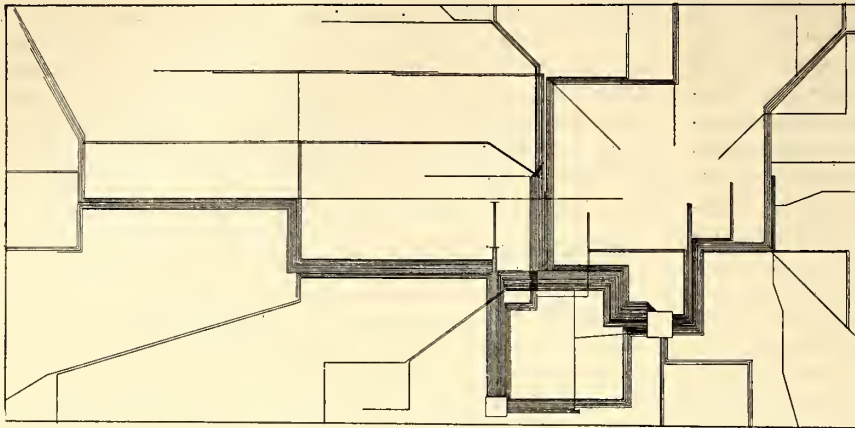


FIG. 1. FEEDER COPPER NOW IN USE IN CITY OF 300,000 POPULATION

drop became too great for satisfactory service, and to remedy this the voltage was increased and feeders were run parallel with the trolley.

As the demands still further increased, the factor of electrolytic destruction of underground pipe necessitated the use of heavy copper feeders in parallel with the rail. The negative booster was also freely used to compensate for the drop in these return feeders.

When first the engine-driven alternator and later the turbo alternator came to the front as the most economical means of power generation, the railway substation soon became popular. In some of the larger cities there were installed one or more central steam plants with a number of large substations located in various parts of the city. Owing to the cost of operating labor, the number of these was kept down to the minimum even at the expense of considerable investment in feeder copper. Not only were large amounts of feeder copper thus involved, but transmission losses were high and schedules were slow.

The development of automatically controlled substation equipment has placed in the hands of the dis-

tribution engineer a possible method of reconstruction that is little short of ideal. Substations can now be scattered about without the specter of heavy and ever-rising operating labor expense. The increase in the number of substations enables the holding of good trolley voltage without heavy expense in large feeder capacity. Trouble due to electrolysis is largely minimized and in many cases entirely eliminated by the increase in number of substations.

Care must be used in applying this remedy that it is not overdone. Sizes of machines and stations must be carefully calculated so that the load factor will be high. In deciding on the best sizes for equipment, several factors

must be considered. Interchangeability is always desirable and, therefore, there should be as few different sizes of machines as is consistent with economical operation. In most city applications two machines will prove to be best, with space provided for a third to take care of future growth.

Where two machines are selected for a given location each one must be capable of carrying the normal off-peak load without assistance. The combined capacity must be sufficient to take care of the peak load.

TABLE I—DATA USED IN CALCULATIONS

Population of city.....	300,000
Present direct-current capacity, old plant (lower), kilowatts.....	8,000
Rotaries in new plant (upper).....	3-2,000 kw.
Total area of positive and negative feeders, leaving old plant, circ. mil.....	25,800,000
Total area of feeders leaving new plant, circ. mil.....	23,000,000
Total area of tie lines, circ. mil.....	8,000,000
Total area in positive feeders, circ. mil.....	40,000,000
Total area in negative feeders, circ. mil.....	16,800,000
Average length of feeders to center of load, miles.....	2
Peak load on two plants, amperes.....	22,000
Average I ² R loss at peak load, kilowatts.....	2,750
Number of cars operated in heavy traffic.....	300
Average weight of cars, tons.....	20
Motor equipment of cars.....	2-60-hp.
Schedule speed in rush hour, miles per hour.....	6
Balancing speed of cars, miles per hour.....	27

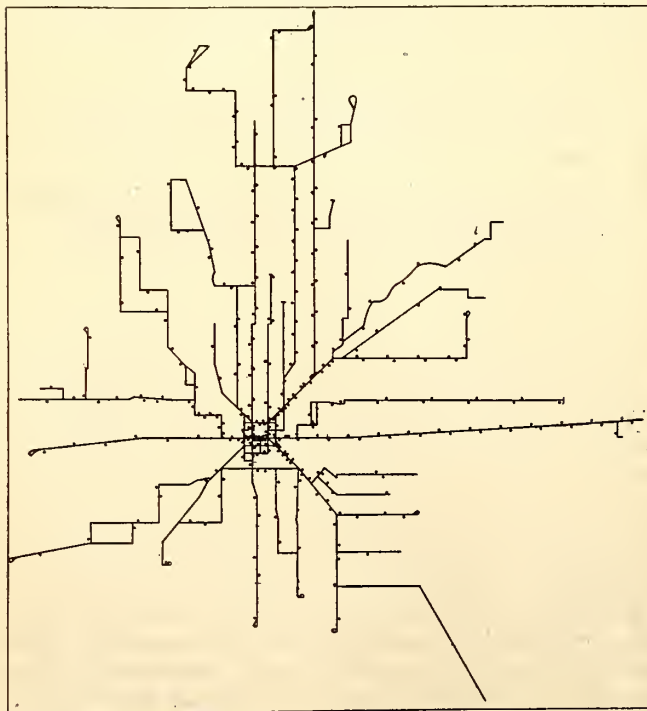


FIG. 2. SPOT MAP SHOWING REQUIREMENTS FOR CARS IN CITY OF 300,000 POPULATION

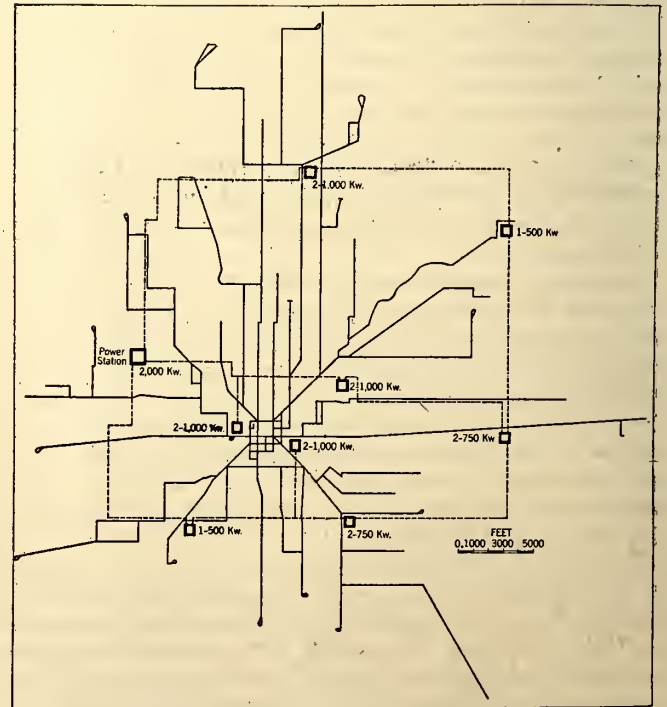


FIG. 3. SUGGESTED LAYOUT OF POWER SYSTEM WITH AUTOMATIC SUBSTATIONS FOR THIS CITY

TABLE II—BALANCE SHEET FOR PROPOSED SYSTEM

Gross cost of the new system:	
11,500 kw. of substations at \$40.....	\$460,000
25 miles of line at \$5,000.....	125,000
Reconstruction of feeder system.....	25,000
Power house equipment, transformers, etc.....	100,000
Total cost of automatic substations.....	\$710,000
Credit power plant scrap.....	100,000
Credit copper removed.....	205,380
Net cost of automatic substations.....	\$404,620
Fixed charges at 15 per cent.....	\$75,693
Annual operating labor.....	7,000
Gross annual charges against automatics.....	\$82,693
Savings due to the new equipment:	
Annual saving in copper loss.....	\$66,000
Annual saving in platform labor.....	14,600
Annual saving in labor due to shutting down of old power plant.....	50,000
Annual cost of substations.....	\$130,600
Net operating credit annually.....	\$82,693
Net operating credit annually.....	\$47,907

By selecting machines of combined continuous capacity equal to the root-mean-square value of the peak load, a reasonable reserve capacity is allowed since the two-hour rating will probably allow one machine to pull over the peak if the other is out of service. To help in such cases, a limited number of feeders should be run through from one station to another, so that a feeder may be opened in the station in trouble, thus transferring a portion of its load to an adjacent station.

HERE IS HOW THE AUTOMATIC PLAN WORKS OUT

To illustrate the way in which the problem of applying automatic substations to city service should be approached, a city of about 300,000 population has been selected as an example. This represents good practice under the old method of centralized distribution. Fig. 1 shows in a general way the distribution of the feeder copper, details of which are given in table I. The two plants used here are about 3/4 mile apart on the same side of the city, and about one mile from the loop district where occurs the section of the greatest load concentration.

The problem is to lay out a new distribution system which will reduce the transmission losses to a minimum, raise the average trolley voltage to a reasonable value, keep the stray earth currents at a minimum and at the same time avoid raising the expense for operating labor to an undue amount. All of this must be accomplished at the lowest possible net cost.

Preliminary to deciding on the size and location of substation equipment, a spot map of the system, based on rush-hour schedule, is desirable. A sample is shown in Fig. 2. A disturbing factor in this case is that there are fourteen interurban lines entering the city, all of which operate fairly heavy cars. In laying out the power supply it has been assumed that two of these cars are at the center of each line which they use for entering the city and that one is equivalent to two city cars. The average current per city car has been taken as 53 amp. After consideration of all of the factors entering into this case, the final location decided upon for the substations was as shown in Fig. 3. Table II shows the balance sheet for this change with the saving which the proposed plan would yield.

In this solution of the problem the entire equipment should be automatic in operation, except the one converter retained in the power plant. One of the converters in one of the loop stations would be set for continuous operation. Many modifications of this layout are possible without materially altering the saving shown.

Is the Use of the Screw Spike Justified?

Baltimore Company Abandons Its Use—Result of Questionnaire Addressed to Prominent Roads Given

BY W. W. WYSOR

Chief Engineer United Railways & Electric Company, Baltimore

IN THESE critical days of the street railway industry, when operating officials are seeking to learn how they may economize in every way possible, it is well not only to point out economies that may be effected, but also extravagances that may be avoided. In caring for the physical properties of the industry, and in building extensions or additions we should consider how the work may be done at the least cost consistent with good construction. It is important that the work be done properly—better one job done right than two jobs done halfway—but there is such a thing as needless refinement and unnecessary expenditure. Our watchword should be "efficiency," and this applies not alone to the men employed in doing the work, but to the methods and materials selected for doing it. If a bridge is to be built over which 10-ton cars are to be operated, it is manifestly a waste of money to build a bridge strong enough to carry 300-ton locomotives; if 3/4-in. trolley cord is sufficient, it is obviously foolish to use 1-in. rope merely because it is stronger; if we wish to move an article weighing one hundred pounds from one section of the city to another, we do not employ a five-ton truck. This brings us down to the question, "Why is a screw spike?"

For a number of years past, in the city of Baltimore, screw spikes have been used as standard construction on all girder rail, with the exception of special work, but there does not seem to be any logical reason for having done so nor for continuing this practice. When the question was asked: "Why use screw spikes?" the answer generally was "Because they hold better," or the more indefinite one, "Because it is better practice or in line with more up-to-date methods." There is no doubt that screw spikes, when newly driven, require more force to withdraw them than do nail spikes, but when ties decay or spikes for any reason become loose, the greater holding power of the screw spike is lost. Moreover, if the lifting force exerted on nail spikes is not sufficient to withdraw or loosen them, why go to the expense of providing a spike of greater holding power? The functions of a spike are to hold the rail to gage and prevent overturning, and there is every evidence, so far as the observations of the writer go, that this is performed by the nail spike equally as well as by the screw spike, at least in street railway tracks.

In the last few years we have reconstructed in the city of Baltimore many miles of track which had been down for periods ranging from ten to twenty-five years and which had been laid with nail spikes. In every case where ties were solid, the spikes were found in place as originally driven, and it required as much or more force to withdraw them than it did newly driven spikes. In the case of rotten ties, of course any form of spike is valueless.

About two years ago we started keeping a record of the cost of screw spikes as compared with nail spikes and found that the former cost about \$1,500 per mile more than the latter, without any apparent benefit.

In order to determine what the various roads were

doing, a questionnaire was prepared and forwarded to forty-eight of the most prominent street railways in the country. Replies were received from thirty-six companies—a list of the questions and a resumé of the answers received being shown in the following statement. It will be noted that a majority of the companies do not use screw spikes and most of the companies that do employ them use them only in particular cases, such as for bridge and subway work. For this kind of work, where traffic is very heavy and where the rails wear out long before it is necessary to renew the ties, the use of screw spikes may be justified, inasmuch as they can be withdrawn and redriven with less damage to the ties; but for ordinary construction in paved streets, not a single valid reason has been given for their use.

When screw spikes were first adopted on this property, tie plates were adopted at the same time, and it seems probable that this was true of other properties, not only of street railways but steam roads, and the better results that have been obtained from this type of construction were, in my opinion, due entirely to the tie plate and not to the screw spike. After a very careful consideration of the matter, this company has abandoned the use of screw spikes but has retained the tie plate. We believe the tie plate to be well worth its cost.

While this article deals with the use of screw spikes in connection with street railways only, it is well to call attention to the report of the committee of the Pennsylvania Railroad, dated April 27, and published in October, 1917, in the Bulletin of the American Railway Engineering Association. This report covers the experimental use of screw spikes ranging over a period of nine years, and the conclusion reached by the committee was that screw spikes have no advantage over nail spikes.

RESULTS OF QUESTIONNAIRE ON SCREW SPIKES

Question No. 1—Do you use screw spikes? Answers: Four companies answered "yes"; ten companies, "to a limited extent only"; twenty-two companies, "no".

Question No. 2—Are they employed as standard construction in (1) city streets? (2) on interurban T-rail track? (3) on special construction such as subways, elevated structures, etc? Answers: (1) Four companies answered "yes"; nine companies, "no". (2) Fourteen companies answered "no". (3) Eleven companies answered "yes" and three "no".

Question No. 3—On what sections of rail are they used? Answers: Eight companies answered "standard T-rail"; six, "high T-rail (Shanghai)"; seven companies, "girder rail."

Question No. 4—Do you use tie plates with screw spikes? If so, are they specially formed so as to give support to the head of the spikes? If not, do you use a clip? Answers: Five companies replied they did not use tie plates; three

companies that they used plain plates; three that they used special plates and three that they used combination plates and clips.

Question No. 5—What considerations led you to adopt the screw spike? Answers: Three companies replied "increased holding power"; four, "special construction, such as subways and bridges and where more or less permanent foundation is employed and where rails can be renewed without disturbing the foundation"; two, "experimental only"; one, "best type of fastening"; one, "used with tie plates to prevent cutting of ties"; one, "on account of decreased maintenance of special work"; one, "seemed to be in accordance with best practice".

Question No. 6—Has it met with your expectations and proved satisfactory in service? Answers: Three replied "yes"; one, "no"; three, "experimental only"; seven, "yes for special purposes for which they are applied".

Question No. 7—In comparing the performance of screw spikes as against nail spikes, are tie plates employed in both cases? Answers: Seven companies replied "yes"; seven, "no"; four, "no comparisons made".

Question No. 8—What is the excess cost per mile of single track of screw spike construction over nail spike construction? Answers: Ten replied "no data"; one, "double the cost of hook-headed spikes"; one, "\$2,422.00"; one, "\$1,000.00".

Question No. 9—Do you consider screw-spike construction of sufficient superiority to justify this excess cost? Answers: Four companies said "yes"; five, "no"; three, "yes as limited to special construction"; one, "in hard wood, no; in soft wood, yes".

Comparison of Automobile and Electric Car Passengers in Schenectady

THE officials of the Schenectady Railway Company, Schenectady, N. Y., have compiled some figures giving a comparison of the trolley and pleasure car traffic in that section during the years 1912 to 1918 inclusive. During this period there has been a constant increase in the number of automobiles used so that the ratio of trolley car passengers to pleasure car passengers has decreased from 20 to 1 to 5 to 1. During the year 1918 there were slightly over 4,000 pleasure cars in that city, or one car for every twenty-six people.

The records of automobile registration in the office of the Secretary of State for the year 1919 are not yet available, so a comparison for this year is not included. However, the registrations of automobiles were about 30 to 35 per cent greater in 1919 than in 1918, according to a statement made by Secretary of State Hugo during a talk in Schenectady in October, 1919. Just how this increase is distributed in Schenectady and over the State in general would be hard to estimate.

The accompanying tables give detailed figures and comparisons, which will be of interest.

RATIO OF TROLLEY CAR PASSENGERS TO PLEASURE CAR PASSENGERS IN SCHENECTADY			PLEASURE CARS IN SCHENECTADY, 1912-1918				
Year	Trolley Passengers	Pleasure Car Passengers	Year	Number Riding Per Day	Total Riding 214 Days	Pleasure Cars in the City	City Population Per Car
1912	20.0		1912	4,330	926,620	866	98
1913	18.8		1913	5,510	1,179,140	1,102	86
1914	12.8		1914	7,425	1,588,950	1,485	65
1915	9.4		1915	9,180	1,964,520	1,836	49
1916	7.7		1916	12,755	2,729,570	2,551	39
1917	6.2		1917	16,920	3,620,880	3,384	32
1918	5.08		1918	20,035	4,287,490	4,077	26

Note: Allowing seven months (April - October, inclusive) or 214 days riding period per car, five passengers per car.

DATA REGARDING TROLLEY CAR SERVICE IN SCHENECTADY, 1912-1918					Population			
Year	Revenue	Transfer	Passengers Carried (City)	Total	Number Cars	Passengers per Car	per Car	Rides Per Capita Per Year
1912	\$15,659,267	2,515,148	479,597	18,654,102	151	123,536	562	220
1913	17,446,810	3,025,274	563,903	21,135,987	158	133,765	599	226
1914	16,482,476	2,919,520	578,034	19,980,030	158	126,456	611	206
1915	14,818,223	2,577,047	574,375	17,969,645	158	113,725	569	199
1916	17,266,463	2,924,553	578,485	20,769,501	158	131,452	623	208
1917	18,725,891	3,147,185	580,985	22,454,061	174	129,046	622	207
1918	18,162,463	3,104,355	525,805	21,792,623	172	126,701	623	202

Characteristics of Rail Bonds*

A Summary of Present Practice in This Field With Comment Upon the Merits and Demerits of the Important Types of Bonds Now and Previously in Use

BY RALPH H. RICE

Principal Assistant Engineer Board of Supervising Engineers Chicago Traction

PRACTICALLY all American electric railway systems operate with grounded returns. The track is usually quite intimately in contact with the earth, which is a good conductor; hence we have the condition that the return current from the car is discharged into the conducting rails and earth with its buried pipes or other metallic structures. So long as the rails are in contact with the earth a division of current between them will always occur in accordance with the laws of divided circuits, and while we cannot entirely eliminate the leakage of current from the rails we can minimize it. Our treatment for leakage or stray currents must be either to prevent any passage of current from the rails to the earth by insulating the rails, or by making the rails such good conductors that only a negligible amount of current will leave them. The former method is not practicable and we shall inquire into the latter.

In some cases, particularly in large cities, it is feasible to make the rail practically continuous by welding

TABLE I—RESULTS OF TESTS OF ELECTRICALLY WELDED RAIL JOINTS IN CHICAGO

	Joints	Percentage
Total tested	44,263	100.00
100 per cent or more conductance	43,769	98.88
Below 100 per cent—		
No break visible	203	0.46
Broken	291	0.66
Total	494	1.12

the splice bars at the rail ends. While such a process is used for mechanical reasons in securing a good joint, it also serves to secure a very low resistance connection between adjacent rails. Several forms of such welds are in use and when properly made they produce an electrical connection which does not exceed in resistance that of an equal length of the rail. The earliest form of such connection was the cast weld produced by pouring molten cast iron into a mold around the rail ends. It was a rather satisfactory mechanical joint but was not of much certain value electrically and has practically been superseded by more efficient forms. A more modern form is the thermit weld. In this the rail ends are actually melted down into a homogeneous mass of great strength and high conductivity. The Clark joint, a special form of this joint, has a weld made between the bases of the rail, thus securing electrical continuity, the ordinary bolted splice bars being used for the mechanical joint.

In the electric weld heavy bars of steel are spot welded to the web of the rail by a heavy electric current. This process requires special apparatus but produces most excellent results. About 150,000 of these welds have been made on the street railway lines of Chicago and the results of tests made on some of them, covering a period of three years, are as given in Table I.

Arc welded joints are similar to the electric weld except that the electric arc is the source of heat.

Special forms of joints, such as the Clark already mentioned, and the Nichols, are used. The latter is made by pouring molten zinc around the bolted or riveted splice bars. Upon cooling, the zinc expands and, if the rail surfaces are clean, it makes a low resistance joint.

These forms of rail weld take the place of rail joint bonds and should be considered when making a selection of the form of connection to use. They are better adapted to heavy city service than any other service on account of their cost, and of the fact that the rails are protected by the pavement from rapid fluctuations in temperature under which conditions a continuous rail may be maintained better than in the open country.

WHAT IS REQUIRED OF A RAIL BOND?

When the track is not welded, some form of electrical connection between the rail ends is essential, and to meet this need various types of bonds have been developed. Bonds are subject to breakage due to mechanical defect, temperature changes, vibration and flexure. They are also subjected to corrosion at the contact surface with the rail, and to oxidation and consequent increase of contact resistance to an amount which destroys their usefulness. Bonding is largely a mechanical problem of maintaining a low resistance contact against the destructive agencies mentioned above.

In a rail bond we want (1) high conductance from rail to rail, (2) permanent contact with rail, (3) protection of bond from theft or mechanical injury, (4) ability to withstand vibration and mechanical strains incident to operation, (5) provision for ready installation by low-grade labor, (6) provision for ready installation without interruption of traffic, (7) ease of inspection and test, (8) as low a cost as is consistent with the grade of installation desired.

To see what has been done to meet these requirements we may make an analysis of types of bonds, under three headings: (A) construction of bonds, (B) location of bonds, (C) application of bonds.

This analysis is shown in Table II.

TABLE II—ANALYSIS OF BOND CHARACTERISTICS

A—Construction:	C—Application:
1. Terminal—see Application of Bonds.	1. Bolted connections
2. Conductor	2. Soldered terminals
Solid	3. Plastic or amalgamated
Stranded	4. Pressure terminals
Ribbon.	Pin terminal
B.—Location:	Compressed terminal
1. On web of rail	Socket terminal
Exposed	5. Brazed or welded terminals
Concealed	Arc weld
2. On head of rail	Flame weld
3. On base of rail	Electric weld
	Copper weld.

ELEMENTS OF BOND CONSTRUCTION

All railway bonds are of copper. Each consists of two parts, the conductor and the terminals for attachment to the rail. The terminals have many forms, which will be considered later. The con-

*Abstract of paper read at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

ductor may be solid, stranded or of flat ribbons, depending upon the length, size and location of the bond. A solid conductor is generally used for long bonds and when not subject to vibration. The ribbon conductor is usually applied with its laminations horizontal and when the bond is subject to vertical motion only, as on third rail construction. The stranded conductor is most commonly used, as it is very flexible in all directions. Special stranding is used and the conductor is divided into two or more cables if necessary. The conductor is usually attached to the terminals by welding, although the terminal is sometimes cast and one type of bond has the copper strands formed into a terminal. The latest type of bond, which is not yet on the market, is one in which a copper terminal is welded to the conductor, and then a facing of steel is brazed to the terminal by the manufacturer. When this bond is applied to the rail a weld is made between the steel face and the rail. This seems to promise excellent results, but is expensive.

Probably the most frequent application of bonds is to the web of the rail, as being the location which interferes least with the track construction and in which the bond is most protected from ordinary injury. Less frequently bonds are applied to the head of the rail and, sometimes, as on an elevated railway third rail, to the base. When applied to the web the bond may be of the exposed or concealed type. The exposed type is attached to the rail beyond the ends of the splice bars and is unprotected in any way from injury or theft. The concealed type is passed under the splice bar and cannot be removed without removing the bar. In some forms the conductor and terminals are entirely under the bar. Special shapes and divisions of the conductor have to be made to enable the bond to keep clear of the bar and bolts, so that the conductor will be free to move with the movement of the rails.

The greatest variety of bond terminals has been devised with the aim of securing a mode of attachment to the rails which will be easy to install and will result in a permanent and efficient electrical connection. Some of the types mentioned below are now practically obsolete, for the reasons given, and others have merits which will be pointed out.

The ideal to be aimed at in any installation of joint bonds is to make a connection between the rails that will not increase the track resistance above that of the continuous rail. In commercial practice a terminal contact area of perhaps seven to nine times that of the cross-section of the bond conductor is customary, which is approximately two-thirds of the theoretically required area.

Bolted Connections: Bolted connections have not been successful. It is difficult to bring into intimate contact large flat surfaces unless these have been carefully prepared for such purpose. The bulk and cost of such connections, and the practical impossibility of maintaining tight joints has eliminated this type for electrical connection. The old channel pin device by which a bond wire is held in a hole by a wedge driven between the wire and rail, is really a form of mechanical connection similar to a bolted connection, and is subject to the same general limitations. Some recent work has been done on developing forms of bolted connections which are superior to the older types.

Soldered Bonds: Soldered bonds require no rail drilling, but do require a thorough cleaning of the rail,

which is sometimes more troublesome than drilling. Such a bond should be applied above ground, as corrosion is sure to impair its value. The soldering fluid used is often the cause of corrosion, and is always a potential source of trouble. The co-efficient of expansion of copper is nearly twice that of steel, so that with temperature variations the film of solder connecting the two different metals is subjected to continual strain and under the vibrations due to traffic will ultimately fail.

With soldered bonds it is difficult to secure complete contact between the rail and the terminal surfaces, no matter how carefully the work is done. The heat capacity of the rail is also so great that it is difficult to get it to a soldering temperature so that frequently the edges of the bond are well attached to the rail but the inner portion is not, and the expected conductivity is materially reduced. On account of the difficulties mentioned soldered bonds have fallen into disfavor.

Plastic Bonds: Plastic or amalgamated terminal bonds have been used to some extent. In this form of bond the rail and terminal surfaces are amalgamated and amalgam is placed in some form of pocket between the rail and bond and permanently held in position by the joint plate. The integrity of the connection is dependent upon the permanence of the clamping device, and experience has shown that such dependence is usually found unjustified by the results. Amalgam may be used with any type of mechanically applied bond as an aid in securing good electrical contact, and tests show that it is effective to some extent in this manner.

Pressure Type of Bond: The pressure type of bond is that in which the copper terminal is placed in a hole drilled in the rail and then in some manner pressure is applied to force the material of the terminal to expand radially and thus come into close contact with the side or wall of the hole. With this form of terminal the continued efficiency of the bond is dependent upon the two metals remaining permanently and intimately in contact. As there is no solder, bolt or other external agency to hold them, the maintenance of the contact seems to depend upon the absence of any cause tending to separate them. It has been claimed that temperature changes due to varying weather conditions will cause the copper terminal to loosen from close contact with the steel, because the copper has a higher temperature co-efficient of expansion than steel. On the other hand, it is claimed, with apparently good reason, that when the copper terminal has been subjected to pressure the distortion of the copper hardens it and it becomes elastic. The elastic properties of the copper and steel will then allow an expansion and contraction action between them sufficient to withstand the stresses caused by ordinary temperature changes.

Pin Terminal Bond: One form of the pressure terminal is the so-called pin terminal or tubular bond in which the terminal has a hole through the center into which a steel pin is driven. These bonds have the advantage of easy application without specially skilled labor. They are quickly applied and require no special tools. In Chicago this type of bond is used on the internal joints of all special work. Over 50,000 40-in. No. 00, $\frac{3}{4}$ -in. terminal bonds have been used.

Compressed Terminal Bond: Another form of the pressure type is the compressed terminal. In this form longitudinal pressure is applied to a solid terminal in such a manner as to produce radial expansion of the

terminal. The terminal is placed in a hole the same size as the terminal and then pressed between the jaws of a screw or hydraulic compressor. The application of this form of bond requires a more highly skilled class of labor than does the pin terminal, and is not so dependent upon a properly drilled hole in the rail, but requires proper centering of the compressor. Probably the chief difficulty with the application of this form of bond is to know how much compression to apply.

Socket Terminal Bonds: A third form of pressure terminal, which may be called a socket terminal, is that in which a hole is drilled into but not entirely through the rail, making a pocket into which the copper terminal is forced by hammering or other pressure. Often the hole has an enlargement of some form, such as a groove, made in its sides so that the copper will flow into this enlargement and the terminal will be held more rigidly, as well as having more area of contact with the steel. This form of terminal partakes of the characteristics of both the pin terminal and the compressed terminal. It is more like the former in its ease of application, and more like the latter in that some irregularity in drilling the hole is not so detrimental to a good contact.

Brazed or Welded Terminals: A brazed or welded attachment is made by the application of heat to the rail and terminal in sufficient amount to soften them so that by the application of pressure the two surfaces may be brought into very close contact and a permanent, low-resistance joint is secured. A connection of this kind made between two pieces of the same metal is a weld, but if a third metal, such as brass or solder is used to fill in between the two metals, then we have braze. Most of the commercial bonds of this type are brazed to the rail. According to the manner of applying the heat we have several forms of brazed or welded connections which may be classified as follows: (1) Arc weld—heat furnished by an electric arc. (2) Flame weld—heat furnished by oxy-acetylene flame. (3) Electric weld—heat furnished by current passing through carbon electrodes in contact with the bond terminal. (4) Copper weld—heat furnished by pouring molten copper into a mold surrounding the bond terminal.

All of these forms of welding require some special apparatus. Each form is sponsored by some manufacturer who contracts to do the work or furnishes the equipment required. They require care and skill in their application. The welding temperature is high and burning of the steel or copper must be avoided. These conditions make the cost relatively high.

WHY CROSS BONDING IS NECESSARY

If every joint on a rail was properly bonded and maintained there would be no necessity for cross bonds between the rails of a track. But bonds and joints fail, and by cross bonding the consequent bad results are minimized. In case of a double track road the two tracks should have cross bonding between them for the reason mentioned above and also because the load on the two tracks can be thus equalized. Any type of bond terminal may be used but the conductor is usually solid as it is not subject to as much vibration as the point bond. Cross bonds are spaced from five to twenty per mile of track, the spacing being the closest in large city systems. In Chicago approximately 15,000

60-in., No. 00, $\frac{3}{4}$ -in. pin-terminal bonds are used, and by ordinance they must be spaced not to exceed 330 ft. apart. Between the tracks an auxiliary copper cable of at least 500,000 circ.mil is used on all straight track, and each cross bond is attached to this cable. This results in extremely good equalization of current between the tracks.

Track special work needs replacement more frequently than straight track, and to maintain the integrity of the return circuit while this is being replaced, some form of bonding around the special work is usually adopted. Also on account of the numerous joints in the special work its internal resistance is high as compared with the straight track.

The best form of bonding may be illustrated by the standards adopted by the Board of Supervising Engineers and used in Chicago. There 129-lb. rails having a copper equivalent of 1,500,000 circ.mil are used for all straight track. The four rails, together with the auxiliary cable mentioned under cross bonds, set a requirement of 6,500,000 circ.mil copper equivalent through the special work. This is secured by: (1) Using a 1,000,000-circ.mil cable through the special work for each rail, the ends of each of the four cables being electrically welded to the straight track rail beyond the last bolted joint, a total of 4,000,000 mils. (2) Each internal joint is bonded with a No. 00 pin-terminal bond, a total of 532,400 circ.mil. (3) Copper equivalent of eight 12-bolt joint plates, a total of 2,000,000 circ.mil. Over 25,000 cable welds have been made in Chicago in carrying out this plan.

TESTING OF RAIL BONDS IS A SIMPLE PROPOSITION

The testing of rail bonds is essentially measuring the resistance of the rail joint across which the bond is placed. This is commonly done by measuring the drop across the joint and comparing it with the drop over an equal length of unjointed adjacent rail. This can be done by using two voltmeters read simultaneously, which is not convenient or accurate. Usually a testing outfit is made up by having a frame with three equidistant rail contacts attached to it, these contacts being connected to the terminals of a differential voltmeter. A zero reading then indicates that a certain length of rail, usually three feet, including the joint, has a resistance just equal to the unjointed rail. In some forms of testers the third contact is movable along the rail and may be placed to secure a zero reading, in which case the length of rail having the same resistance as the joint is ascertained. Autographic readings may be made on some testers and there are in use testing cars so arranged that by running over the line the bonds may be tested and recorded automatically. The principle of operation is the same in all cases. Sometimes there is insufficient current flowing in the rail to secure reliable indications. In such an event current must be sent into the rail from an independent source, from points beyond the tester contacts.

A common error is made in assuming that a bond is defective if a test reading is secured greater than the standard. For instance, if the drop is taken over a 3-ft. length of rail, including the joint, and a 5-ft. length of unjointed rail is necessary to balance this drop, then it is often assumed that the bonded joint is defective. This does not follow at all because the test means that the resistance of the 3 ft. of rail containing the bond is greater than 3 ft. of unjointed rail. The

bond may be 100 per cent perfect, but if the area of the bond is not sufficient to equal the copper equivalent of the rail such a result will always follow. A test of this kind means very little unless we compare the results of the test with those secured at the time of installation of the bond. Any increase of resistance of the joint may be due to a partial failure of the bond, or it may be due to a lessened conductance through the splice bars. The only way to ascertain what has happened to the bond itself is to test its contact, independently of the rail section.

SUMMARY AND CONCLUSION

All parts of the return circuit should be intimately connected together so that each part may be utilized to the fullest extent for carrying the load. Any high resistance in the return circuit is just as detrimental as one in the positive circuit, and it is bad engineering to neglect the returns because they are usually out of sight. Perhaps on most roads there would not be any financial advantage in bonding merely to save energy, as the loss might readily be less per annum than the fixed charges on the bonding investment. But this should be determined for each road, and it is quite feasible to work out a mathematical relationship which will indicate how much might be spent for bonding for the purpose of saving energy.

A more important reason for good bonding is to secure better voltage conditions. A large line drop will, of course, give low voltage at the motor terminals and cause loss in speed. To develop the same power in the motors increased current will be drawn from the line and this increased current will cause larger power losses in the motors and line. The peak load demand will be raised correspondingly. From no point of view are these results beneficial.

The leakage of current from grounded returns causes electrolysis of underground structures when these are so situated as to be in the leakage path. These leakage currents, of course, follow the fundamental electrical laws, and if our track construction has produced the highest practicable resistance to leakage, then our only recourse to further reduction of leakage is to make the track conductance the highest possible. This opens up a large field, and it is not the intention to discuss electrolysis problems except to point out their existence and cause and to suggest their fundamental relation to rail bonding. Any betterment in the return circuit will directly aid in the reduction of possible electrolytic damage.

Mr. Shoup on Railway Situation

Where Fare Has Been Raised Electric Railways
Are Doing Well—Bus Trials Described—
Railway Securities Have Large
Values Behind Them

IN AN address before the San Francisco Chamber of Commerce on Jan. 12, Paul Shoup, vice-president of the Southern Pacific Railway and president of the Pacific Electric Railway, gave as the fundamental difficulty with the traction lines in the United States "the failure of the public generally, and also of the owners of the lines themselves, to realize that after all the traction line is a private industry, is simply an agent for the public in the furnishing of transportation. As such it should be looked upon as other agents would be who furnish pri-

vate capital to carry on a public purpose to meet a public need. It should be entitled to protection, just as any other agency would be under like circumstances, and it should not be made the instrumentality of trying to collect other taxes—other than the tax necessary to maintain this industry as a carrier—as a means of transportation." In Mr. Shoup's opinion if the electric lines were freed from their burdens for paving, licenses, etc., it would make a very marked change in their net earnings and therefore in the values of their securities in the market.

Mr. Shoup spoke optimistically of the results on the California roads where the fare had been raised. Referring particularly to his own road, he said that in Stockton and San José the 6-cent fare had given very satisfactory results, the San José property doing better than for twenty-four or twenty-five years. The Fresno Traction Company is also doing as well as to gross and net revenue as at any time in its history, due partly to the increased prosperity of Fresno. The same situation does not prevail on the Pacific Electric Railway, but the State Commission report on how expenses might be reduced through public co-operation on that property offers hope.

Mr. Shoup spoke enthusiastically of the safety car. He said that the companies with which he was associated had had fifty in use for about a year, and were planning to buy 100 more. He also referred to experiments with installing buses as feeders on several of the properties, including Fresno and San José, but they have been failures. "So," Mr. Shoup said, "every one who believes that the jitney would succeed the electric lines may dismiss the subject or doubt from his mind at this time, so far as the present stage of development is concerned, anyway. The great difficulty is that they do not stand up under the wear and tear when you put them into the same kind of service as that which an electric car performs, and ask them to stop at every street corner to take on or let off a passenger or two, or run a hundred yards or two or three hundred yards and stop again, and we can dismiss the jitney as a serious competitor of the electric lines, provided it is subject to the same regulations by the public and made to accept the same obligations by the public that the electric lines have to accept."

Mr. Shoup said that the business of the California electric railways at the present time is very good, so far as gross earnings are concerned; the difficulty is with the net earnings. In spite of this fact, the state has raised its tax from 4 per cent to 5½ per cent of the revenue. He believes the public sentiment in California is sympathetic with the roads and favorable to private ownership, in spite of the example which has been set by San Francisco.

Speaking of the investment side, Mr. Shoup said there were more than 3,000 miles of electric track in California, against which \$155,000,000 in bonds had been issued. He estimated it would take \$200,000,000 to replace the capital which had been put into the lines, and \$300,000,000 to reproduce them at the present high prices of labor and materials. With these values and in view of the real estate owned by the companies and covered by the mortgages he believes that the securities are selling very cheaply today. In conclusion he said, referring to the electric railways, "There is not a cloud on the horizon which indicates that the industry is going to be wiped out. The public cannot get along without them, and it will have to take care of them."

C. E. R. A. Meets at Louisville

Principal Operating Topics Discussed Were Rail Bonds, Safety and Economy of Electrical Energy on Cars—Organization of Electric Express Company to Serve Central States Proposed—Debate on Place for Summer Meeting

THE annual meeting of the Central Electric Railway Association was held at the Seelbach Hotel, Louisville, Ky., on March 10 and 11. As usual a number of delegates made the trip to Louisville by special through electric cars from different points in the Central Electric Railway territory. The sessions of the association were set to begin at 2 p.m. on Wednesday so as to permit many of the delegates to leave their home cities on the morning of the same day.

The convention was opened by President J. F. Collins, Grand Rapids, Mich., who delivered the annual presidential address. In it, he made a plea for greater standardization of operating practices and equipment, recommended a charge for transfers to minimize their misuse and took a stand for 10-cent city fares and interurban fares equal to steam road rates. He said, in part:

In cities where the population is 100,000 or less, tracks and special work should be of a specified weight, and in cities of a population of more than 100,000 the tracks and special work should be of a heavier type. Tongue switches should be the same in all cities, large or small. It is costly to the companies to have the present various kinds of rail, tongue switches and other special work and often, if a piece of special work becomes needed, it takes three or four months to obtain new material. In the meantime the railway company is delayed in making the needed repairs. Why not also establish a uniform rail bond for cities and another for interurbans? The block signal system used in cities where single track is installed should also be uniform throughout.

A standard order board on all interurbans should also be established. The rules governing operation should be the same, except for minor changes, to fit local conditions. This should also apply to the telephone system. This would simplify the operation of interurbans where various divisions are operated under one management, as platform men could be transferred from one division to another and could take up employment with another company without difficulty. The uniforms of the platform men should be the same, as well. Trolley wire and trolley special work should also be made standard throughout.

There is no doubt but that the type of cars for medium size cities should be the one-man car. The wheels, flanges and treads, and the trucks should be of one design. There is no good reason why one city should have a different type of truck than another. The manufacturers of cars and trucks would welcome the standard car. In cities of a population of 100,000 or more the type of car should also be standardized, although, on certain lines in large cities, one-man cars would be preferable. Interurban cars, as nearly as possible, should be of one particular design also. It is true that some interurban companies use a larger car than others.

The entrance to the larger type of city car should be exactly the same in all cases. In some of the cities passengers enter from the rear and leave from the front and rear. In other cities, passengers enter and leave from the side of the car, and again in others passengers enter from the front and leave from the side. Why not have one standard so that passengers will always know just where to enter the car? Again, it seems that almost every city has a different system of taking on passengers. Some stop at the far crossing, some at the near crossing, others make special stops where poles are painted a certain color, etc. In my opinion, it would be to the interest of all the city railway companies to stop on the near crossing. In cities where the skip-stop system is used, enamel signs should be hung on the span wires reading: "Cars stop here." Under present conditions, transients when arriving in a city must learn from a policeman or some citizen as to where to board a trolley car.

It seems that most managers of city railway properties pay very little attention as to how transfers are handled. In a great many of the cities in which I have had occasion to examine the transfer system, I have found pads of transfers in such places as the stoves during the summer season and in sand boxes and under the seats in the winter season. I have also found that conductors are allowed to help themselves to transfers in the dispatcher's office. You will often hear railway managers say that transfers have no value when they are not registered. Of course this is not a fact. Transfers have a value. I am a strong advocate of charging passengers for transfers, either 1 cent or 2 cents, as the case may be, thus giving transfers a greater value than at the present time. I also recommend a closer check on the dispatchers and conductors in the matter of handling transfers. There should also be a close supervision of duplex tickets issued.

During the Government's control of the railroads, the interurban lines have been a clearing house in the matter of freight and ticket agents for the steam railroads. Therefore, it has become necessary on a good many interurban divisions to break in many new men and to employ what is known as traveling ticket and freight agents for the purpose of instructing the new agents as to their duties. It was also found necessary to increase the number of traveling auditors to check the stations more frequently. The method of employing traveling freight and ticket agents and having the stations checked more frequently has met with considerable success and I heartily recommend this system as reducing the number of shortages to a minimum.

I also heartily indorse the further development of through freight service to all member companies, within the Central Electric Railway Association territory, as well as the establishing of complete express service within the territory of the association.

With the increase in costs of material and labor that the city and interurban lines are compelled to meet, it is going to be necessary that all city lines charge 10 cents per ride, it being a fact that money is worth only one-half of pre-war values. The interurban lines should charge per mile the same as steam roads. I predict in the near future a 4-cent-per-mile rate per passenger, and a 25 per cent increase in freight rates.

There never has been any good reason why interurban lines should not charge the same rate as the steam lines. With their frequent service and delivery of passengers in the down-town districts, they would handle the same volume of business as at present with the lower rate. This has been demonstrated, because, before the war, the steam roads and electric lines both charged 2 cents, and when the steam roads went to a 3-cent fare their business did not suffer.

ASSOCIATION CONSIDERS OPERATING TOPICS

The principal technical topic considered at the Wednesday afternoon session was that of rail bonding, as presented in a well-received paper by Ralph H. Rice, principal assistant engineer Board of Supervising Engineers, Chicago Traction. This paper, which is published in abstract in this issue, was followed by prepared discussions by M. B. Lambert and J. S. Hagan of the Westinghouse Electric & Manufacturing Company, Ralph W. Palmer of the General Electric Company, E. W. Rowland of the Ohio Brass Company, and R. J. Custer, Interstate Public Service Company, Indianapolis. Abstracts of the papers by Messrs. Rowland and Palmer are printed in this issue; those of the others presented will be printed later.

At the end of this discussion, the report of the committee on express service was presented. H. A. Nicholl, Anderson, Ind., chairman of the committee, told of the work it had done in developing the possibilities and

considering the advisability of organizing an electric railway express company with some such title as the American Electric Railway Express Company. He said that a majority of the companies of the Central Electric Traffic Association were in favor of such a plan and that it offered a greater opportunity for the electric railways to increase their earnings than any other character of transportation service. The committee is now sending out a questionnaire to member companies to ascertain how much business can be expected from manufacturers and other shippers from the territory served by each road. An effort is also being made to estimate how much capital will be required to establish and handle the business such as that involved in the purchase of motor trucks for pick-up and delivery service, the building of terminals and for additional rolling stock, etc. This report, Mr. Nicholl said, should be considered as constituting simply a progress report. Mr. Nicholl added that the committee hoped to have a complete report ready for the summer meeting.

Harry Reid, Louisville, Ky., then brought up the plan of the National Safety Council for nationalizing and standardizing the accident prevention work of the electric railways and introduced James Harmon, safety engineer Interstate Public Service Company, to speak further on the subject. After a brief address Mr. Harmon offered a resolution that a committee be appointed to work with similar committees from other electric railway associations and the Council in formulating a plan for promoting safety work more consistently and forcefully.

This resolution was adopted and President Collins said he would appoint the committee at the Thursday session.

NEXT MEETING PLACE—ELECTION OF OFFICERS—BANQUET

A lively discussion followed the announcement that the executive committee, at its meeting Wednesday morning, had decided to hold the summer meeting at the Ottawa Beach Hotel, Macatawa Park, Mich., and not to have the popular and customary boat trip. The delegates seemed loath to substitute anything for the Great Lakes boat trip, though someone did make the suggestion that the boat be routed mainly through Canadian waters. Charles L. Henry admonished the members to consider the best interests of the association rather than the pleasure of the outing as the primary purpose of the meeting, but a motion was passed requesting the Executive Committee to reconsider its decision at the March 11 session of the committee.

The nominating committee of which F. D. Carpenter, Lima, Ohio, was chairman, then presented the following recommendations for officers for the ensuing year and the secretary was instructed to cast the unanimous ballot of the association electing them:

President, Robert I. Todd, Indianapolis.

First vice-president, A. C. Blinn, Akron.

Second vice-president, E. J. Burdick, Detroit.

Members of the Executive Committee: F. D. Carpenter, Lima; Charles L. Henry, Indianapolis; H. A. Nicholl, Anderson; S. W. Greenland, Ft. Wayne; G. T. Seely, Youngstown; W. S. Rodger, Detroit; F. W. Coen, Cleveland; J. F. Collins, Grand Rapids; Harry Reid, Louisville; C. B. Kleinhaus, Toledo; L. G. Parker and H. E. Rasmussen.

The annual banquet Wednesday evening was attended by two hundred. President Collins acted as toastmaster

and Ex-Judge Arthur Peter, Louisville, made a short address about "Other Days."

SECRETARY AND TREASURER'S REPORT

At the session of the association on Thursday morning Secretary-Treasurer Nereamer presented his annual report. An abstract follows:

The interurban railway membership of the association, as shown in the report for 1918, consisted of 63 lines operating 4,814 miles and two city lines. During the past year there have been several changes in the interurban lines, such as consolidations and separations, which leaves the net result of membership in this association sixty-four lines and 4,364 miles, with two city lines, an increase of one line and 50 miles.

During the year 1919 we had 155 supply members as against 126 in 1918. This is an increase of 29 members.

The receipts and disbursements for the year 1919, both totalling \$9,398.97, are as follows:

Receipts:	
Cash on hand, Jan. 1, 1919	\$962.12
Interurban lines	4,962.51
City lines	200.00
Supply members	1,550.00
Sale of buttons	20.00
Central Electric Traffic Association	1,084.25
Central Electric Railway Accountants' Association	12.40
Sale military efficiency and defense maps	87.20
Annual dinner	45.95
Returned by Summer Trip Committee	182.38
Fall meeting dinner	12.75
Interest	278.41
Disbursements:	
Pay roll	\$4,320.00
Traveling expenses	531.52
Stationery and printing	1,840.16
Boat trip, advertising, etc.	361.53
Postage	162.43
Telephone and telegraph	88.04
Central Electric Traffic Association, miscellaneous	50.32
Central Electric Railway Accountants' Association, miscellaneous	15.00
Office fixtures and incidentals	27.00
Freight and express	3.73
Office rent	84.00
Legal expense	35.00
Investments	500.00
Annual dinner	9.30
Taxes and insurance	5.00
Cash on deposit	609.94

It will be noted from this statement that the cost of all material used by the association has greatly increased, while the operating expenses of the association remain the same as the preceding year. There was expended by the committee in charge of the summer meeting \$361.53 on account of expenses incidental to the boat trip.

The only investment during the past year was the purchase of \$500 of Victory Loan bonds.

A statement of the expenses of the Central Electric Railway Accountants' Association follows:

Total expenses for the year	\$196.70
Received from sale of pamphlets	\$3.40
Dues at \$5 per annum from two lines not members of the Central Electric Railway Association	10.00
	13.40
	\$183.30

As an explanation to the item covering Stationery and Printing and the Miscellaneous charge against the Central Electric Traffic Association, a statement is submitted herewith of the receipts and expenses of that association for the year 1919:

Received from sale of tariffs	\$1,084.25	
Traveling expenses		97.70
Stationery and printing		913.48
Postage		25.00
Telephone and telegraph		15.49
Freight and express		9.83
Legal expense		35.00
Dues from member companies	82.67	
Surplus		70.42
	\$1,166.92	\$1,166.92

A statement of the current assets and liabilities of the association for the year just ended follows:

Current Assets:		
Cash on deposit		\$609.94
Investments	\$2,000.00	
Liberty bonds		
Railroadmen's Building & Savings Ass'n.	3,046.40	5,046.40
Due from members		153.80
Liabilities		\$0,000.00
Balance		\$5,810.14
	\$5,810.14	\$5,810.14

Your attention is called to the fact that the financial status of this association is the best that it has been since its organization, and this result has only been achieved by carefully watching every cent that has been spent for any purpose whatever. No unnecessary supplies have been purchased through the secretary's office. If the present prices of paper and cost of printing are kept up, the next showing, a year hence, will not be as good as it is now. We have arrived at a place where the continued advance in everything we use will, during the coming year, eat into our surplus unless the income of the association is greatly increased in some manner. The work in the secretary's office has been increasing from time to time, and from present appearances it will probably be necessary to have additional help before another year is ended. This, of course, will call for more income from the members or the use of the permanent investment.

In closing, your secretary and treasurer desires to thank the officers, committees and members for the assistance given him in the discharge of his duties during the year just past.

A report of the technical sessions on Thursday will appear in a later issue.

Types of Rail Bonds*

BY R. W. PALMER

Railway Supply Department General Electric Company,
Schenectady, N. Y.

RAIL bonds may be divided into two groups: Those for the head of the rail and those for the web or base of the rail.

U-shaped bonds for attachment to the head of the rail were originally soldered. These were followed by different forms of stud terminal bonds mechanically attached to the rail head, but both forms have given way almost entirely to welded or brazed types of bonds, due to the rapid advances made in the art of welding by oxyacetylene and the electric arc.

The facility with which these bonds can be applied is sometimes misleading, as regards actual economy. In other words, there is a tendency to put too much stress on the first cost of short bonds with the idea that it is cheaper to replace them, due to one cause or another, than it is to adopt a longer and more expensive bond in the first place. Unfortunately, the length of bonds for the head of the rail has become fixed, or almost so, by competition between manufacturers, at $7\frac{1}{2}$ in. and smaller, with a capacity usually of No. 0000, although roadway conditions vary to a considerable degree. Therefore, regardless of the manner in which the bonds are attached at their terminals, the same length of bond will have a long or short life, due to rail joint movement, depending upon the conditions found on any particular property. Yet this very important point of length of bond is often completely ignored by the railway man when it comes to comparing one manufacturer's price with another.

Before discussing the merits of welded types of bonds, it will be well to consider briefly the selection of bonds in the second group, or those for other parts of the rail than the head. In this classification we have the well-known "concealed" types of bonds which are installed under the splice bar, also the long bonds installed outside of or around the splice bar. The concealed type of bond is widely used and has about as many advantages as disadvantages. Undoubtedly, the simplest way to apply the concealed bond is by mechanical means, with compressed type or pin type of terminal, in holes drilled in the rail web. Such bonds have been welded only to a very limited extent, and

the advisability of welding them to the web is still an open question, for the reason that the spot welding of rail webs in so far as it contributes to rail fractures is a matter which still gives many engineers concern. Moreover, it is difficult to design terminals which are suitable in shape for welding and at the same time will fit beneath the splice bar. The chief consideration, where concealed bonds are used, is the matter of space available. Too often the bond takes up all the space in a new joint, so that when the splice bars wear and are drawn in, the bonds are crushed. The space which dictates the size and forms of bond is that under a worn-out splice bar.

The long bond applied outside of and around the splice bar is easily attached by the various welding methods and is undoubtedly superior to other types where the bonds are not exposed and subject to theft. This form of bond has been used for a number of years both in the solid conductor and the stranded type. With this type of bond, it should be remembered, the cost to the railway is not exactly proportioned to the length of the bond. The principal expense in making this bond is the terminals, so that the cost of a bond installed does not increase in proportion to the length of the bond, and we urge that this point receive careful consideration.

BONDS MUST BE INSTALLED PROPERLY

Of equal importance to the selection of bonds is the selection and training of men to install them properly. Many bond failures can be traced to improper installation, the work often being intrusted to track laborers or others who have no conception of the importance of the work they have in hand. This point was brought forcibly to the writer's attention while rebonding an interurban property because of excessive drop in the return circuit. In going over the track we found a number of joints which tested open, indicating that the bond was either broken or missing entirely, but when the angle plate was taken off the bond was seemingly in as perfect condition as when installed, a number of years previous. Further examination, however, showed that the terminals as well as the holes in the rail were badly corroded, indicating that the holes had been drilled too large for the size of the terminals used.

To secure the best results with expanded terminal bonds, the terminals should be accurately milled to size and the holes in the rails reamed at the time of installation to give a snug fit. It is also important that the bond terminals should be properly cleaned, after which the contact surfaces should not be touched with the hands. This precaution is necessary to prevent corrosion. Providing the bond terminals are properly expanded after these precautions are taken a very satisfactory contact can be formed and maintained during the life of the bond. The same degree of care should be exercised in connection with the installation of acetylene or arc welded bonds.

WELDED BONDS

The welding of bonds with the electric arc and the oxyacetylene flame is such an improvement over other methods that it is receiving the favorable consideration of railway engineers everywhere. Welded bonds are of three kinds, those for gas or flame welding, for metallic arc welding and for carbon arc welding. Only the flame weld and metallic arc weld types will be discussed here.

*Abstract of paper presented at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

Flameweld bonds are made with drop forged all copper terminals and with various kinds of steel terminals mechanically attached to copper conductors. The nature of the gas welding process precludes the necessity of having forged copper terminals welded to the conductors at the factory, and this type is very little used now. The steel terminal bonds are considerably cheaper and are equally as good when properly installed, but a little more care is required when they are applied to insure all of the wires being welded together. When flameweld bonds are applied it is not necessary to grind the rail, though the surface of the rail should be coated with flux metal before the bonds are placed in position to weld. This practice insures a thorough union between the rail and the flux metal. At the same time the oxide is removed from the rail surface by the flame.

Pure copper, when used as the attaching metal with the gas flame, does not give good results. Molten copper has a very strong affinity for oxygen, and when used with the gas flame a very porous and brittle metal structure of low mechanical strength and poor conductivity results. The flux wire which we furnish and recommend is a phosphor bronze wire containing a fair percentage of tin. Phosphorus is a deoxidizer and serves as the fluxing agent. The composition is important, as all phosphor bronze wires do not give like results in gas welding.

The resistance of flameweld bonds is about 5 per cent less than that of a perfectly installed double stud or twin terminal bond, and is about equal to that of a brazed bond. Compared with the steel welding, arcweld bond resistance is about 15 per cent less. Therefore, electrically, the flameweld bond is as good, if not better, than the best. Mechanically, it is very strong.

The weld is a simple one to make, and the speed of installation compares favorably with all other types of heat applied bonds. One man and a helper, if expert, will easily install eighty bonds in a ten-hour day. The apparatus is readily portable, and in localities where a supply of gas can be maintained readily, these bonds are worthy of thoughtful consideration.

The steel-faced arcweld bond is the latest development and is meeting with much favor. This type of bond has a steel face welded to a drop forged copper terminal at the factory. This is a forward step in the problem of bonding, for the reason that the old difficulty of attaching copper to steel by some satisfactory means is done at the factory, thus leaving a steel to steel weld to be made in the field. This simplifies the matter, for this kind of welding is common.

To obtain the best results when arcweld bonds are installed, the spot on the rail adjacent to the bond should be carefully cleaned, and all rust, dirt or annealing scale removed. This work can be accomplished with the use of an old file and a steel wire brush. After the rail is prepared the bond should be clamped or held in position and the arc started at the lower edge or bottom angle formed between the terminal and the rail. The operator should carry the arc across the entire length of the terminal if possible without breaking the arc so that the first layer of deposited metal will make a firm union between bond and rail. Before applying the next layer, the operator should use a steel wire brush to remove any surface oxide which may form on top. During the process of welding the operator should hold his electrode at such an angle that for the greater part of his time he will be devoting his efforts toward the rail, inasmuch as the rail being

a larger mass of metal than the bond it will require more heat to insure good penetration.

With arcweld bonds, it has been found that the best results can be obtained by using 125 to 130 amp. at a voltage of approximately 20, this being the average voltage required for successful welding with the metallic electrode.

The arcweld bond is now made in two general types: The familiar U-shape for the head of the rail, and a long flexible type for spanning the splice bars. The U-shaped bonds are furnished with round wire strand or with flat wire, and the flexible bonds in two designs of terminal, for attachment either to the rail web or to the rail base.

EQUIPMENT FOR BOND INSTALLATION

So far, the question of electrodes for bonding has not received as close attention as its importance deserves. Naturally, the deposited metal should be as homogeneous as possible, so as to provide the maximum conductivity for the steel. A very pure wire of high conductivity before welding is not necessarily the best after welding, as the composition undergoes a change in the arc. The desired result differs from that of most steel welds where strength is the prime consideration.

The polarity of the electrode is a much mooted subject. Good welds are obtained both ways and with the alternating current arc. It is safe to say, however, that the positive electrode acts differently from the negative electrode, and the welder has to become accustomed to handling the arc with either polarity before good welds can be made.

This brings us to the point of equipments for installing the bonds. The most popular type at present is the resistance welder, commonly called a resistor. In spite of the fact that the power wastage is large with the resistors, they meet with favor because of their inherent reliability and low cost of maintenance. The first cost is low, and they are readily portable, the wire type for 600 volts weighing as little as 80 lb. Aside from the fact that it is necessary for the electrode to be positive with this type apparatus, the high voltage permits a long arc to be held, and it is generally conceded that a long arc is conducive to poor welds. Consequently, due to what might be termed the elasticity of the arc, there is generally a lack of uniformity with the welds made with these machines.

A low-voltage rotary outfit is conceded to be the best for uniformly good welds, but a motor-generator set has the great disadvantage of weight, single operator sets weighing close to 1,000 lb. This is not at all convenient to move from joint to joint. The dynamotor is the lightest type rotary machine for the purpose, and offers the most attractive proposition both from first cost and weight standpoints.

In conclusion, I will point out the chief features of our arcweld bonds: The steel welding face is in plate form, and the copper in the terminal is directly welded to it. In the manufacture, no intermediate metal is used to join the steel and copper together, both metals being directly joined while their surfaces are in a state of fusion. No matter how hot an arc is used on the steel face, the copper will not separate from it. This is very important because it is necessary to raise the bond terminal to a high temperature to insure a weld between the electrode and the steel face.

You may wonder why we go to the expense of applying the steel welding face, instead of using a plain

copper terminal. If the problem was simply one of welding two pieces of copper together, we could do that, but when we try to weld steel and copper together, using either a steel or copper electrode, it is not successful because of the different thermal conductivities of the two metals. Unless the copper bond is preheated (and this is not feasible), it is doubtful if any electrode will be developed which will do this.

The cost of installing any particular type of bonds, having terminals welded to the rails, will vary with the cost of labor, current and conditions under which the work is done. Therefore, it is impossible to give any figures which might apply generally.

The only data which we have as to the number of bonds which can be installed in a given time are for some No. 00-26-in. arcweld bonds, applied to the base of 40-lb. rails in coal mines. Here the current for bonding was supplied from a motor-generator set mounted on a small car coupled to a mining locomotive, and a crew of three men was used. One prepared the rail and the other two took turns at welding and operating the locomotive, the other acting as helper. With this outfit an average of twelve bonds per hour were installed, and the man in charge of the work established a record of applying twenty-four bonds in fifty-five minutes. Taking into consideration the time required in moving the equipment from place to place and the difficulties encountered in doing this class of work in the mines, it is believed that the results obtained were very satisfactory.

It might be well to state that the bonding was done after the mines had ceased work for the day, so that no interference was encountered due to operation of hauling locomotives.

Which Type of Bond Is Best?*

BY ERNEST W. ROWLAND

Bond Engineer, The Ohio Brass Company, Mansfield, Ohio.

ON SOME properties the rail bonding work falls to the way department, on others the line department is responsible, while on still others each of these departments seems to switch the work off on the other to the detriment of bonding generally.

Basically track bonding is one of the most important phases of railway work. So much depends on it that it seems surprising that more attention is not paid to it. For example, consider a few of the evils that are directly traceable to poor bonding. First there is electrolysis; next in line is loss in power; next loss of voltage; then baked armatures and fields on motors, broken rails due to arcing at the joints and other effects too numerous to mention here.

As to the loss in voltage, there is probably nothing more irritating to a rider than to be compelled to sit in a car late at night with the light varying anywhere from a very dull red to utmost brilliancy. Some of this can be traced to lack of positive feeders, but most of it is due to poor bonding. And baking of armatures is an important item from a financial standpoint alone.

Comparatively speaking it is an inexpensive proposition to bond a line thoroughly. In fact a good bond can be installed for less than a dollar a joint, and when one considers the waste caused by poor bonding this cost fades into insignificance.

Recently an article appeared in one of the railway

papers regarding the breaking of rails due to the arcing at the joints where bonds were broken. The author remarked that under normal conditions such joints would break in from six months to two years. His time interval is, I believe, too short, but such action does occur within from three to five years and often less. Which, then, is cheaper; to spend a dollar for a good bond which will last from eight to ten years, or to renew a rail that is burnt out every five years?

Loss in power is another important item, especially when the railway company is buying its power. An instance that came under my observation recently will illustrate this point. A certain railway in the East had one substation which was overloaded about 50 per cent of the time; so badly overloaded that the engineer in charge decided that he would have to put in additional rotaries. But before proceeding to do this he rebonded the track leading past the station and buried some old rail in the street as a supplemental negative feeder. When he had completed this work he found that he had so reduced the load on the station that it was unnecessary to install additional rotary capacity.

The foregoing leads us into a discussion of track bonding generally. For convenience all bonds may be grouped into two classes; those mechanically applied and those heat applied. The mechanically-applied bonds include the pin and compressed-terminal types; also channel pins, about which the less said the better.

As far as the pin and compressed-terminal types are concerned, there are at present no better bonds made, provided they are installed properly, but there, unfortunately, is the rub. It is fairly safe to say that on the average railway property 90 per cent of the men doing the actual work do not do it properly. And yet, if the men have been taught to do the work properly either one of these types cannot be excelled for new work. But they have their limitations. When it comes to renewing them the cost is almost prohibitive. Then, too, few of the workmen install the bonds properly. It is necessary to exercise a few precautions to make the bond effective. Water must be kept away from the bond terminal. Drills should be ground by an expert. It is well also to paint the terminal after installation.

Under existing conditions it is often easier to break a man in to install a welded bond than to train him for installing the pin and compressed-terminal types which are apparently so easy to install that it is not considered necessary to have one man do the work all the time. Hence the normal precautions are not taken. With a welded bond it is necessary to have one man who can do the work. In both the gas and arc welded types a small amount of instruction is generally all that is necessary to enable a man to install the proper type of bond. And it is a very simple matter to check the operator in his welding, because a hammer will test the welds in a perfectly satisfactory manner. On the mechanically-applied bonds the tests are electrical.

As to the relative advantages of gas- and arc-weld bonds, it is necessary for the individual to choose which is the more applicable to his property. Those properties which are distant from service stations have difficulty in getting gas, so that they have been more inclined of late to swing over to the arc weld. The arc weld bond probably requires a little more expertness in its application, but even on the smallest road these difficulties are not insurmountable.

*Abstract of paper presented at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

As to the heat effect of the gas or arc on the rail, while there is a slight hardening effect due to both the processes, I can say, after experience of four years with the gas-weld bond, involving the installation of thousands of bonds of the gas-weld type, I have yet to see an authentic case of breakage due to the welding. Other bonding men report the same experience.

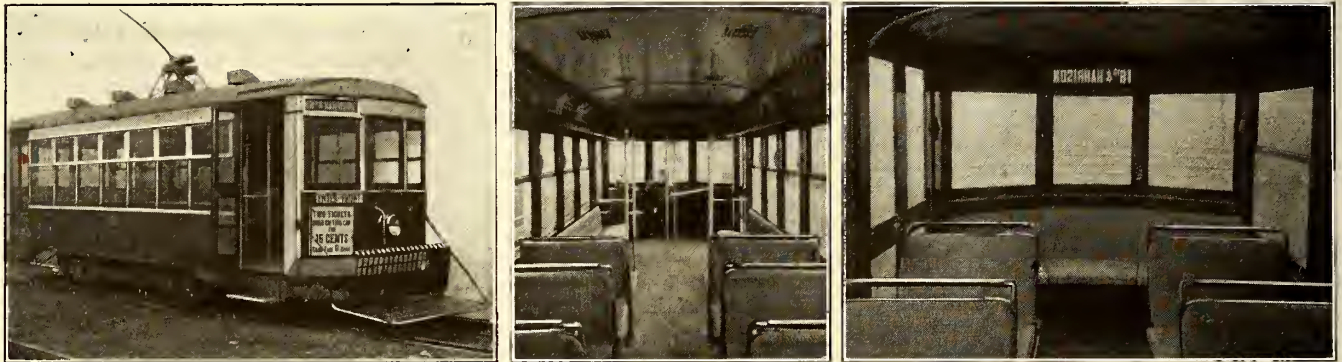
USE OF THE ARC WELDING PROCESS IN ELIMINATING BONDING DIFFICULTIES

Some companies have gone into the arc welding of rail joints within the last few years in order to overcome the difficulties attendant upon bonding. This has apparently worked very satisfactorily, but it might be well to "make haste slowly" here. After all the only test is that of time, and the time interval since the adoption of this type of joint is comparatively short. It would appear that the stress on the small welded surface would be so heavy as eventually to break the weld. This would involve more than the weld, because it would mean the renewing of a rail. This is especially true on an interurban road, where the expansion and contraction of the rails imposes an added hazard.

First of New Safety Cars Arrive in Kansas City

HEREWITH are shown the first pictures of the latest one-man safety cars used by the Kansas City Railways. In them can be seen the results of some of the changes from the "standard" Birney car which P. J. Kealy, president of the Kansas City company, was convinced would add materially to the appearance, comfort and durability of the cars and enhance their popularity with the riding public. These changes have been quite fully described in articles which have appeared in *ELECTRIC RAILWAY JOURNAL*, one by Mr. Kealy on page 31 of the special report issue dated Oct. 11, 1919, and one on page 998, issue of Dec. 20, 1919. The front-end loading well and stanchions, the headlining and side sheathing, the cushioned seats, and the strengthening of truck and underframe, are among the more important features. The complete car pictured above tipped the scales at the railway company's shop at 14,200 lb. and the weight of the similar double-end safety car is 16,400 lb.

The first cars used were of standard construction and had a seating capacity of thirty-five passengers.



NEW KANSAS CITY SAFETY CAR

At left, exterior; in center, interior, showing space for standing passengers; at right, rear seating arrangement.

After all, the cheapest plan in the long run is the ordinary joint, kept tight, with a good bond, either a properly installed mechanically-applied bond or a welded bond. It would appear from conditions generally that of the two the welded bond is the better, and yet it is possible to make a mistake even in this type.

In purchasing a welded bond, either arc or gas, it is well to be sure that at least a 90-deg. scarf is presented. If an acute-angle scarf is formed on the welding surface, vastly more expert work is required in welding than when the operator has at least a right angle to work on. Again, there is a minimum effective limit to the length of a bond. Vibration tests have shown that 7 in. is probably the shortest practicable length. Below this length the breakage due to vibration increases enormously.

While undoubtedly the shorter the bond the less the resistance, the fact that there is a limit to the mechanical efficiency of the bond compels the manufacturer to forego the advantages of the lower resistance in order that he may produce a bond that is superior mechanically.

There has been a great deal of argument presented as to the relative advantages of the ribbon-type as against the cable-type bond. Tests seem conclusively to demonstrate that, all other things being equal, the cable-type bond has a longer life than one constructed of ribbons.

Twenty-eight of these were fitted with fourteen of the cross seats, six on two three-passenger longitudinal seats and one on a one-passenger seat in the rear. This seating arrangement provided for a 22-in. aisle space and practically no standing room except in the aisle.

The cars of the latest type illustrated have a seat across the rear which accommodates five passengers. There are ten cross seats and two longitudinal seats in front with a total seating capacity of thirty-four. It is thus seen that by sacrificing one passenger seat there has been gained a standing capacity of approximately 8 ft. between the front row of cross seats and the motorman's railing.

In a recent issue the *Railway Review* gives some data for electric operation at the Philadelphia terminal of the Pennsylvania Railroad, where two lines are electrified, one from Philadelphia to Paoli, and the other from Philadelphia to Chestnut Hill. The combined car mileage of the two lines for one month last summer went as high as 252,216, with five detentions totaling 14 min., although the average mileage was somewhat less than this, and the average number and duration of detentions somewhat more. Of the total car-mileage the Chestnut Hill line was credited with about one-quarter early in its operation, but at present it has grown to about one-third.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION
PERSONAL MENTION

Coast Division Electrified

Milwaukee Replaces Steam With Electricity on 207-Mile Division Into Seattle and Tacoma

When the Olympian, the overland limited of the Chicago, Milwaukee & St. Paul Railroad, pulled out of Seattle and Tacoma for Chicago on March 5, operation of the coast division of the Milwaukee lines by electricity was started. The electrification of the coast division adds 207.4 miles to the 440 miles previously electrified in Montana on the Rocky Mountain and Missoula divisions, making a total of 647.4 miles of the lines of the Milwaukee now operated electrically.

ONE GAP STILL OPEN

The coast division just opened extends from Othello, in central Washington, to the shops in Tacoma on the Puget Sound end. The Montana electrification extends from Harlowton in the east to Avery, Idaho, on the west. Between Avery and Othello is a stretch of 212 miles yet to be electrified. When that gap is closed the Milwaukee will be operating passenger and freight service with electric motive power over 860 miles of its western lines.

All of the electric current used in the operation of these trains is generated from water power. Substitution of water power for steam, by the generation of hydro-electric energy, on the entire 860 miles means a saving in fuel which, based on the business of 1918, will be approximately 300,000 tons of coal and 40,000,000 gallons of fuel oil annually.

The power for the coast division is taken from the hydro-electric plants of the Puget Sound Traction, Light & Power Company on the west and from the Long Lake plant of the Washington Water Power Company on the Spokane River. The Puget Sound Company has three large generating stations on streams of the west side of the Cascade mountains. White River and Puyallup River are two of the sources of this power. These streams are fed by the glaciers of Mount Rainier. The third plant is on the Snoqualmie, utilizing the picturesque falls of that name, a sheer drop of 268 ft. over a basalt precipice.

TRANSMISSION LINES LINKED

The plant at White River, the plant at Electron on the Puyallup River and the two plants at Snoqualmie Falls are interconnected and are in reality one huge generating machine of 114,533 hp. In addition the Puget Sound Traction, Light & Power Company has an auxiliary steam plant capacity of some 45,000 hp., making a total of approx-

imately 160,000 hp. available at the western end of the Milwaukee system. This system of tied in plants on the west side is in turn interconnected with a similar system of like capacity on the east side of the Cascade mountains. So on the day the switch was closed connecting Snoqualmie and Long Lake there were tied into one system some 1,500 miles of transmission lines serving some 30,000 square miles of territory.

Power furnished to the Milwaukee lines from the Snoqualmie plant at the west end near Seattle, and from the Long Lake plant on the Spokane River is delivered to the railroad's transmission lines at 100,000 volts. There are eight substations between Othello and Tacoma in which the high tension alternating current is stepped down to 3,000 volts direct current for use on the motors of the locomotives. This 3,000 volt current is carried over the rails by overhead trolley wires.

FIRST ELECTRIC OPERATION IN 1915

The first electrification of the Chicago, Milwaukee & St. Paul lines was completed and put into operation in December, 1915. It was the Rocky Mountain division of 226 miles. The locomotives on this section had been burning coal. The following year the Missoula division of 211 miles was placed under electrical operation. This division had been operated with oil burning engines. Oil was used on the newly-electrified coast division.

River Tunnels Ready for Service

John H. Delaney, Transit Construction Commissioner in New York City, has announced that two new tunnels under the East River will probably be opened to traffic in April.

One of these is the tunnel from Whitehall Street, Manhattan, to Montague Street, Brooklyn, and the other extends from Sixtieth Street, Manhattan.

The reconstructed Brighton Beach and Culver lines can be routed through the tube from Montague Street so as to carry passengers from outlying sections of Brooklyn under Broadway, Manhattan, and as far north in that borough as Sixtieth Street.

Practically all of the track work in the Broadway-Fourth Avenue tunnel from Sixtieth Street, Manhattan, to Queensboro Plaza, Long Island City, has been finished and will be ready for train service about April 15.

As soon as the special track work at Queensboro Plaza is completed under-river service can be instituted by the Brooklyn Rapid Transit System.

Out of the East

Manager of Shanghai Tramways, on His Way to London, Studies American Lines

Donald McColl, general manager of the Shanghai (China) Tramway Undertaking, passed through New York last week on his way to London, where he will confer with the English interests that control the line in Shanghai. Mr. McColl has been in Shanghai for eleven years. He took charge soon after the line was opened. Previous to that he had been connected in turn with the Glasgow (Scotland) lines, the Lisbon (Portugal) Tramway and the London Underground.

7,000,000 PASSENGERS A MILE

On taking charge in Shanghai Mr. McColl had to contend with a depreciated Chinese copper currency, but so successfully did he do this that the shares of the company have steadily risen in value from £5 to more than £20. He is a strong advocate of the zone system and low fares for short stages. He says that he handles in Shanghai 7,000,000 passengers per mile of road per annum. He has found trailer operation very successful. He long since saw the value of the light weight car.

Mr. McColl came across the United States from Seattle. On his way he stopped off in a number of cities to study city railway operation. He believes the city of Seattle is making a heroic effort with its municipal railway, but is of the opinion that many things still remain to be done there before the system is fully brought to meet the possibilities which exist there for the development of the riding habit.

Mr. McColl was particularly impressed with the work that T. E. Mitten is doing in Philadelphia. He found the property there in very good physical condition. He said that Mr. Mitten was doing a really big, constructive work by his development of the idea of selling rides as merchandise.

NOT AFFECTED BY WAR

Questioned about his own problems, Mr. McColl said that he was not seriously hampered by the war. At the outbreak of hostilities he quickly ordered material and supplies ahead for about three years. By exercising a little mechanical ingenuity here and there he had been able to keep the road well up to standard.

It is his opinion that excellent opportunities exist elsewhere in China than Shanghai for the installation of electric traction with a comparatively free field to such capital as cares to go a long way from home to seek investment.

Toledo Settlement Delayed

Changes in Proposed Grant Make Settlement Measure Impossible of Adoption, According to Mr. Doherty

In the rush to get the proposed cost-of-service ordinance for a settlement of the railway problem at Toledo, Ohio, before the Council for preliminary action, a mass of hopeless difficulties has entered into the fight which will delay the submission of the plan to the voters till Aug. 10, at least. The negotiations have been further complicated by the injection of the wage dispute and possibility of higher fares into the franchise tangle.

LAST-MINUTE MODIFICATIONS

The commission appointed by Federal Judge John M. Killits to prepare a cost-of-service plan, in its final meetings, added a few more provisions to the ordinance which had previously been made public. In addition to the feature of a premium for economical operation added to the measure last week, the commissioners inserted two more clauses into the ordinance which relate to the purchase of power by the new Toledo Street Railway, created by the ordinance, and the conditions under which the ordinance, if ever made operative, may be forfeited.

The power section provides that the contract for current shall run between the Toledo Street Railway and the Acme Power Company, which now supplies current to the Toledo Railways & Light Company, which then retails to consumers. The idea of this change in the contract form of the ordinance is to limit the Doherty interests to a single profit for electric power.

The forfeiture provision gives Council the power to declare the whole contract void if the courts declare any one of the following five salient points of the measure invalid:

1. The schedule of rates of fare.
2. Valuation of the property of the Toledo Railways & Light Company.
3. City control of service.
4. City's right to inspect the books and accounts of the company at all times.
5. The right of the city to buy the property by direct purchase or condemnation.

In the event one or more of these parts of the ordinance are contested by the company and held by a court to be invalid, then it is provided that Council has the right to declare forfeiture of the entire franchise grant, subject to the charter right of referendum. The company, however, is given no such contesting right.

TRANSPORTATION ENGINEER PROPOSED

In the event the city sinking fund trustees are held by a court as not eligible to hold amortization funds of the company a provision has been added giving Council the right to select some bank or trust company as trustee. And in case it is decided that it is illegal to invest funds in stock of the company there is a provision allowing investment in other standard securities.

If the creation of the office of transportation commissioner is illegal it has

been provided that the city can place his duties with other city officials.

With these corrections and with the insertion of the city's valuation figures—\$7,111,336—the ordinance was sent to the printer and offered to Judge Killits to be submitted to Council. The judge has consented to give the company additional time to make objections to the new ordinance and he has also asked the commissioners to modify the ordinance in keeping with these suggestions if made in writing before April 3.

The final ordinance will then be handed to Judge Killits, on April 24, after which it will be submitted to Council and later to the voters.

The Council at its meeting March 8 passed a resolution in which it joined with Judge Killits in the extension of time for the purpose of getting written objections and remedies from the company.

MR. DOHERTY OBJECTS

Henry L. Doherty, in a telegram to the commissioners, declared, "What purports to be the final draft contains several provisions which would make it impossible for us to accept the ordinance." This indicates that Mr. Doherty will insist on several changes in the measure as it now stands. Mr. Doherty also referred to the ordinance as "hopeless." He said that legal talent would advise against the purchase of securities as unsafe, that new attorneys couldn't understand the ordinance, that he couldn't accept it in its present form, that the city couldn't afford to do so either, that sections of the draft are in conflict and that it is unworkable. Mr. Doherty suggested submitting the whole matter to a legal specialist as a referee.

The franchise matter was further clouded when Mr. Doherty and Frank R. Coates, president of the Toledo Railways & Light Company, in conference at New York, opened the proposals for wage increases filed by representatives of union labor. The Brotherhood of Electrical Workers demand \$1.12½ an hour for foremen of linemen, \$1 an hour for linemen, 75 cents an hour for groundmen and emergency track repairers, and 65 cents an hour for chauffeurs and drivers. The Amalgamated Association demands 70 cents an hour for all men having been one year in service and an increase generally of about 40 per cent for all other employees.

Mr. Doherty declared that these demands would mean an increase in railway fares. He said:

The increased wages demanded by the railway operators alone, aside from the electrical workers employed in the railway department, would amount to more than 1½ cents per pay passenger, and whatever increase of wages is agreed upon will have to be added to the railway fares.

Mayor Cornell Schreiber immediately declared that the city would fight any

increase in fares. The fare is now 6 cents with a 2-cent transfer charge. The initial fare under the new franchise is 6 cents with 1-cent transfer charge, and the maximum is 7 cents and a 1-cent transfer charge.

At present, the cars in Toledo are operating under the extension of the ouster ordinance, passed by Council, and an order of the federal court. In case of a wage dispute the case will immediately be thrust into the federal court for settlement.

Advocates of municipal ownership are looking for an early decision from the Ohio Supreme Court in the city's test case to determine whether it has power to issue bonds for the purchase of the railway, pledging the general credit of the tax duplicate of the city.

Electric Railway Case Before New Kansas Court

The Amalgamated Association has filed a complaint with the Kansas Court of Industrial Relations, making the Pittsburgh & Joplin Railway, respondent. The union alleges that the company is now and has been unlawfully failing to pay a fair, living and reasonable wage and has thus endangered the continuous and efficient operation of the utility named. It contends in short as follows:

That the association has used every diligent effort to make a settlement of the controversy.

That the respondent has failed, neglected and refused to make a settlement or come to a fair agreement.

That failure, neglect or refusal to make such settlement will lead to further dispute and endanger the continuity and efficiency of operation of the utility and will lead to further disputes and produce strife and disorder and endanger the public peace, health and welfare.

The union requests the court to require the company to answer charges; make and establish a reasonable wage pending investigation; make due investigation of the charges contained in the complaint and after hearing to "make and prescribe such orders, rules and regulations for conducting such business as shall be just and reasonable and effect such other relief as to this honorable court may seem just and proper."

This is the first case affecting an electric railway to come before the new court for the settlement of industrial disputes brought into being by the last Legislature at the behest of Governor Allen. The union has filed with the court its former agreement dated Aug. 1, 1917, and purporting to expire on Aug. 1, 1920. No date for a hearing has been set by the court.

On July 31, 1918, the War Labor Board handed down a finding granting the trainmen on this road 38 cents an hour for the first three months of service, 40 cents an hour for the next nine months and 42 cents thereafter. For other employees a minimum of 42 cents an hour was fixed, with an increase by the same percentage that the maximum of the wage scale paid motormen and conductors was increased by the award.

City and Railway Battle It Out

One Side Charges Bad Faith and Other Makes Promises That Would Be Fine If Fulfilled

The officials of the Detroit (Mich.) United Railway and the supporters of Mayor Couzens' municipal railway plan are agreed upon the point that extensions to lines in Detroit are greatly needed. Following the announcements of the routing of the proposed municipal system, Detroit United Railway officials made a statement of the company's attitude in regard to the much needed extensions. Additional extensions which the company believes are needed to meet the immediate surface line requirements of the city are described.

COMPANY SUGGESTS EXTENSIONS

The suggested extensions are based not only on the experience of the transportation men and engineers of the company, but also embody many suggestions that have been made by city officials and former Railway Commissioners to accomplish the development of the city as a whole. They are subject to such alterations or changes as the Common Council might direct, the company maintains.

The company expresses its readiness to construct about 130 miles of extensions and fully to equip them with cars, power houses, yards, carhouses and other facilities. It also agrees to operate them as a unified system, under one rate of fare and liberal transfer arrangements under any reasonable arrangement that may be entered into with the public.

In discussing the municipal ownership plans, officials of the company express the belief that the Mayor's estimated costs of construction are grossly insufficient. The fact is emphasized that since the Mayor's estimates were made, the price of rails has advanced \$5 a ton, and that no new promises for delivery can be obtained until after 1921 for city rails. An equally difficult situation covers steel for car building, and costs that enter into the operation of the lines have advanced so that it is believed the Mayor's estimates of operating expenses are entirely too low.

COMPANY HAS DOUBTS

The company asks where the \$500,000 will be secured to be laid aside annually for thirty years to pay the \$15,000,000 bond issue, since during the first year and perhaps the second and third years during construction, it can not be collected from the car riders for there will not be many on an incomplete system. Any loss for any reason puts the burden on the people and the people's property is liable for the loss since the people's property stands mortgaged until all the bonds are paid.

In referring to the Mayor's alleged statement that the \$15,000,000 in bonds for the municipal lines will have back of them \$15,000,000 worth of physical property and that besides this the bonds

will be backed by a "perpetual franchise from the city," the Detroit United Railway states it has assumed that what the Mayor had in mind was a piece meal railway for, by and of the people of Detroit. If the plan is something else the whole situation will have to be viewed from another and even more startling angle. In this connection it says:

This looks as if not only the cat but all her kittens got out of the bag. The bonds, when issued, go to the bondholders. Back of the bonds will be a perpetual franchise from the city. The bondholders to have as protection a perpetual franchise behind the bonds they hold. And no rate of fare mentioned in the franchise!

The question is raised as to who are to be these bondholders, with no limit to the rate of fare, when the Mayor refuses to discuss a limited period franchise for the Detroit United Railway at a fixed fare, and even refuses to consider the Taylor plan that fixes fares and service for the operating company.

COUNCIL MEMBER DEFENDS CITY'S PLAN

In speaking in favor of the Mayor's plan, a member of the Council reviewed the long series of dickers whereby the city granted the Detroit United Railway concessions in the hope of getting improved service. This member maintained that the company could have improved service any time in the past and have reduced congestion in the center of the city. He further contended that instead of so doing the Detroit United Railway used the plea of congestion to obtain concessions from the city.

The proposition presented by the Mayor, it is stated, is the first one ever before the people entirely free from some proposal to grant additional rights to the Detroit United Railway. The city takes nothing away from the company. It is claimed that the Detroit United Railway is now offering to build extensions and make other improvements that should have been achieved years ago. The value of these promises, it is stated "are written in an undeniable record of steel and iron," since in the city of Detroit only 9 miles of extensions have been constructed since 1910.

Mayor Couzens' plan has been indorsed by the Detroit Federation of Labor and a copy of the resolution will be sent to every affiliated union with the request for support of the plan. This action is in opposition to that of the local Amalgamated Association.

The question has been raised regarding the adjustment of any differences as to wages of men employed on the proposed municipal lines. It is believed by the city's chief executive that in the event of municipal ownership becoming a reality, the city would have to deal with the federation as repre-

senting the men, and that he would have no legal right under the charter to interfere with the organization of the men.

According to Corporation Counsel Wilcox a strike of railway men would mean resignation of their positions. Under the home rule act, civil service would have to be installed in a municipal system as soon as possible and if the men left their positions they would have to be re-examined before being reinstated. The opinion was also expressed that increases in wages could be granted only once a year, when the budget was being considered.

Ex-Governor Raps Union Rule

Former Governor Joseph M. Brown of Georgia has reprinted in pamphlet form his speech "The Supremacy of the Law" made at Atlanta on Oct. 27, 1912. He also issued in pamphlet form "An Appeal for Just Laws and for Their Impartial Enforcement."

In the "Supremacy of the Law" Mr. Brown expresses the opinion that when a State charters a public utility it not only permits but commands the operation of the utility for the benefit of all the people, and that whoever prevents such operation, thereby impeding public travel and paralyzing the public commerce, puts himself in rebellion to the law.

In "An Appeal for Just Laws," which is addressed to the Senators and representatives in Congress, Mr. Brown deals with the history of the Amalgamated Association in Atlanta. It is largely a review of organized labor's misdeeds. Mr. Brown makes it plain that he has no "general complaint" against President Wilson. He says:

My criticism is restricted to his toleration of acts plainly against the Constitution and laws, and against the cardinal rights of the public, by some of the labor unions, which acts are sternly forbidden to be done by other citizens, or inhabitants, of our country and which, if done by the latter, are punished through the process of law. Therefore, the result of President Wilson's course, as above indicated, is to establish for certain organizations, or combinations of people, preferential privileges over those allowed to all other inhabitants of the United States.

Mr. Brown, who has been characterized as the "most insignificant looking person in the United States," is one of the outstanding public figures of the South. He has been the storm center of the greatest political fights in the South during the last generation. Despite this it is said he has never had the temerity to take the stump and make a public speech. Recluse-like in his habits and nature, "he has fought his battles on paper and fired his shots with a virile pen from a farmhouse that nestles in the mountain shadows of northern Georgia." Mr. Brown is the son of a former Governor. He was graduated from Oglethorpe University in Atlanta and studied law at Harvard. Among his many other activities he has been connected with the Western & Atlantic Railroad and is a former Railroad Commissioner of Georgia.

Paving Suit Lost

Under Franchise Milwaukee Company Must Repave with Asphalt Instead of with Macadam

The United States Supreme Court on March 1, 1920, held that there was a contractual duty for the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., to repave, arising from the acceptance of the franchise, and that the language of Section 2 of the franchise was not distinguishable from that involved in earlier cases in which it had held that a duty to keep "in proper repair" without qualification was broad enough to require paving and repairing with the same material with which the street was repaved.

The paving had been ordered on Nov. 8, 1915, by a city ordinance after the city had laid such a pavement on all of the streets except the railway zone. Up to that time the street had been paved from curb to curb with macadam. The company admitted that the railway zone was in need of repaving at that time, but it insisted that under an ordinance of Jan. 2, 1900, which constituted its franchise to lay tracks on Center Street, it was entitled to repave with macadam and could not be compelled to repave with asphalt.

After referring to the history of the case, which had been decided by the State courts in favor of the city, the Supreme Court considered the matter under four heads. Under the first head the court said that the obligation in the franchise for the company to repair "with the same material as the city shall have last used to pave and repair these spaces and the streets" did not excuse the company from paving with asphalt. Otherwise, said the court, "this would put upon the city the burden of paving the whole street in case of any innovation in paving save by agreement of the company with the city. This is not a reasonable construction of the provision." Under the second head the court referred to the claim of the city that the use of macadam by the company on its strip would be injurious to the asphalt paving on the rest of the street because water would seep through the macadam and get under the asphalt. Hence, the court declared it could not say that the city's "requirement that the railway zone be paved like the rest of the street with asphalt upon a concrete foundation was inherently arbitrary or unreasonable."

Under the third head the court considered the claim of the company that the return being earned on its property was less than a reasonable one and that to improve the additional burden of paving with asphalt would deprive it of its property in violation of the fourteenth amendment. On this point, quoting cases, the court said:

The Supreme Court of the State answered the contention by saying, "The company can at any time apply to the railroad commission and have the rate made reasonable." The financial condition of a public service corporation is a fact properly to be considered when determining the reasonableness of an order directing

an unremunerative extension of facilities or forbidding their abandonment. But there is no warrant in law for the contention that merely because its business fails to earn 6 per cent upon the value of the property used, the company can escape either obligations voluntarily assumed or burdens imposed in the ordinary exercise of the police power.

The fourth defense raised was that the ordinance was void because it denied equal protection of the laws. This contention rested upon the fact that since entry of the judgment the Supreme Court of the State had decided *Superior v. Duluth Street Railway Company*, 166 Wis. 487, which the company alleged was not reconcilable with its decision in this case. On this point the Supreme Court said that it could not see a close similarity between the two cases. Continuing, it said:

However that may be, the Fourteenth Amendment does not in guaranteeing equal protection of the laws, assure uniformity of judicial decisions, *Backus v. Fort Street Union Depot Company*, 169 U. S. 557, 569, any more than in guaranteeing due process it assures immunity from judicial error. *Central Land Company v. Laidley*, 159 U. S. 103; *Tracy v. Ginsberg*, 205 U. S. 170. Unlike *Gelpcke v. Dubuque*, 1 Wall. 175, and *Muhlker v. New York*, 197 U. S. 544, where protection was afforded to rights acquired on the faith of decisions later overruled, the company seeks here to base rights on a later decision between strangers which, it alleges, is irreconcilable on a matter of law with a decision theretofore rendered against it. The contention is clearly unsound.

As we conclude that there was a contractual duty to repave arising from the acceptance of the franchise, we have no occasion to consider whether there was, as contended, also a statutory duty to do so arising under section 1862 Wisconsin Statute, which provides that street railways shall "be subject to such reasonable rules and regulations * * * as the proper municipal authorities may by ordinance from time to time prescribe."

Justices Pitney and McRenolds filed dissent of the opinion handed down.

Must Meet Franchise Conditions

The United States Circuit Court of Appeals at New York has reversed a decision of Federal Judge Chatfield which enjoined the Board of Estimate from revoking the franchise of the Manhattan & Queens Traction Corporation because of the company's failure to extend its line from Jamaica to the city limit. The opinion was written by Judge Rodgers. It was concurred in by Judges Hough and Manton.

When the board, about a year ago, ordered the company to extend its line the company asked for receivers, and the receivers obtained the injunction freeing them from building the extension. Under the decision of the Circuit Court the city has now the right to take over the road.

The company obtained its franchise in 1912 to operate from Jackson Avenue and the Queensboro Bridge Plaza along various streets to the Nassau County line. It refused to continue construction beyond the Long Island Railroad station in Jamaica. The court says the franchise was an entire franchise and that the line must be built and operated when the city so directs.

Corporation Council Burr of New York City says that the decision means that "every corporation must keep its contracts with the city or suffer forfeiture."

Wage Case Closed

Atlanta Company Concludes Its Testimony Before Arbitration Board—Increase in Fares Necessary

The wages of railway employees in Atlanta, Ga., have been increased in greater ratio than the advance in the cost of living, and if another increase is allowed at this time there must be an increase in fares to meet it. Resting on this contention the Georgia Railway & Power Company on March 5 concluded its case before the board of arbitration that had been appointed to consider the advisability of a salary advance for trainmen. Judge John D. Humphries, umpire of the board, announced that the board would consider the case when the testimony presented had been fully transcribed. A decision will probably not be rendered before April 1.

Preston S. Arkwright, president of the Georgia Railway & Power Company, and H. M. Atkinson, chairman of the board of directors, represented the company. They presented figures to prove that at a 6-cent fare, the present rate, the company could not afford to pay the men any advance in wages. Even at 6 cents, the company executives stated, the corporation is not able to break even on railway operation. Therefore, it was pointed out, that if the board decides in favor of the employees and grants an increase in pay there must necessarily be an increase in fares to meet the added expense.

In presenting the company's side of the case Mr. Atkinson said:

The company gets absolutely nothing from the last increase in fares to 6 cents. The additional revenue goes to the employees in increased wages.

The railway is being run today literally for the public benefit. We are paying no dividends and stockholders are getting nothing.

The fixing of wages and rates ought to be in the hands of some governing body. In my opinion it would be wise in the State of Georgia, to put the power to fix both these factors in the hands of the State Railroad Commission.

Considering the money spent on wages, material, power, damages, taxes, interest, depreciation and miscellaneous items in 1919, the company paid out \$1.03 for every \$1 it took in under the 6-cent fare.

These were among the most important points made by Mr. Atkinson during his testimony.

Mr. Arkwright set forth detailed figures showing the system of wages for motormen and conductors, indicating that salaries have been advanced in the past few years in a ratio that more than covers the advanced living costs.

The arbitration board consists of Judge Humphries, of the Fulton County Superior Court, who was chosen as umpire after both the company and the union had refused to accept several other men suggested for that important position. Luther Z. Rosser is arbiter for the company. Madison Bell represents the men.

The only question to be decided by the board is that of wages to be paid during 1920. All other issues arising from the 1920 contract have been settled by previous negotiations to the satisfaction of all concerned. While the

exact increase in pay asked by the men has not been made public it is understood on good authority that they ask an increase that will cost the company nearly \$600,000 a year, according to figures presented by Mr. Arkwright.

Based on the number of working hours in 1919, Mr. Arkwright pointed out that an increase of only 1 cent an hour would cost the company an additional \$30,000. He presented the figures for each additional cent per hour, showing that a 5-cent increase would cost the company almost \$150,000 a year; a 10-cent increase almost \$300,000; a 15-cent increase almost \$450,000; and a 20-cent increase close to \$600,000 additional.

It has since been reported from Atlanta by telegraph that the men have gone out.

Present Prices in Valuations

U. S. Supreme Court Holds That Lands and Terminals Can Be Valued at Present Prices

The railroads of the country won an important and far-reaching decision over the I. C. C. in the Supreme Court on March 8, 1920. The court held that in fixing a valuation of a common carrier the commission must follow the provisions of the act of Congress passed March 1, 1913, and consider the present cost of condemnation and damages, or of purchase in excess of original cost or present value of all lands, terminals and rights-of-way owned or used by the railways in their business.

The suit was brought by the Kansas City Southern Railway to compel the commission, which was ascertaining its valuation in accordance with the March 1, 1913, amendment to the Act to Regulate Commerce, to hear proof "that its refusal to investigate and find such present cost of condemnations and damages or of purchase in excess of original cost or present value would result in great wrong and injury to the regulator and in the aggregate would result in a finding with respect to said lands at least \$5,000,000 less than the value so directed by the Act of Congress."

The commission declined to do this because such a plan seemed to be in conflict with the ruling of the Supreme Court laid down in the Minnesota Rate Case, but the Supreme Court held that this was an erroneous view to take. Continuing, it said:

It is impossible to conceive how the Minnesota rate ruling could furnish ground for refusing to carry out the commands of Congress, the cogency of which consideration is made particularly manifest when it is borne in mind that the Minnesota rate cases were decided prior to the passage of the act in question.

Finally, even if it be further conceded that the subject matter of the valuations in question which the Act of Congress expressly directed to be made necessarily opened a wide range of proof and called for the exercise of close scrutiny and of scrupulous analysis in its consideration and application, such assumption, we are of opinion, affords no basis for refusing to enforce the Act of Congress. * * * The judgment of the Court of Appeals is therefore reversed with directions to reverse that of the Supreme Court and direct the Supreme Court to grant a writ of mandamus in conformity with this opinion.

News Notes

Strike in Sioux City.—Employees of the power plant at the Sioux City (Ia.) Service Company walked out on March 4, tying up railway traffic and cutting off light service.

Industrial Relations Court Proposed.—The creation of a state court of industrial relations with broad powers to prevent strikes and lockouts and to insure "efficient and continuous" operation of all industries of public interest and of public utilities and common carriers is provided in a bill introduced by Chairman Knight of Senate labor and industries committee in New Jersey.

Committee Approves Cleveland Subway.—The street railway committee of the City Council of Cleveland, Ohio, has approved the issuance of \$15,000,000 of bonds for the construction of a municipal subway. It has also approved the proposition to lease the subway to the Cleveland Railway. The proposals will be submitted to a referendum vote on April 27, if accepted by the City Council.

Home Rule Act in Kentucky.—A home-rule bill has been introduced in the Kentucky House. It has been ordered printed and referred to the committee on rules. The measure provides that "any city or town in the Commonwealth of Kentucky shall have the right by ordinance to regulate the service, and to fix and regulate the rates, tolls, and charges of water, light, gas, electric light, power and heat, telephone and street railway service to users, consumers and customers."

Binghamton Men Strike.—Because the Common Council of Binghamton, N. Y., failed on March 8 to adopt an ordinance permitting an increase in fares to 6 cents the employees of the Binghamton Railway struck on March 9 and the system is completely tied up. The men said their action was not against the railway, which had promised them a raise in pay if they got the increased fare, but against five Aldermen who voted against the ordinance. New compromise ordinances have been introduced.

Preparing New Scale at Wheeling.—To prepare a new annual wage scale to be presented to the electric railway officials of the entire Wheeling district to become effective on May 1, an all-day session of representatives of the various crafts affiliated with the union was held on Feb. 23. The session was attended by thirty-five representatives from all the lines in Wheeling, eastern Ohio and as far up the river as Weirton. It is stated that the new wage scale will be completed and ready for presentation by April 1.

Programs of Meetings

New England Street Railway Club

The twentieth annual banquet of the New England Street Railway Club will be held at the Copley Plaza Hotel, Boston, Mass., on March 25 at 6:30 p.m. The annual meeting for the election of officers will be held at 3 p.m. the same day.

The New England Street Railway Club has always been honored at its annual banquets with speakers of great national prominence. The speakers at the coming meeting will be William C. Sproul, Governor of Pennsylvania; Calvin Coolidge, Governor of Massachusetts; Andrew J. Peters, Mayor of Boston, and Matthew C. Brush, president of the American International Ship Building Corporation.

Second Railroad Conference

The second annual railroad conference of the American Association of Engineers will be held in the Congress Hotel, Chicago, on March 15. Among the speakers and subjects are:

"Plans for A. A. E.'s Future Railroad Work," by G. W. Hand, chief engineer of the Northwestern Railway. Discussion by J. B. Jenkins, valuation engineer of the Baltimore & Ohio and F. E. Morrow, chief engineer of the Chicago & Western Indiana.

"A. A. E. Railroad Salary Schedule," by W. C. Bolin of the association railroad committee. Discussion by R. W. Barnes, principal assistant engineer of the Southern Pacific, C. F. Bower, president of the Burlington Lines East Railroad Section, A. M. Knowles, president of the Erie Railroad Section, O. R. West, president of the Santa Fe Coast Lines Section.

"Railroad Sections: Their Organization and Function." The speaker is not selected.

"Railroad Sections: Their Relation to the Railroad Management," by F. C. Huffman, president of the Chicago & Northwestern Railroad Section.

"Railroad Sections: Their Relation to the Chapters," by Paul Augustinus, past president of the Chicago Chapter.

These subjects will be presented at the afternoon session, of which J. R. Leighty, chief engineer of the Missouri Pacific, will be chairman. The morning session will be in charge of W. W. K. Sparrow, assistant chief engineer of the Milwaukee. It will be devoted to registration, reports, and a résumé of the work of the association during 1919.

At the evening session W. H. Hoyt, chief engineer of the Duluth, Missabe & Northern Railroad, will preside. Dr. F. H. Newell, president of the association, will speak on the "American Association of Engineers—Its Aims and Ideals." Other speakers at the evening session will be Arthur S. Tuttle, chairman, Bion J. Arnold and Oscar C. Merrill.

S. M. Felton, president of the Chicago Great Western Railroad, will also speak at the evening session. His subject will be "Problems of the Railroads Since Their Return to Private Control."

Financial and Corporate

Drastic Reorganization

Stockholders of Another Interurban Wiped Out Entirely in Reorganization

The Kansas City-Western Railway, operating between Kansas City, Mo., and Leavenworth, Kan., and in Leavenworth, was sold at auction on Feb. 16, for \$250,000. As noted previously in the *ELECTRIC RAILWAY JOURNAL*, the property was purchased by Walton H. Holmes, president of the Pioneer Trust Company, Kansas City, Mo., representing a committee of bondholders.

SALE FOLLOWED FORECLOSURE

The sale was the result of a foreclosure suit brought in the Federal Court in Kansas by the Guaranty Trust Company, New York, N. Y., trustee for the holders of \$1,600,000, par value, of bonds. The committee which purchased the road included Walton H. Holmes, P. W. Goebel, president of the Commercial National Bank, Kansas City, Kan., and P. T. White, Cleveland, Ohio. The committee headed by Mr. Holmes succeeded in having a large number of claims for damages declared junior to the lien of the bondholders by the Federal Court and also avoided a receivership.

The original plan and agreement for the reorganization of the company was dated April 1, 1919. This was subsequently modified because conditions changed and made the operation of the line more and more difficult. The amended plan is dated Feb. 16. Depositing bondholders who do not desire to approve the amendment have the right to withdraw their bonds and assessments, less their pro rata share of expense incurred to date by the reorganization committee and receive their share of the distributable proceeds from the sale of the property. Such non-depositing bondholders will receive about \$110.74 for each \$1,000 bond and coupons attached.

REASONS FOR MODIFYING PLAN

It is pointed out that the gross earnings of the property for the calendar year ended Dec. 31, 1919, were \$407,804, the largest in the history of the company. The operating expenses, including maintenance, were \$396,866, almost the largest in the history of the company. It was feared, however, that if the plan of April 1, 1919, was carried out another reorganization would be necessary in the near future, as the burdens upon the earning capacity of the property would be too severe to provide for the interest of 6 per cent upon the new first mortgage bonds.

The original plan of reorganization provided for the authorization of \$1,000,000 of first mortgage 6 per cent bonds, \$500,000 of preferred stock and

\$500,000 of common stock. It was proposed to issue under this plan \$958,800 of first mortgage bonds, \$479,400 of preferred stock, and 479,400 of common stock. There was previously outstanding \$42,000 of Kansas City-Leavenworth Railroad 5 per cent first mortgage gold bonds due Sept. 1, 1919; \$1,598,000 of Kansas City-Western Railway first mortgage 5 per cent twenty-year gold bonds; \$42,000 of bonds to retire the Kansas City-Leavenworth first mortgage gold bonds and \$10,000 of bonds in the treasury of the company, making the total outstanding bonds, \$1,650,000. There was also outstanding capital stock to the amount of \$2,000,000.

It is explained that the property upon confirmation of the sale by the court will belong to the depositing bondholders represented by \$1,558,000 par value of bonds, the assessment paid upon which is intact. If the amended plan is approved the money so deposited will be used to pay the estimated expense of foreclosure and reorganization placed at \$116,151. The amendments proposed to the original plan of April 1, 1919, are as follows:

1. Reduce the interest on the new bonds from 6 per cent per annum to 5 per cent per annum.
2. Date new mortgage as of April 1, 1920, or as soon thereafter as the sale is approved by the court.
3. Issue preferred stock at par equal to interest include March 1, 1920, instead of March 1, 1919, on bonds surrendered.
4. Authorize \$1,250,000 of bonds, \$625,000 of preferred stock, and \$625,000 of common stock.

None of the securities in excess of the amounts provided in the plan of April 1, 1919, is to be issued at this time, except the necessary preferred stock to provide for the accrued interest on bonds surrendered.

It is expected that the court will defer confirmation of the sale until a satisfactory plan is determined upon.

Offers Road to City

George A. Stanley, president of the New York & North Shore Traction Company, operating from Flushing to Whitestone, and to Hicksville in Nassau County, Long Island has offered his line to the city of New York as a gift, if the city will operate the road at a 5-cent fare. He made this proffer at a hearing before the Public Service Commission for the First District called to investigate the action of the company in ceasing service over all its lines. He stated that at many points the company's tracks were buried beneath several inches, and in some cases several feet, of ice, and that the company had no money with which to remove the encumbrances. He stated, however, that he was willing to resume service immediately after the snow had melted and the tracks were clear.

Harrisburg Expenses Jump

Passenger Traffic Increases 10 Per Cent — Employees Get 97.7 Per Cent More in Wages Than Before the War

The report for the year 1919 of the Harrisburg (Pa.) Railways states that 3,795,574 car miles were operated, and that the total number of passengers including cash and transfers was 31,572,762. The total number of passengers carried shows an increase over 1918 of 1,640,544.

COSTS JUMP, TOO

With the increase in the number of passengers, the cost of operation likewise increased. During 1918 the cost of operation amounted to \$747,396 while in 1919, the cost was \$989,267, equivalent to 32.3 per cent increase. This increase was due to higher wages allowed carmen and other employees during the year, and the increased costs of practically everything pertaining to the railway system. Since the beginning of the war, the wages of the employees of the company have been increased 97.7 per cent.

FARES INCREASED

On Oct. 1, 1918, the 6-cent fare went into effect. Since then wage increases have been allowed that amount to 7 cents per hour. This increase represents a raise of approximately 20 per cent during the period. It has eaten up most of the revenue derived from the increase in fare.

Another important item of expense is taxes, for the Harrisburg Company pays, perhaps, more than any other railway operating in any city of the third class in Pennsylvania. During the past year \$130,000 was necessary, \$39,000 of which went into the coffers of the Harrisburg city treasury under the provisions of the franchise.

IMPROVEMENT PLANS

The company during the coming spring and summer contemplates making many improvements that should have been made in the past. Among these it will build the extension on Herr Street from Seventh Street to Eighteen-and-a-half Street with the hope of being able to render better service to a rapidly growing section of East Harrisburg. Changes are also contemplated at the power house and carhouse due to the rapidly increasing load and the number of cars operated. At the present time, the company owns 133 cars, 110 of which are of the closed type, and twenty-three are open cars.

New Louisville Director

L. W. Botts, president of the Fidelity & Columbia Trust Company, and connected with the Louisville, Henderson & St. Louis Railroad, controlled by the Louisville & Nashville Railroad, has been elected a member of the board of directors of the Louisville Railway, making the fourteenth member, of the fifteen agreed upon. Mr. Botts was formerly a director of the company.

Duluth Operates At a Loss Increased Expenses Eat Up Gain in Gross—Surplus 10 Per Cent Less Than Last Year

The annual report of the Duluth-Superior Traction Company, Duluth, Minn., for the year 1919 shows that the cost of rendering service increased more during the past year than the gain in revenues. As a result the net income transferred to profit and loss at

revenue made it necessary to seek additional revenue; especially after the citizens in Duluth on April, 1919, had voted against municipal ownership.

In anticipation of the necessity of obtaining increased revenue the company on Sept. 1, 1919, started an appraisal of the property and on Dec. 4, 1919 renewed its efforts with the city of Duluth to obtain an increase in the unit rate of fare. Similar application is also pending before the Wisconsin

Vancouver Pays Dividend

Difference in Exchange Rate Enables Common Stockholders to Benefit by a Bonus

The annual report for the year ended June 30, 1919, of the British Columbia Electric Railway, Ltd., recently issued indicates that notwithstanding the serious twenty-four day strike of June, 1919, the company was able to maintain its dividend payments. This was not due entirely to actual earnings, but to the unusual existing profit on exchange in remitting moneys from Vancouver to London and the appropriation of certain monies held for contingencies, which, under the altered conditions, the directors considered were no longer needed. This amounted in all to £138,419.

The net income transferred to profit and loss from operation during the year amounted to £391,763. The profit from exchange, and transfers of reserves no longer needed, registration fees, etc., made a total of £530,327. Adding the balance from the previous year, less a 5 per cent dividend of £72,000 for the year ended June 30, 1918, on the cumulative perpetual preference stock (really a bond issue) gives £6,085, thus making the total revenue £369,105.

Deductions were as follows—£154,727 for depreciation, equivalent to 3.1 per cent on the book value of the property; directors and trustee fees, office rent, salaries, etc., £12,581; leaving a balance of £369,105 for interest and dividends.

Interest on debentures and debenture stock for the year was £132,447. Dividends on the 5 per cent cumulative perpetual preference stock and an interim dividend of 2.5 per cent on the preferred ordinary stock paid during the year totalled £108,000. The balance therefore available for further distribution was £128,657. At the annual meeting, the directors voted the payment of a final dividend on the preferred ordinary stock of 2.5 per cent for the year ended June 30, 1919, a 3 per cent dividend and a 3 per cent bonus on the preferred ordinary stock, amounting in all to £122,400. The balance for the year therefore was £6,258.

STATEMENT OF EARNINGS OF DULUTH-SUPERIOR TRACTION COMPANY

	1919	1918	Per Cent Change + Increase - Decrease
Revenue from transportation.....	\$1,925,726	\$1,656,139	+16.27
Revenue from other railway operations.....	11,417	9,770	+16.83
Total railway operating revenues.....	\$1,937,143	\$1,665,909	+16.29
Way and structures.....	\$202,978	\$183,496	+10.62
Equipment.....	213,235	154,617	+37.95
Power.....	205,432	197,226	+4.16
Conducting transportation.....	735,381	570,390	+28.95
Traffic.....	1,338	1,488	-10.08
General and miscellaneous.....	216,472	187,462	+15.48
Transportation for investment—Cr.....	*1,722	* 997	+72.70
Total railway operating expenses.....	\$1,573,114	\$1,293,682	+21.57
Net operating revenue.....	\$364,029	\$372,227	- 2.20
Taxes assignable to railway operation.....	105,683	95,395	+10.79
Operating income.....	258,346	276,832	- 6.67
Non-operating income.....	22,293	20,575	+ 8.35
Gross income.....	\$280,639	\$297,407	- 5.64
Interest on funded debt.....	174,838	175,002	- 0.09
Interest on unfunded debt.....	110	1,015	-89.20
Miscellaneous debits.....	923	2,333	-60.50
Total deductions from gross income.....	\$175,871	\$178,350	- 1.40
Net income transferred to profit and loss.....	\$104,768	\$119,057	-12.00

* Deficit.

the end of the year was 12 per cent less than in 1918.

The gross revenues showed an increase of \$272,951 or 16.22 per cent over the previous year and an increase of \$315,049 or 19.15 per cent over the year 1917. The net income transferred to profit and loss for the year showed a decrease of \$14,288 or 12 per cent as compared with the year 1918 and a decrease of \$181,029 or 63.34 per cent as compared with the year 1917.

The increase in operating expenses

Railroad Commission. Hearings have not yet begun, pending the completion of the valuation.

An analysis of the accompanying table shows that passenger traffic increased more than 15 per cent with a corresponding increase of 16.27 per cent in passenger revenues. Operating expenses as a whole including depreciation based on the 4 per cent sinking fund method increased 21.57 per cent. The equipment and conducting transportation accounts show the greatest in-

STATISTICAL STATEMENT OF THE DULUTH-SUPERIOR TRACTION COMPANY

	1919	1918	Per Cent Change + Increase - Decrease
Gross revenue.....	\$ 959,436	\$1,686,485	+16.22
Revenue passengers.....	38,475,440	33,088,747	+16.25
Transfer passengers.....	6,408,086	5,728,778	+11.85
Total passengers.....	44,883,526	38,817,525	+15.64
Mileage—first main track.....	57.04	57.04
Total miles—all track.....	104.09	103.75	+ 0.34
Revenue from transportation—Per mile of line.....	\$33,761	\$29,000	+16.42
Per mile of single track.....	\$18,515	\$15,950	+16.10
Passenger traffic—Per mile of line.....	785,000	682,000	+14.80
Per mile of single track.....	448,000	374,200	+19.75
Operating ratio (per cent).....	81.35	77.70
Per cent on \$1,500,000 preferred stock earned and paid.....	4.00	4.00
Per cent on \$3,500,000 common stock earned.....	1.28	1.68	-0.40
Taxes—per cent of gross revenue.....	5.40	5.66	-0.26

was attributed to the continued high cost of materials and supplies used in the maintenance and operation of the property, and also to the two wage increases to the employees. The inability of the company to meet its increasing costs with a continual decreasing net

crease—these being 37.95 and 28.95 per cent respectively. The operating ratio increased from 77.7 in 1918 to 81.35 in 1919 or 3.65 per cent. Taxes increased \$10,288 or 10.79 per cent notwithstanding the fact that the tax per \$100 of gross revenue decreased 26 cents.

Court Enters Decree of Sale

Judge Sater, sitting in the United States District Court at Cincinnati, Ohio, has entered a decree of foreclosure and sale of the property of the Springfield Terminal Railway & Power Company, Springfield, Ohio. The court has, however, given the company until March 31 to pay the principal of the \$250,000 of first mortgage bonds and accrued interest. In the default of making such payments the receiver, George Whysall, is ordered to sell the property at public auction to the highest bidder at the County Court House in Springfield, Ohio, on a day to be named by Mr. Whysall. As the receiver must advertise the property before offering it, there is little likelihood that the sale will take place before early in May.

Louisville Deficit Increases

Expenses of Operation Exceed Revenues Without Depreciation Allowance or Dividend Payments

The Louisville (Ky.) Railway in its annual report to the stockholders for the year ended Dec. 31, 1919, compares present financial conditions with those existing in 1916—the year prior to the World War. This comparison shows that during this period expenses increased five times as fast as the revenues from operation.

Despite the strike of the trainmen operating revenue increased nearly \$500,000. It is difficult to give in exact

allowance for wage increases. This actually calls for an increase in the net operating revenue of 100 per cent.

A table is presented showing the effect of public opinion on the increased expenses of the company as reflected by the value of its securities.

\$341,000 of Bonds Authorized

The Public Utilities Commission of the District of Columbia has ruled favorably on the application of the Washington Railway & Electric Company for permission to issue \$341,000 of general mortgage 6 per cent gold bonds. The commission has, however, care-

which he offers to increase the interest rate to 5½ per cent for the period of extension.

The franchises of the company expired in June and September, 1919, and the company, which was operating at a deficit, has been released from rate restrictions and some other conditions unfavorable for profitable operation of the line.

The Doherty interests took over the road in 1913 and it has shown the following net results: 1913, \$6,972; 1914, \$6,486; 1915, \$10,329; 1916, \$11,690; 1917, \$2,836; 1918, deficit, \$9,156; and 1919, deficit, \$28,199.

Passenger rates have been increased and unprofitable freight business has been abandoned, but the management has not had sufficient time to determine the effects of the new conditions, it is announced.

Interurban Earnings Increase

The annual report of Edward Goepfer, president of the Toledo, Bowling Green & Southern Traction Company, to the stockholders at their meeting at Findlay, Ohio, on Feb. 24, showed an increase in gross receipts of 11.5 per cent over the previous year, while operating expenses were 18.33 per cent less.

The suspension of car service within the city limits of Toledo by the working of the "ouster ordinance" approved by the people last November caused a loss of \$15,000, the president's report indicated.

Injuries to passengers in accidents cost the company \$15,175. The most costly accident was a collision of a Clover Leaf Railroad train and a traction car at a crossing south of Toledo on March 10, 1919. This accident alone cost the company \$8,873.

Receiver for White Plains Line

Leverett S. Miller on Feb. 28 was appointed by Supreme Court Justice Joseph Morschauer as receiver for the Westchester Street Railroad, White Plains, N. Y. Mr. Miller is the present manager of the railway. Justice Morschauer, acted on complaint of the Farmers Loan & Trust Company, New York, which seeks to foreclose a mortgage of \$168,000. The court granted a motion for a receiver in order that the road may be kept running and the public may not be inconvenienced.

The Westchester Street Railroad is controlled by the New York, New Haven & Hartford Railroad and is operated by the same management as the New York, Westchester & Boston Railway. The company owns 22.50 miles of track and operates 7.63 miles additional under trackage rights, making 30.13 miles in all. It leases and operates the Shore Line Electric Railroad, a system with 1.46 miles of track. The Westchester Company has outstanding \$700,000 of capital stock and \$386,000 of bonds. The Shore Line has outstanding \$50,000 of capital stock and \$23,737 of bonds. The total capital liabilities of the two companies are therefore \$1,159,737.

INCOME STATEMENT OF LOUISVILLE RAILWAY

	1919	1916	Per Cent Change +Inc. —Dec.
Railway operating revenue.....	\$3,537,234	\$3,078,296	+14.92
Railway operating expenses.....	2,794,439	1,561,580	+72.60
Net operating revenue.....	742,795	1,516,716	—51.00
Taxes assignable to railway operation.....	366,000	315,051	+16.15
Operating income.....	376,795	1,201,665	—68.60
Other income (a).....	105,297	182,000	—42.70
Gross income.....	482,092	1,383,665	—65.10
Interest on bonds and discount on notes sold.....	639,597	621,750	+28.70
Net income.....	*157,505	761,750
Dividends.....	None	670,650
Surplus.....	*157,505	91,265
Depreciation (not paid in 1919).....		85,000
Balance.....	*157,505	6,265
Taxes—per cent of gross revenue.....	79.10	50.80	Increase 29.70
Operating ratio (per cent).....	13.50	10.25	2.25

* Deficit. (a) Louisville Interurban net earnings in this item.

figures the cost of the strike. On the one hand, revenues were diminished. On the other, the expenses of operation were less. What the revenue would have been had there not been a strike, is purely an estimate. That the expenses were less comes from the fact that but few cars were operated a part of the time and not for a number of weeks were normal operations resumed. The best judgment places the net cost of the strike at \$327,000. Even a gain of this amount in gross revenue would have been insufficient to pay a depreciation allowance of \$85,000 and a 5 per cent dividend on the \$3,500,000 outstanding cumulative preferred stock. A deficit of \$90,505 would have existed at the end of 1919 without any dividend on the common stock having been paid.

LOUISVILLE RAILWAY QUOTATIONS

	Jan. 1	1920	1917	Loss	Per Cent Decrease
Common stock.....	25	96	71	74.0	
Preferred stock.....	50	101	51	50.5	
First mortgage bonds (5%).....	83	103	20	19.4	
Second mortgage bonds (4.5%).....	64	92	38	41.4	
Consolidated mortgage bonds.....	65	99	34	34.4	

One of the outstanding reasons for this deficit is the fact that since 1916 the compensation to employees has increased 87.5 per cent and taxes 16.15 per cent.

In order properly to provide for deferred maintenance, pay the 5 per cent dividend on the preferred stock and a 6 per cent return on the common stock it is obvious that the railway operating revenue must be increased by at least 20 per cent without making a further

fully laid down the conditions of the issue, it being of the opinion that the expenditures indicated in Schedule "B," amended, were not in whole or in part reasonably chargeable to operating expenses or income.

On Sept. 26, 1919, the company renewed its application to the commission for a certificate of authority to issue and sell general mortgage 6 per cent gold bonds to the amount of \$341,000, face value, dated Dec. 2, 1918, payable on Dec. 1, 1923, the proceeds of the sale to be used to reimburse the company's current funds for the balance of the capital expenditures made from Jan. 1, 1909, to Jan. 31, 1915.

In its order the commission said:

The valuation of the company's property has been completed and the opinions and findings of the commission were announced on Sept. 4, 1919. From the information now before it, the commission is of the opinion that the money to be procured by the sale of the said bonds of the Washington Railway & Electric Company to the amount of \$341,000 is necessary to, and reasonably required by, the said company for reimbursement of funds heretofore expended for the purposes indicated in its Schedule "B," excluding therefrom those items enumerated as covered by bonds issued under authority of the commission's order number 143.

Bond Extension Asked

The Maumee Valley Railways & Light Company has asked holders of the \$300,000 of first mortgage 5 per cent gold bonds of the old Toledo & Maumee Valley Railway which matured on March 1, 1920, to consent to an extension of the maturity date for one year. Frank R. Coates, president, addressed a letter to all bondholders in

Losing \$2,525 a Day

Frank Samuelson, auditor for the receiver of the New York (N. Y.) Railways, testifying recently before the Board of Estimate, said that operations for January showed a deficit of \$78,293. The company is losing on an average \$2,525 a day in operation. It lost during recent snow tieup \$675,000 in receipts, and the cost of snow removal, with only part of the bills in, was \$207,000, making total for February storm of \$882,000. Mr. Samuelson admitted that the company had reserve for maintenance and depreciation from \$1,700,000 to \$1,800,000 under the order of the court to set aside 38 per cent, but defended the necessity for accumulating this amount on the ground repairs come in cycles and it would be impossible to make necessary provision from earnings of any one year.

Henry L. Stimson showed that the gross receipts of the company since reorganization have been stationary or decreasing. Gross receipts for the year ended June 30, 1913, were \$13,605,852; for 1915, \$13,010,932; for 1917, \$11,195,729, and for 1919, \$11,606,853. He said that the saturation point in receipts of company has been reached and the only remedy is an increase in fare.

While the total underlying mortgages of the subsidiary companies is only \$21,450,000, the assessed valuation of the land and buildings now under control of the receiver is placed by the city at \$19,408,000, and the valuation of the property in the streets including conduits is placed by state assessment at \$19,551,900.

Traffic Increases in Atlanta

The 1919 annual report of the Georgia Railway & Power Company, Atlanta, Ga., indicates that the passenger traffic exceeded that of the previous year by nearly 10 per cent notwithstanding fares were increased 20 per cent in April, 1919, except on two lines, due to contracts the fare is limited to 5 cents.

For the three months ended March 31, 1919, before the rate of fare was changed the increase in the number of passengers carried over the corresponding period of 1918 was 7.75 per cent. For the nine months covering the balance of the year, during which time with the exception of first two weeks in April, the 6-cent fare was in effect, the increase in passengers carried was 10.2 per cent over the corresponding period of the previous year.

This gain would indicate that the increase in fare did not have any deterrent effect on the passenger traffic. A part of this, however, may be attributed to the growth of the territory served, for the population inside the corporate limits of the city of Atlanta has increased from 154,000 in 1910 to at least 225,000 and that it is now generally conceded to be the financial, commercial and railway center of the South. The real population served by

the 248.14 miles of track forming the electric railway system, which covers more than merely the corporate Atlanta limits, is estimated to be 250,000.

The mention of the traffic details was made in our issue of Feb. 7.

North American Company to Reduce Stock

A special meeting of the stockholders of The North American Company will be held March 17 for the purpose of (1) acting upon the proposition to amend, alter and change the certificate of organization so as to increase the authorized capital stock of the company from \$30,000,000, its present authorized capital stock, to \$43,750,000, consisting of 500,000 shares of 6 per cent cumulative preferred stock of the par value of \$50 each, and 750,000 shares of common stock of the par value of \$25 each and (2) acting upon the proposition to decrease the issued capital stock of the company from \$29,793,300, the amount now issued and outstanding, to \$22,344,975, such decrease to be effected by reducing the par value of the shares now outstanding, viz., \$100 each, to \$75, to consist of one share of 6 per cent cumulative preferred stock of the par value of \$50 and one share of common stock of the par value of \$25.

Increase in Net for Holding Company

Earnings of the American Light & Traction Company, New York, for the year ended Dec. 31, 1919, on stocks of subsidiary companies owned were \$3,355,055 as against \$3,732,941 in 1918, a decrease 10.12 per cent. Miscellaneous earnings totaled \$1,006,490, an increase of 69.7 per cent. Gross earnings equaled \$4,361,546 as against \$4,326,367 in 1918. Deducting expenses, which were \$218,683, or 29.8 per cent less than in the previous year, the net earnings were \$4,142,863 compared with \$4,014,801 in 1918. Adding surplus and reserve of \$11,869,329 for 1918, the total surplus earnings applicable to dividends were \$16,012,192, as against \$17,104,281 in 1918, a decrease of 5.86 per cent.

During the year 35.5 per cent of the surplus was paid out in two cash and one stock dividends amounting in all to \$5,689,447. The surplus balance for the year was \$10,324,745 a decrease of 13 per cent.

Service-at-Cost Commission

Appointment of a committee of three to draw up for Tacoma, Wash., a service-at-cost plan has been completed by the naming of F. H. Rudkin, United States District Judge at Spokane, who makes the third member of the commission. The city has appointed one man and the railway one. The three will draw up a new franchise embodying the Cleveland idea and establishing, it is believed, a sliding scale of fares. It is planned to submit the franchise to the voters at the April election.

Financial News Notes

Purchase at Gadsden Approved.—The Alabama Public Service Commission sitting at Montgomery has approved the transfer of the electric and the railway properties at Gadsden to the Alabama Power Company. The companies taken over are the Alabama City, Gadsden & Attalla Railway and the Gadsden Railway. The proposed transfer of the properties was referred to in the ELECTRIC RAILWAY JOURNAL for Feb. 7, page 307.

Business Men Save Railway.—Electric railway service was saved for Eureka on Feb. 28 by the business men of the city, who raised a fund of \$2,443 to pay the 5½ per cent State tax on the annual gross earnings of the Humboldt Traction Company, which the company had announced it was unable to pay. Manager J. W. Hale had announced that service would have to be discontinued unless some one came to the rescue of the company, as the security holders had declined to pay the State tax, or spend any further money on the road.

Directs Study of Reorganization Plan.—A bill has been introduced into the Legislature of Rhode Island directing the Public Utilities Commission to investigate the plan for the reorganization of the Rhode Island Company as advanced by the receivers and also to inquire into any other plan that may be offered for reorganizing the company. The bill requires the commission to report not later than March 23. The receivers have suggested State ownership and control for the company with private operation. Their plan was referred to at length in the ELECTRIC RAILWAY JOURNAL for Feb. 28, page 445.

Kansas City Railways Doing Better.—Philip J. Kealy, president of the Kansas City (Mo.) Railways, points out that during the month of January the system cleared approximately \$51,000 above operating expenses, and that the February figure will be greater. In an agreement with the bondholders' protective committee the company is discounting bonds and interest on notes for this year, which at the end of the year will total nearly \$2,000,000. Mr. Kealy referred to the 1919 situation, declaring that the company lacked nearly \$750,000 of meeting expenses of operation.

First Profit for Municipal Line.—For the first time since it was placed in operation, the Tacoma (Wash.) Municipal Railway, connecting the city with the shipyards and other industrial plants, is said to have operated at a profit in the month of January. A balance of \$1,839.23 was left after charging off a depreciation of \$2,000.

The net passenger revenues for January were \$12,418 with switching revenues of \$1,600. It is said the reason for the profit is the establishment of a loading station at the shipyard end of the line, making possible the collection of all fares.

A Loss That Became a Gain.—The municipally owned electric railway between Attleboro and Briggs Corner, Mass., showed a deficit in its first year of operation of \$383.54, according to figures made public by Harry J. Goodale, superintendent of public works, who manages the road. The total operating receipts were \$17,485.47 and the total operating expenses were \$17,873.54. A 7-cent fare is charged. The city considers the road a success inasmuch as practically \$2,000 extra was obtained by the city treasury because of the increased valuation on property abutting the road.

Change in Name.—The name of the Mahoning & Shenango Railway & Light Company, operating electric power and light and city and interurban railways in Mahoning and Trumbull Counties, Ohio, and Lawrence, Mercer and Beaver Counties, Pa., with main offices in Youngstown, Ohio, has been changed by the stockholders to The Pennsylvania-Ohio Electric Company. The change in name in no way affects the property, ownership or management. It has been made because the activities of the company have outgrown the old name and the new name is better descriptive of the territory served and the services rendered.

Receiver Must Fix Scrap Value.—At the Federal Court at Cleveland, Ohio, on Feb. 14, C. G. Taylor, receiver of the Sandusky, Norwalk & Mansfield Electric Railway, was given three weeks in which to appraise the scrap value of the system, which is roughly estimated at \$175,000. This action was taken in behalf of the majority bondholders who desire to scrap the road. The court, it is stated, has taken steps to give the minority bondholders the privilege of buying in the property. The receiver has jurisdiction over 25.6 miles of track between Norwalk and Plymouth and 6.9 miles between Plymouth and Shelby. It is stated that only the northern division is involved in the courts.

Tacoma Traffic Increasing.—An increase of 19 per cent in the total number of passengers hauled in January, 1920, and 22 per cent increase in the number of revenue passengers over the same month in 1918, is reported by the Washington Water Power Company, Spokane, Wash., to Mayor Fleming in the monthly statement as to railway operations. No comparison with January, 1919, was made because of the existence of influenza last year, which sent traffic totals below normal. Expenses, exclusive of taxes, also show an increase of 19 per cent over January, 1918. Taxes increased 35 per cent, while the pay received by the street railway employees advanced only 29 per cent.

\$89,000 of Bonds Authorized.—The Indiana Public Service Commission has

authorized the Interstate Public Service Company, Indianapolis, Ind., to issue and sell at not less than 80 per cent of par \$89,000 of first and refunding mortgage thirty-year 5 per cent gold bonds to reimburse its treasury for 75 per cent of the cost of additions, improvements and extensions. The Interstate Public Service Company has also been authorized to buy from Martin J. Insull all the capital stock, \$150,000 common and \$50,000 preferred, and \$89,821 of promissory notes of the Indiana Public Service Company for \$110,000, such sums to be paid in serial, promissory notes at 6 per cent interest, due in from three to sixty months.

Southern Road Needs Help.—Joseph K. Choate, vice-president of the Augusta-Aiken Railway & Electric Company, Augusta, Ga., at a recent rate hearing before the Georgia Railroad Commission made plain the perilous financial condition of the company. Mr. Choate explained that the railway had obtained a loan of \$140,000 through the operating managers of the company, the J. G. White Management Corporation. He said that the affairs of the railway were critical. It needed help instead of adverse criticism and suspicion. This help must come quickly to avoid bankruptcy—to the general detriment of the service and the probable dismantlement of the property of the company.

City Permits Discontinuance.—The city of Davenport, Ia., is planning to order the discontinuance of the Fourth Street line of the Tri-City Railway and to turn approximately 1 mile of the street traversed by this line into a boulevard. The company has for several years urged the discontinuance of the line as it parallels two other lines and has been losing at the rate of \$10,000 annually. The company stopped service on this line last year, but was compelled to resume state operation in order to secure a 7-cent fare. The city authorities have now come to realize that the company should be no longer burdened by operating a consistent money-losing line. The city's recent action was taken independently of company suggestion.

Valuation Under Way in Richmond.—Stone & Webster have been engaged by the Richmond Railway & Power Company, Richmond, Va., to make a complete inventory and appraisal of the property of the company in Richmond. It is estimated that the work will be completed in three months' time. The valuation is being made for the purpose of establishing a basis for determining a rate of fare which will enable the company to produce a fair return on the fair valuation. Before beginning the work, Thomas S. Wheelwright, president, extended an invitation to the State Corporation Commission and to the City Council to designate representatives to co-operate with the engineers in order to arrive at a valuation acceptable both to the company and to the public.

Abandonment of Service Proposed.—The board of trustees of the Eastern

Massachusetts Street Railway, Boston, Mass., has announced that service will be indefinitely suspended on the Hyde Park Lines unless the municipalities served render financial assistance in the operating expenses. The result of such an act will deprive the communities of Hyde Park, Mattapan, Dedham, Readville, East Walpole, Norwood and Westwood of service and reduce the mileage of the system about 20 miles. The suspension of service will take effect on April 1 unless the relief asked for is forthcoming. The company has announced that owing to the shortage of cars and the conditions of tracks owing to the severity of storms prevalent in this section this winter, service will be indefinitely suspended on the Reading-Lowell, Reading-Lawrence, Woburn-Lowell and the North Reading-North Reading Junction lines.

Rental Payments on Account.—By a decree entered on March 2 in the Superior Court by Presiding Justice Tanner, the receivers of the Rhode Island Company, Providence, R. I., are directed to pay \$250,000 to Cornelius S. Sweetland, receiver of the United Traction Company. In explanation of this decree, Eugene A. Kingman, who petitioned the court, stated that the decree authorized the payment of \$250,000, on account, to Mr. Sweetland, on behalf of the United Traction Company, toward the rental price that the receivers of the Rhode Island Company may be called upon to pay for the use of the Union, Pawtucket and Suburban Railroad systems. In April last, the leases of these three systems to the Rhode Island terminated, and the receivers have since operated these roads. The matter of the rent to be paid by the receivers for the use of these systems is now pending before Richard E. Lyman as master, who will determine the total price at a later date. The \$250,000 payment authorized by the decree is simply a partial payment, the exact wording being "on account."

Puget Sound Will Issue Preferred Stock and Change Its Name.—It is proposed to change the name of the Puget Sound Traction, Light & Power Company, Seattle, Wash., to the Puget Sound Power & Light Company. The company some time ago sold its railway lines in Seattle to the city. At the time the name is changed a proposal will be voted upon to authorize \$10,000,000 of 7 per cent cumulative prior preferred stock, issuable from time to time as may be desirable. Since the refunding of the short-term notes in June, 1918, it has been necessary to spend considerable sums on the power system and the directors believe it would be highly undesirable if not impossible to finance all of the requirements by further increases in the funded debt. They feel that the sale of stock not only will make it possible to maintain a more conservative balance between the debt and the capital stock, but also will enable permanent borrowing on a more economical basis if it appears wise to resort to such borrowings.

Traffic and Transportation

Asks Enabling Legislation

Vancouver Company Would Come Under Jurisdiction of Provincial Commission—Inquiry Held Up

It is expected that amending legislation will be passed this spring which will again place the British Columbia Electric Railway under the jurisdiction of the Public Utilities Commission of British Columbia. The company has joined in the petition that this be done. When this has been done it is expected that the investigation will be resumed which was commenced by Commissioner Retallack some time ago to ascertain the fare to be charged in the city of Vancouver and that an appraisal will be made of the property of the company on the mainland.

FARE INQUIRY DROPPED

The investigation by the commissioner into the matter of fares in Vancouver was adjourned temporarily owing to peculiar circumstances. In Vancouver the company is charging a 6-cent fare. This rate was provided by the City Council in July, 1918, authorizing this charge for a period of nine months. The act creating the commission was passed before this period expired. It provided, however, for the continuance of the 6-cent fare, subject to the company being able to satisfy the commission that this rate was just.

The act also provided that until such proof was furnished to the satisfaction of the commission the amount received by the company in excess of the 5-cent fare previously charged should be deposited in a special account in a chartered bank in Vancouver, and that if the rate should be fixed at less than 6 cents the excess amount be handed over to the Vancouver General Hospital.

COMMISSION LOSES JURISDICTION

Owing to an amendment to the general railway act of Canada the railways of the company passed from the jurisdiction of the Province of British Columbia and of the Public Utilities Commission to that of the Dominion of Canada and of the Dominion Railway Board. This, of course, negated the inquiry by the local authorities. As stated previously it is now hoped that amending legislation will result in the return of the company to the jurisdiction of the officials of the province.

Lynn Jitneys Given More Time

The City Council of Lynn, Mass., has extended to April 26 the time limit for the operation of jitneys within the city limits. By action of the Council, the licenses of the forty-two Lynn jitney

drivers will expire on that date. The Council had previously set March 1 as the date for the expiration of the licenses. The Eastern Massachusetts Street Railway had asked that jitney competition be stopped, so that it could give Lynn adequate service at reduced rates. This action was taken in accordance with its policy of demanding that the communities which it serves choose between the railway and the buses as means of transportation.

Legislation Introduced at Albany

Among the bills introduced recently at Albany are the following:

Senate Intro. No. 506, Print No. 540, Introduced February 17th by Mr. Karle. Adding new section 54-a Railroad Law, by providing that a steam or electric railroad having a franchise in this state operating to and from stations in New York city and owned or operated by a railroad having a franchise from another state shall not charge in such city a rate in excess of rate charged for similar service from such city to stations in adjacent state whether over its own tracks or under agreement with another railroad.

Senate Intro. No. 661, Print No. 678, Introduced Feb. 25, by Mr. Lusk. Amending Section 40 Public Service Commission Law, by providing that if after a hearing on complaint alleging violation of section 26, or upon consideration of facts admitted in writing by a carrier, the Public Service Commission shall determine that any party complainant is entitled to award of damages, the commission shall make an order directing carrier to pay such award.

Senate Intro. No. 695, Print No. 729, Introduced Feb. 26 by Mr. Lusk. Amending Section 161-d Labor Law, by providing that no female under eighteen instead of twenty-one years as at present shall be employed on any street, surface, electric, subway or elevated railroad.

Senate Intro. No. 698, Print No. 732, Introduced Feb. 26 by Mr. Thompson. Adding new Section 194-a Railroad Law, providing for a crew of at least one motorman or driver and one conductor on every street, surface or interurban railway and for one conductor on every trailer. Each separate violation is made a misdemeanor.

Senate Intro. No. 708, Print No. 742, Introduced Feb. 26 by Mr. Shackno. Adding new subdivision 5, Section 57 Railroad Law, prohibiting any railroad company owning or operating a steam or electric road through any of the boroughs of New York City from charging more than a single fare of 5 cents for carrying a passenger from any station in the city to any other station therein on any train scheduled to stop at such stations.

Senate Intro. No. 843, Print No. 922, Introduced March 4 by Mr. Fowler. Enacting the Municipal Utilities Law constituting Chapter 71 of the Consolidated Laws. On application of municipalities the Public Service Commission shall determine the fair value of any utility property subject to acquisition or estimate cost of establishing a municipal utility where it is proposed to be done wholly or partly by acquisition of other property or by new construction. The commission must take into consideration amount of capital honestly and prudently invested, present condition of property, its depreciation and adaptability for municipal utility purposes. The finding of the commission shall not constitute conclusive evidence of value.

Senator Thompson introduced a bill on March 9 to amend the railroad law as an aid to the financial difficulties of street railway companies. By its provisions the companies would only be obliged to pay for paving 6 in. outside the rails. At present, street railway companies are obliged to pay for paving 2 ft. outside the rails. Senator Thompson explained that the bill was introduced at the request of the officers of the New York Electric Railway Association.

Surface Lines Prodded

New York Body Thinks Depreciation Allowance of 38 Per Cent Too Large

The Board of Estimate and Apportionment of New York has temporarily concluded the inquiry into the rapid transit lines and turned its attention to the surface roads. A discussion of the financial condition of the New York Railways, which operates the "green car" lines, took up the March 10 session. Corporation Counsel William P. Burr, who is conducting the inquiry for the city, attacked the present financial methods of the company, chiefly those relating to the fixing of the rate of depreciation.

RESERVE FUND CALLED EXCESSIVE

Mr. Burr declared that the allowance of 38 per cent of the passenger revenue as a reserve fund against maintenance and depreciation was excessive. This amount was awarded the company some time ago by Federal Judge Julius M. Mayer. The Corporation Counsel held that the reserve fund was too high to permit the company to realize any profit on its investment. He contended that if the company had adhered to the old reserve of approximately 20 per cent, allotted by the Public Service Commission in 1912, its books would show a surplus where they now show continual losses.

In reply to the Corporation Counsel's request that the statement made by Henry L. Stimson, counsel for the company, to the effect that the practice of maintaining a reserve of 38 per cent was a common one, be substantiated by testimony, Mr. Stimson called to the witness stand Frank Samuelson, auditor for the company. Asserting that the company had fallen short in adequate protection of the property to the extent of \$1,394,000, Mr. Samuelson maintained that the 5-cent fare was at present totally inadequate to meet the operating expenses.

Colonel Stimson offered evidence to show that the lines now in the hands of Job E. Hedges, receiver for the company, had been reduced by order of the Federal Court to less than 100 miles of road from the original 150 miles, and that the lines are not now earning any interest on the investment. He said that the lines in control of Mr. Hedges had lost during February in revenue through inability to operate and cost of snow removal a sum amounting to between \$800,000 and \$900,000.

Fare Increase Suspended

The Public Service Commission of the State of Washington has suspended for a period of ninety days a schedule of rates of the Grays Harbor Railway & Light Company, Aberdeen, under which the company proposed to raise fares in Aberdeen, Hoquiam and Cosmopolis from 5 cents to 7 cents beginning Feb. 20. No increase was planned in the rate between Hoquiam and Aberdeen.

Seven Cents in Nashville

The Tennessee Public Utilities Commission in an order issued on March 3 authorized the Nashville Railway & Light Company to charge 7-cent cash fares. The commission ordered the sale of four tickets for 25 cents. The company was directed to make improvements in its rolling-stock and trackage, to discontinue certain cross-town lines and to provide more adequate service during the morning and evening rush hours. The higher fare went into effect on March 8.

The company's application for an increase had been before the commission last December, when it asked permission to charge a 7-cent fare pending an investigation of its financial condition by a board of three members, representing respectively the city of Nashville, the commission and the company. It was proposed that a permanent rate should be based upon the findings of this board.

This is the second fare increase authorized by the commission within a few weeks, the Chattanooga Railway & Light Company having been authorized recently to charge 7-cent fares. The case of the Memphis Street Railway is now pending. Fares in Memphis were raised to 6 cents several months ago.

Louisville Program Under Way

Since the Louisville (Ky.) Railway was reorganized, the company is getting better official and public support, and the managerial committee, which is operating the road, reports progress. It is believed that the new president will be elected during the next three weeks. In the meantime the program will be started for working out the plans of future operation under the reorganization. Some improvement in service is being shown, and some slight economies have been effected in cost of operation. It is planned to drop several parallel lines, and increase carrying equipment on the ones remaining. This will result in faster and better service.

The management is posting notices on cars and in carhouses expressing its desire to improve service and asking maximum co-operation from employees and the public.

One of the notices says:

To the public: We are endeavoring to provide the people of the city of Louisville with the best car service possible. We have the loyal support of the officials and the men of all departments, and we ask the hearty co-operation of the riding public.

Mayor Smith, the presidents of both boards of the General Council and the directors' managerial committee of the Louisville Railway conferred on March 4 with F. H. Sager, consulting engineer and traction expert of Chicago.

Jitneys Curbed in Muskogee

The city government at Muskogee, Okla., has taken action to stop the operation of jitneys that have been threatening the very life of the Muskogee Traction Company. When the company announced it would suspend all cars on

its East Side lines if the jitneys were not stopped, Mayor F. B. Fite ordered the arrest of all owners and drivers of jitney buses. The city had been helpless to protect itself up to a week previous, when District Judge Watts in a decision held that the city had absolute control of its streets and that it was within its police powers to regulate and control, even to prohibition, the jitneys. Mayor Fite said:

The railway company's revenue is being taken from it by the jitneys that operate just ahead of the cars on streets where cars run. We must protect the company's investment or be classed as a jitney town. I have instructed the police and legal departments of the city to use all their efforts in banishing the jitneys from our streets.

Details of I. R. T. Service Order

Public Service Commissioner Lewis Nixon of the First District, has issued an order directing the Interborough Rapid Transit Company to make material increases in the service which it renders on all of its subway lines, particularly in the non-rush hours. The order calls generally for ten-car expresses instead of eight-car, and six-car trains practically throughout the daytime non-rush hours. A part of the service increase also covers service in evening non-rush hours. Some increases are made in rush-hour local service.

The tracks are now operated practically to capacity for express service during rush hours, and no material increase is possible during such period. The service improvements directed by Commissioner Nixon will add to the service being operated in the non-rush hours a total of 600 cars more than are now operated in these hours, and about 30,000 more seats than are now furnished in these hours.

The order follows extensive investigations made by the commission into Interborough service. The commission gave the company until March 10 to determine whether it would accept the order, and to March 17 to put the new service into effect. The order was referred to briefly in the *ELECTRIC RAILWAY JOURNAL* for March 6, page 488.

Transportation News Notes

Would Retain 8-Cent Fare.—Rolla Wells, receiver for the United Railways, St. Louis, Mo., on March 4 applied to the State Public Service Commission for permission to continue in effect the 8-cent cash fare charged by the company.

Asks Hearing on Tube Raise.—The New Jersey Board of Public Utility Commissioners on March 6 sent a communication to the Interstate Commerce Commission asking for a public hearing on the reasonableness of a proposed

fare increase on the lines of the Hudson & Manhattan Railroad. The company, which operates the tubes under the Hudson River connecting New York and New Jersey, has announced that on April 4 it will raise its fare to 8 cents. The present fare between the Hudson Terminal and Jersey City and Hoboken is 5 cents and between other stations in Manhattan and the latter points, 7 cents.

Freight Service Proposed for Cincinnati.—The Cincinnati (Ohio) Traction Company is working out plans for the establishment of a general freight service on its lines. Walter P. Draper, vice-president of the company, has suggested to Street Railway Director Culkins that the returns from such service would assist in relieving the system's financial condition. As a first step toward the organization of freight service negotiations have been started with several manufacturers of Norwood relative to their financing of an extension of the Edwards Road line to a connection with the South Norwood line.

Supreme Court to Pass on Fares.—The city of San Antonio, Tex., has taken steps to appeal to the United States Supreme Court in its contest with the San Antonio Public Service Company over the question of fares in San Antonio. The last court action was the granting last fall of an injunction in the Federal District Court by Judge Duval West restraining the city from interfering with the company in charging a fare sufficient to meet expenses and insure an adequate return on its investment. The company showed that the 5-cent fare fixed by the city was confiscatory, and on this showing Judge West based his decision. It is now charging a straight 7-cent fare.

Eight Cents Asked in Johnstown.—Notices of a proposed increase in fares to take effect April 1 have been posted by the Southern Cambria Railway, Johnstown, Pa. Single cash fares will be 8 cents for each zone, but tickets will be sold in books at the rate of 7½ cents a zone. There are ten zones on the line from Johnstown to Ebensburg, so that the increase will mean a maximum of 10 cents on a cash fare. On books of tickets, however, and on workmen's tickets, the actual increase is only 5 cents each way. New express tariffs have also been filed, but they provide for increases only on shipments weighing more than 500 pounds on which a reduction in rates had formerly been allowed.

Information at the Source.—As an aid to the improvement of railway service in Toledo, Ohio, officials of the Toledo Railways & Light Company who are not directly connected with the railway department of the company will be assigned to ride cars at rush hours and mix with the public for the purpose of obtaining suggestions from the car rider's viewpoint. On Feb. 25 the first assignments were made. Advertising Manager E. R. Kelsey discovered that

in a certain type of car additional straps in the front end would provide room for nearly twenty passengers. The improvement was immediately sanctioned by the railway department. Regular assignments to ride the cars will be made in the future.

Long Hauls Blamed for High Fare.—Street Railway Director W. C. Culkins of Cincinnati has submitted to the City Council a report outlining the reasons for the 7-cent fare charged by the Cincinnati Traction Company. The council had asked for an explanation of the conditions which made the 7-cent fare necessary. Mr. Culkins declares in his report that the city can hope for no reduction in fares until sparsely settled districts through which the company is now operating for long distances at a loss, are built up and become more densely populated. He points out that the company pays an annual city tax of \$350,000. According to Mr. Culkins the use of the skip-stop resulted in a saving to the company of \$60,000.

Secession Move in Staten Island.—A group of business men of Richmond Borough, Staten Island, N. Y., has organized a movement for the separation of the borough from New York City. The agitation for secession resulted from the transportation situation in Staten Island, a large part of which has been without electric railway service since the Staten Island Midland Railway suspended operation last January because of lack of funds, its request for a higher fare having been refused by the New York City Board of Estimate. A petition for the return of the trolleys at an increased fare has been signed by 15,000 Staten Islanders. The Richmond County Grand Jury is conducting an investigation of the trolley situation in the borough.

Wants Rochester Service Improved.—Corporation Counsel C. L. Pierce of Rochester, N. Y., has filed with the Public Service Commission for the Second District a brief in which he asks the commission to order improvements in the service furnished by the Rochester lines of the New York State Railways. The commission recently conducted three hearings at Rochester into the condition of the company. In his brief Mr. Pierce contends that the company can improve its service while continuing to operate on a 5-cent fare basis. He asks the commission to direct the company to carry out a definite schedule on each line, based upon a specific headway for the line as a whole, this service to continue for a trial period of three months, during which time the company's books should be open to public inspection.

Seven Cents in Worcester.—The Worcester (Mass.) Consolidated Street Railway on March 7 raised fares on its Worcester City lines from 6 cents in each zone to 7 cents and on its suburban zones from 5 cents to 6 cents. The increase was granted by the Massachusetts Department of Public Utilities on the application of Clark V. Wood,

president of the company, who stated that an increase in revenue was necessary to prevent bankruptcy. The 7-cent fare is a temporary arrangement. The utilities commission will hold a hearing on April 1 as a preliminary to the fixing of a permanent rate. The company last December established two 5-cent zones on its Worcester lines. In January the fare in each zone was raised to 6 cents. The company's receipts were greatly reduced by interruptions in service during the recent blizzard.

Stricter Jitney Control Urged.—Retention of jitney competition with the Springfield (Mass.) lines of the Eastern Massachusetts Street Railway, is recommended in the report of the jitney committee of the Springfield City Council. The committee states that unrestricted jitney competition is in its opinion unfair, but urges that the vehicles be allowed to operate providing their regulation is made more strict. It recommends that each jitney be capable of carrying twenty persons and that each pay a \$100 license fee, furnish a \$1,000 cash bond and give \$500 in bond or insurance for every passenger carried, thus making the total security at least \$11,000 per vehicle. Jitney fares would be made the same as those charged by the Eastern Massachusetts Street Railway, and jitney routes would be lengthened and would include routes not served by the trolley company. The vehicles would operate eighteen hours a day and seven days a week.

Publicity Campaign to Curb Jitneys.—J. M. Ives, receiver for the Danbury & Bethel Street Railway, Danbury, Conn., is conducting a campaign of publicity through the advertising columns of Danbury newspapers, to interest the car riders of that city and Bethel in the company's plight. The company's receipts have been cut into by jitney competition, especially on the Bethel line. Mr. Ives used a full page in the *Danbury Evening News* on Feb. 24 to explain the seriousness of the company's situation, pointing out that, if unrestricted jitney competition continues, the company will be compelled to abandon service on the Bethel line. To bring home to the public what such a suspension would mean, he reprinted in part the article in the January issue of *Aera* dealing with the Toledo situation. On Feb. 28 he reprinted in the *Evening News* extracts from the article in the *ELECTRIC RAILWAY JOURNAL* for Jan. 31 on the trolley-jitney fight in Massachusetts.

Asks Seven Cents in Fort Wayne.—Robert M. Feustel, president of the Fort Wayne & Northern Indiana Traction Company, operating the lines in Fort Wayne and interurban lines to Bluffton, Huntington and Lafayette, Ind., has petitioned the Indiana Public Service Commission for authority to increase the fare on the Fort Wayne city lines. He asks for permission to charge a 7-cent cash fare and a 6-cent ticket rate. In applying for a higher fare Mr. Feustel stated that the com-

pany planned to grant its employees a substantial advance in wages. The company in a public statement recently gave prominence to the following facts concerning its financial condition: Total revenues for the year 1919, \$730,809; total operating expenses \$638,225; taxes \$11,257; net available for returns on investment, \$81,327; return on investment of \$2,780,000, 2.88 per cent; revenue passengers carried 14,026,200; transfer passengers carried, 2,805,202; average passengers per day, 46,113.

Wins Appeal Against Car-Shortage Penalty.—The Judicial Committee of the Imperial Privy Council has allowed the appeal of the Toronto (Ont.) Railway against a penalty of \$1,000 a day for twenty-four days imposed by the Ontario Railway & Municipal Board for failure to carry out the board's order of Nov. 9, 1914, for the supply of 100 double-truck cars by Jan. 1, 1918. Owing to war conditions the company was unable at that time to supply the cars. The city, however, made several applications to the board to compel the company to comply with the provisions of the order. The matter drifted until early in 1918, when special legislation was passed by the Ontario Legislature providing a penalty not exceeding \$1,000 a day for non-compliance with an order of the board. The law became effective on March 26, 1918; the board thereupon inflicted a penalty of \$1,000 a day from that date for failure to provide 100 cars by Jan. 1, 1918. The company immediately appealed on the ground that the board had no authority to make such an order and that the company had made every effort to supply the cars but was unable to do so because of war conditions.

Would Bar Jitneys From Thoroughfare.—John A. Beeler, who is conducting a survey of traffic conditions in Kansas City, Mo., has submitted a report to the board of control of the Kansas City Railways in which he recommends regulation of vehicular traffic and the installation of loading platforms for the relief of congestion in Main Street. Mr. Beeler would forbid the operation of jitneys on Main Street within the congested district. He maintains that the operation of jitneys in Main Street constitutes a serious hindrance to the operation of street cars, pointing out that they constitute 35 per cent of the vehicular traffic in that thoroughfare. During the period from 4 p.m. to 6 p.m. on a certain day recently a count at Twelfth and Main Streets showed that 795 passenger automobiles carried 1,547 persons including drivers, or an average of 1.9 persons per car. Jitneys numbering 324 carried 1,349 persons, or an average of 4.2 persons per vehicle, not including the driver. Regulations proposed by Mr. Beeler have already been put in effect on Tenth Street. These provide for the relocation of stops, the employment of double-berthing, the readjustment of positive stops, giving the right of way to the heavy lines and precedence to street cars over other traffic.

Personal Mention

Mr. Mitchell Steps Up

General Manager of West Penn Railways Succeeds Williston Fish as Vice-President of System

H. L. Mitchell, general manager of the West Penn Railways, Pittsburgh, Pa., on March 1 assumed the duties of vice-president of the system. Mr. Mitchell was elected to the vice-presidency at a recent meeting of the board of directors to fill the vacancy caused by the resignation of Williston Fish. The latter has been appointed general manager of the Chicago (Ill.) Surface lines, as announced in previous issues of the *ELECTRIC RAILWAY JOURNAL*.

EIGHTEEN YEARS WITH SYSTEM

Mr. Mitchell has been identified with the West Penn Railways and the companies which it controls during the period of their development into one of the most important utility systems in Pennsylvania. The lines of the company radiate through the Connellsville coke region of southwestern Pennsylvania, penetrating the Wheeling district of West Virginia. Mr. Mitchell has had an active part in building up and organizing this net-work of lines. His election to the vice-presidency came just eighteen years from the date of his first connection with the system.

He entered the employ of the old Pittsburgh, McKeesport & Connellsville Railway at Pittsburgh on March 1, 1902. On February 13, 1903, when the general offices of that road were moved to Connellsville, he became chief clerk to Thomas Elliot, then general manager. From that date until July 1, 1911, he held various positions with the company, among them those of paymaster and office manager. He also had charge of the general and district stores department.

MR. MITCHELL ALSO AT WHEELING

On July 1, 1911, when the West Penn interests acquired additional lighting and railway property in Allegheny, Butler, Armstrong, Washington and Green Counties, Mr. Mitchell was transferred to Pittsburgh as assistant to W. E. Moore, vice-president and general manager. At the time of the reorganization of the West Penn System in November, 1918, he was made assistant manager of the light and power department, continuing in that capacity until July 1, 1918, when he entered the office of Williston Fish as assistant to the vice-president. On Sept. 15, 1918, he was transferred to Wheeling as vice-president and general manager of the Wheeling Traction Company and on Feb. 1, 1919, returned to Pittsburgh as general manager of the West Penn Railways.

Augustus T. Throop, superintendent of the light and power departments of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has resigned.

E. B. Atchley Joins Akron Company

E. B. Atchley, publicity manager of the Kansas City (Mo.) Railways, has resigned, effective March 15, to direct the publicity work of the Northern Ohio Traction & Light Company, Akron, Ohio. Mr. Atchley leaves Kansas City



E. B. ATCHLEY

after four years of service under President Philip J. Kealy. During this time he established a monthly magazine for the employees of the company and a weekly leaflet dealing with public affairs which is distributed on the company's cars. Both publications are known as the *Railwayman*, and both have been very successful in promoting a community of interest between company and employees on the one hand and company and patrons on the other.

Mr. Atchley has had a free hand in promoting the interests of the Kansas City Railways through broad and open publicity policies, and has wielded a material influence in making the company's motive understood by the people during the troublous times of the past few years. Prior to his connection with the company he was editor of the *Kansas City Post*, and previous to that was associated in an editorial capacity with the *Kansas City Star*, the *St. Louis Globe-Democrat*, the *Omaha Bee*, and other newspapers.

In going to Akron, Mr. Atchley will take with him the creed which he formulated into ten commandments expressing the policies and aims of the street railway, when he undertook his connection with the Kansas City Railways. This creed has stood the test of four years' application, and it will now

be applied to the territory served by the Northern Ohio Traction & Light Company. Mr. Atchley's "Ten Commandments" follow:

1. Thou shalt not, in any manner, deceive the public; and those working, being of themselves the company, shall be likewise undeceived.

2. Thou shalt furnish a proper service for a just compensation at all times.

3. Thou shalt deal fairly with those who ride in the cars, and recognize the rights of the men who operate them.

4. Remember thy promises always—and keep them.

5. Seven days, day and night, rain or shine, shalt thou labor. There is no rest for thee. For the people must have transportation continually.

6. Thou shalt not have "watered" stock or engage in stock juggling. The time for that is past.

7. Honor the city and the community in which you have car lines, that the relationship may be pleasant and that the city and community may continue to be blest by growth.

8. Thou shalt not operate cars recklessly.

9. Thou shalt keep thy cars clean and sanitary and in good repair.

10. Thou shalt not squander the money entrusted to thy care by the people who ride in the cars for those who have built the street railway system. Remember, thou art but husbanding such money, acting as agent for the owners and the people, to produce the maximum service for the minimum cost.

Mr. Hill Returns to California

W. V. Hill, who resigned recently as manager of the Washington office of the American Electric Railway Association, has returned to California, where he will resume his duties as manager of the California Electric Railway Association. Mr. Hill's work at Washington for the national body commenced when he was appointed assistant manager of the American Electric Railway War Board under E. C. Faber. Both in this post and in the other capacities in which he served the association so successfully at Washington, Mr. Hill was able to draw on the large fund of information which he had accumulated in his long and varied experience in active railway work and as manager of the California association.

As stated in the *ELECTRIC RAILWAY JOURNAL* for March 6, an arrangement has been made with Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company, Indianapolis, Ind., and chairman of the committee on national relations, to take over the active supervision of the affairs of the Washington office.

Mr. Henry will give as much of his time to this work as may be necessary. The office will be open continuously and all communications addressed to Mr. Henry at 950 Munsey Building, Washington, D. C., will receive prompt attention.

The Washington office of the association is equipped to act as agent before the Interstate Commerce Commission for member companies of the association requiring this service. Such companies as are not so represented or who desire to make a change in their present arrangement should communicate with Mr. Henry at Washington.

Executives and others connected with member companies having business in Washington are urged to make the association's rooms their headquarters.

Mr. Heindle Leaves Railway Work

William A. Heindle, general superintendent of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has tendered his resignation to take effect on April 1. On that date Mr. Heindle will go into business in Wilmington as an engineer and contractor. He has been connected with the company since 1910.

Mr. Heindle was graduated from Lehigh University in 1891 with the degree of civil engineer. For the next three years he was employed by the Baltimore City Passenger Railway in the construction of cable and overhead trolley lines. From 1894 to 1899 he was engaged in the construction of lines in Washington, D. C. In 1900 he became associated with J. G. White & Company, Ltd., London, Eng., on engineering contracts in Great Britain and on the Continent.

Returning to the United States in 1906 Mr. Heindle served for four years as supervising and electric railway engineer with J. G. White & Company, Inc., New York. He resigned in 1910 to join the Wilmington & Philadelphia Traction Company.

Mr. Hoover Gets First Washington Award

Herbert C. Hoover was presented with the Washington Award, founded in 1916 by John W. Alvord, at a dinner in his honor in Chicago on Feb. 28. The Western Society of Engineers acted as spokesman for the founder societies and Charles F. Loweth, chairman of the Washington Award Commission, made the presentation speech. Onward Bates spoke as a representative of the American Society of Civil Engineers, James Rowland Bibbins for the American Society of Mechanical Engineers, Bion J. Arnold for the American Institute of Electrical Engineers and Charles H. MacDowell for the American Institute of Mining and Metallurgical Engineers.

To use the words of the donor, the award is for presentation annually "to a member of the engineering profession who has accomplished much for the world about him in vital, important, far-reaching ways, and whose services in general have been noteworthy for merit in promoting the public welfare."

In his acceptance address Mr. Hoover stated that he could not accept the award except as a way of doing homage in a measure to the 1,000 engineers who had associated themselves with him in his work. His address dealt in general with the inter-relationship of general industries and food production and distribution.

Charles N. Ryan, secretary and treasurer of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has resigned.

Edgar E. Clark, of Iowa, has been elected chairman of the Interstate

Commerce Commission. The office of chairman is occupied in rotation.

Kenneth P. Allen has been appointed assistant equipment engineer of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis. Mr. Allen was formerly connected with the engineering department of the Firestone Tire & Rubber Company.

Charles R. Wright, who for some time past has been connected with the Knoxville Railway & Light Company, Knoxville, Tenn., has resigned to accept a position with the Acme Electric Company, which does electrical contracting.

P. T. Reilly, superintendent of transportation of the Scranton (Pa.) Railway will sever his connection with the company on April 1 to accept the position of general superintendent of the Wilmington & Philadelphia Traction Company, Wilmington, Del.

William E. Dowdell has been appointed general superintendent of the Portsmouth Electric Branch of the Boston & Maine Railroad, with headquarters at Portsmouth, N. H. Mr. Dowdell was formerly assistant general superintendent of the line, which operates between Portsmouth, Rye and North Hampton.

Rodney Hitt, who was associate editor of *ELECTRIC RAILWAY JOURNAL* from 1908 to 1912, has organized the firm of Hitt, Farwell & Park, with headquarters at 37 Liberty Street, New York, to transact a general investment business. For the past eight years Mr. Hitt has been associated with White, Weld & Company, bankers, New York.

R. A. Leussler, general manager of the Omaha & Council Bluffs Street Railway, Omaha, Neb., was elected second vice-president of the company at the annual meeting of the board of directors. Mr. Leussler will continue to perform the duties of general manager. He has been connected with the company since 1906. A biography and portrait of Mr. Leussler were published in the *ELECTRIC RAILWAY JOURNAL* at the time of his appointment as general manager in October, 1919.

Archibald Page, general manager of the Clyde Valley Electrical Power Company, Scotland, has resigned. Mr. Page has been appointed a technical member of the Commission under the Ministry of Transport for the control of the electrical supply of the kingdom. In last week's issue it was erroneously stated that Mr. Page had resigned as general manager of the Glasgow Corporation Tramways Department. Mr. Page has at no time been connected with the latter organization.

William B. Skelton, whose election as president of the Androscoggin & Kennebec Railway, Lewiston, Me., was noted in the *ELECTRIC RAILWAY JOURNAL* for Feb. 21, was born in Bowdoin, Me., in 1871. He was graduated from Bates College in 1892, and in the following year was admitted to the bar. In addition to the practice of law in Lewiston he has taken an active part

in municipal and State affairs, serving as Mayor of Lewiston from 1903 to 1905 and as Judge Advocate General with the rank of Colonel on the staff of Governor Cobb from 1905 to 1909. From 1914 to 1919 he served on the State Public Utilities Commission. Mr. Skelton is a member of the law firm of White, Carter & Skelton, Lewiston.

W. V. Neal, assistant general manager of the Monongahela Valley Traction Company, Fairmont, W. Va., has tendered his resignation, to take effect on March 15. Mr. Neal plans to enter the provision business in Clarksburg, W. Va. Before joining the Monongahela Valley Traction Company in January, 1919, he was connected with the Trinidad Electric Transmission, Railway & Gas Company, Trinidad, Col. For several years he was connected with the Stone & Webster interests with headquarters at El Paso, Tex. He was at one time an employee of the United States Government and had charge of the construction of a number of engineering projects in the Philippine Islands.

Harry C. Stevenson, formerly auditor of the Elizabeth, Plainfield & Central New Jersey Railway and later assistant to Edmund W. Wakelee, vice-president of the Public Service Corporation, has been promoted to personal representative to Thomas N. McCarter, president of the latter company. Mr. Stevenson began his business career in May, 1897, as secretary to Thomas N. Barr, then president of the Worcester (Mass.) Consolidated Street Railway. In 1901 Mr. Barr became the president of the Elizabeth, Plainfield & Central New Jersey Railway at the same time Mr. Stevenson was made auditor. Mr. Stevenson entered the Public Service Corporation when that organization was formed in 1903. In 1907 he was made assistant secretary to the Public Service and its underlying companies, becoming assistant with Mr. Wakelee in April, 1917. Mr. Stevenson will be assigned to the southern division which embraces Camden and the territory as far north as Trenton.

Obituary

R. L. Cadwell, construction engineer of Georgia Railway & Power Company, Atlanta, Ga., died recently at his home in Tallulah Falls, Ga.

A. H. Rogers, president of the Southwest Missouri Railroad, Webb City, Mo., died on March 6 in Los Angeles, Cal. Mr. Rogers was president of the Globe Publishing Company, Joplin, Mo.

H. M. Davis, manager of the advertising department of the Sprague Electric Works of the General Electric Company, died at his home in Brooklyn on Feb. 9. He had been connected with the Sprague Company since December, 1899.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER,
SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES

BUSINESS ANNOUNCEMENTS

Heavy Ordering of Electrical Sheets

Full Capacity Booked by Mills for First and Second Quarters—Higher Prices Expected For Third Quarter

Steel mills are entirely booked up on electrical sheet through the first half of the year. Where books were opened in November for the first half, the mills concerned had no difficulty in taking care of their capacity in a very short time. Where booking by the quarter is practiced, second-quarter capacity was contracted for in almost no time a few weeks ago, and in some districts a good part of it was done over the telephone.

Realizing that the demand was far ahead of the supply, the mills and their agents writing up second-quarter business first took care of their regular trade of long standing; and even these customers were not always able to secure sufficient sheets to supply their needs. District agents had only their allotment of mill capacity, and this in turn had to be allotted further. New customers and new manufacturers in the field were hard put to it to obtain material, but apparently jobbers held sufficient of the electrical sheets to supply part of their needs anyway.

During the first quarter some customers bought heavily, really more than they would consume in that period, but they were a little ahead of the game when second quarter was allotted. Consequently some mills had small amounts extra that they could hand out, and these were eagerly snapped up by other than regular customers. In one case in point, where the mill agent offered one of these small lots to a rather new customer, the latter was in no hurry to take it. Two weeks later, when he wrote in for it he was much upset to learn that it had been gobbled up by another firm. That is merely one instance in which the nature of the market is shown. Electrical sheets are not now being sold over the counter at the buyer's will.

Books for the second half year or for the third quarter are not yet open. Mills expect just as large a demand as that experienced over the first half year. Slightly better capacity will be available, it is reported. A loosening up of the labor market would place the industry on a still better basis. It is expected that orders may be placed along toward the end of April or early in May when the books will be open. Prices for the second half year will probably be higher than those quoted for the first half, while those for the third quarter are hardly expected to show much advance over those of the second quarter.

The foreign demand for sheets is heavy, but there is extremely little capacity set aside to serve it. In some cases there has been no allotment whatever set aside for this market. Actual orders are on hand for a considerable tonnage from European countries, but the mills have been unable to fill them and care for their regular domestic trade too. In some quarters this policy has been questioned because the good

will which might be built up at this time might be very acceptable when the demand for sheets shall have decreased in the domestic market and a foreign outlet for an excess mill capacity be sought.

It has been contended in some quarters that small tonnages would materially help the foreign situation now and undoubtedly help the domestic mill in the future.

Rolling Stock Purchases Break Records

More Than 1/3 as Many Cars as Were Bought During the Whole of 1919 for City Service Have Been Ordered in January and February, 1920

Safety car purchases during January and February have broken all records. For the first two months alone, as far as is known, 545 of these quicker-headway, minimum-energy-demanding safeties have been ordered from the different carbuilders, although late re-

turns may swell the total to more than 600. The former number is equivalent to more than 25 per cent of all cars ordered during the past year for city service.

With the 181 double-truck motor cars and trailers added, which have been placed during January and February, as shown in Table II, rolling stock purchases amounting to 726 cars for the two months are equivalent to more than 33½ per cent of the total number of cars ordered during 1919 for city service. This number is 126 cars greater than the conservative estimate of the ELECTRIC RAILWAY JOURNAL made early in the year for cars to be purchased during the first two months. Also reference to this table shows the decided trend toward the use of safety cars. The total of double-truck motor cars and trailers, however, does not include electrified steam roads, hence the seventy cars ordered by the Long Island Railroad for its electric division are not included.

Table I gives the list of railways ordering safety cars and is but a slight indication of what may be expected later. Five large city railways are reported to hold options for a total of more than 400 safeties and the greater number of these are expected to be placed during the next sixty days.

With the railways all over the United States in both large and small cities ordering safeties at a rate of between 2,000 and 4,000 cars a year, manufacturers are actively planning production on a large scale to meet the demand which is everywhere apparent. The rush for sheets, plates and shapes, control, air brake equipment, door and step control equipment, motors, etc., has been so strong that manufacturers of the different products are swamped and already long deliveries are being quoted, which may make it physically impossible for the carbuilders to turn out the increasingly large number of

TABLE I—SAFETY CARS ORDERED DURING JAN. & FEB., 1920

<i>New England States</i>	
Biddeford & Saco R.R.	2
Boston Elevated Ry.	31
Concord (N. H.) St. Ry.	4
	<hr/>
	37
<i>Middle Atlantic States</i>	
Empire State Ry. Corp.	6
Reading Transit & Lt. Co.	12
Salem & Pennsgrove.	6
Trenton, Bristol & Philadelphia Ry..	40
Trenton & Mercer Co. Traction.	33
United Rys. & Electric Co.	6
Westchester St. Ry.	6
	<hr/>
	109
<i>Southern States</i>	
Baton Rouge Electric Ry.	8
Birmingham Ry. Lt. & Pr. Co.	10
Columbus (Ga.) R.R.	9
Mobile Lt. & R.R.	10
Monongahela Valley Traction.	8
Tampa (Fla.) Electric Ry.	8
	<hr/>
	53
<i>East Central States</i>	
Hodenpyl Hardy & Co.	118
Galesburg Ry., Lt. & Pr.	20
Indiana Ry. & Lt. Co.	10
Decatur Ry. & Lt. Co.	6
Pekin (Ill.) Municipal Ry.	3
Peoria Ry.	20
Urbana & Champaign Ry.	6
	<hr/>
	183
<i>West Central States</i>	
El Paso Electric Ry.	10
Galveston Electric Ry.	15
Grand Forks (N. D.) St. Ry.	6
Lincoln Traction Co.	15
Northern Texas Traction.	25
Peoples Gas & Elec., Burlington, Ia..	6
Topeka Ry.	8
	<hr/>
	85
<i>Rocky Mountain and Pacific Coast States</i>	
Everett Ry., Lt. & Pr.	2
Los Angeles Ry.	45
San Francisco-Oakland Term.	25
Tacoma Ry. & Pr.	6
	<hr/>
	78
Total companies placing orders.	43
Total safety cars ordered.	545

safety cars that will be required by the railways.

The St. Louis Car Company, since the completion of its many war contracts, has made necessary changes in the arrangement of its plant to turn out safety cars on a large scale. For the present shop facilities have been arranged for the production of five safety cars per working day. Deliveries by this company, which are thought

TABLE II—COMPARISON OF NEW ROLLING STOCK FOR CITY SERVICE

	1916	1917	1918	1919	1920
Safety cars	187	280	644	1,383	545
Double truck motors, cars and trailers	2,859	1,718	1,198	746	181

to be very good, will be announced at a later date. The company also contemplates selling its safety cars, which are of the standard type, direct to the railways.

The Osgood-Bradley Car Company is preparing its shops for quantity production. It is reported that the company is now building 300 safety cars for stock purposes although it is known that perhaps 100 of these have already been spoken for.

Prospects for a heavy volume of business in all kinds of equipment accessories and supplies used in the manufacture of both safety cars and double truck cars never were brighter and manufacturers and railway supply men are now openly enthusiastic about the prospects for the coming months.

New Officers of Galena Signal Oil

At the annual meeting on Feb. 24 of the Galena-Signal Oil Company, Franklin, Pa., a stockholders' advisory committee was created consisting of J. S. Cullinan, John B. Dennis and Frederick Strauss, and several changes made in officers and directors. Lauren J. Drake was elected president to succeed J. S. Cullinan who becomes a member of the new committee. W. A. Trubee, who was district manager at New York, and W. F. Walsh, who was district manager at Chicago, become vice-presidents. L. F. Jordan remains as vice-president at New York and F. E. Linahen as vice-president at Franklin. F. French Miller was elected secretary-treasurer at Franklin, L. W. Stull as assistant secretary and assistant treasurer at Franklin and C. W. Hochette as assistant secretary and assistant treasurer at New York.

The directors re-elected are: L. J. Drake, L. F. Jordan, J. French Miller and E. V. Sedgwick. In addition, F. E. Linahen, W. A. Trubee and H. S. Skinner were added to the board.

Lauren J. Drake, the new president of the company, was born at Keokuk, Iowa, on Aug. 27, 1880. He was educated in the public schools of Omaha, Neb., and Chicago, Ill., and in 1899 was graduated from the Shattuck Military School, Faribault, Minn. He then entered the oil business and in 1905 he joined the Galena-Signal Oil Company and was a representative of that com-

pany in the Middle West. In 1916 he was transferred to the company's executive offices in New York to become vice-president and director of the company. As president, Mr. Drake will have his headquarters in New York.

W. A. Trubee, who has been elected a vice-president and director with headquarters at New York, was born in Bridgeport, Conn., on March 22, 1867. He attended a private school in Bridgeport and later the Greylock Institute at South Williamstown, Mass. During February, 1898, he entered the service of Galena-Signal Oil Company as sales representative at Bridgeport, Conn. In May, 1912, he was transferred to New York office and in March, 1919, he was appointed district manager at New York, which position he held until his recent election as vice-president and director of the company.

National Federation Construction Industries to Meet

The first annual meeting of the National Federation of Construction Industries will be held at the Hotel Sherman, Chicago, March 24-25. The chief business of the meeting will be consideration of several important proposed changes in the by-laws of the organization. Through changes in the by-laws, it is proposed to increase the number of vice-presidents, create an advisory board, provide for a staff council and take measures to develop district organization.

Rolling Stock

Boston Elevated Buys Seventy Large Cars

The Boston Elevated Railway, which was mentioned in the Feb. 7 issue of the ELECTRIC RAILWAY JOURNAL as being in the market for 100 cars, has now placed orders for this number of cars with three different car builders. As previously announced, thirty safety cars were placed with the J. G. Brill Company.

Forty cars for use on the elevated line, similar to those now in use, have just been ordered from the Pressed Steel Car Company. In addition an order has been placed with the Laconia Car Company for thirty standard center-entrance double-truck surface cars equipped for train operation.

Westchester Street Railway, White Plains, N. Y., noted in the Jan. 3rd issue of the ELECTRIC RAILWAY JOURNAL as being in the market for safety cars, has placed an order with the Osgood-Bradley Car Company for six safety cars.

New York & Stamford Railway, Port Chester, N. Y., noted in the Jan. 3rd issue of the ELECTRIC RAILWAY JOURNAL as being in the market for safety cars, has placed an order with the Osgood-Bradley Car Company for seven safety cars.

Boston (Mass.) Elevated Railway, noted in Feb. 7th issue as having placed an order for thirty Birney safety cars, has specified the following details.

Number of cars	30
Builder	J. G. Brill Company
Type	Safety
Seating capacity	32
Length over all	28 ft. 3/4 in.
Truck wheelbase	8 ft. 0 in.
Width over all	7 ft. 10 1/2 in.
Interior trim	Bronze
Headlining	None
Air brakes	G. E. (CP-27 compressor)
Axles	Hammered steel, 3 in. x 6 in.
Couplers	Journal
Fixtures	Pocket in bumper
Curtain supply	Curtain
Designation signs	Hunter illuminated
Door operating mechanism	Brill
Fare boxes	International hand
Fenders or wheelguards	H. E.
Heaters	12 Cutler-Hammer panel
Headlights	Crouse-Hinds incandescent
Journal bearings	Friction
Motors	G. E. 264
Seats	Inside hung
Sanders	Ohio Brass air
Seats	J. G. Brill
Seating material	Wood—J. G. Brill
Trolley catchers	retrievers
Trucks	Ohio Brass & Keystone
Ventilators	Brill special 79-E-1
Wheels	8-Brill exhaust
Special devices	26 in. diameter steel
	Railway Utility heat regulators

Reading Transit & Light Company, Reading, Pa., noted in the Feb. 28 issue of the ELECTRIC RAILWAY JOURNAL as having placed an order for twelve safety cars with the Osgood-Bradley Car Company, has specified the following details:

Number of cars ordered	12
Date of order	Feb. 5, 1920
Delivery	In six weeks
Builder	Osgood Bradley Car Company
Type	Semi-convertible safety
Seating capacity	32
Weight, total	16,000 lb.
Length over all	27 ft. 9 1/4 in.
Truck wheelbase	8 ft. 0 in.
Width over all	7 ft. 9 1/8 in.
Height	10 ft. 3 1/8 in.
Body	Semi-steel
Interior trim	Birch
Roof	Arch
Air brakes	G. E.
Armature bearings	Roller
Axles	A. E. R. A. No. E-2
Signals	Consolidated car heating
Control	K-10
Designation signs	Hunter
Fare boxes	Johnson
Hand brakes	Brake shafts
Heaters	Gold double-coil
Headlights	Golden Glow SM-95
Journal bearings	Roller
Lightning arresters	Garton Daniels
Motors	Two No. 264 G. E.
Motors	Inside hung
Paint, varnish or enamel	Both
Registers	International
Sanders	Air operated
Seats	Osgood Bradley
Seating material	Slat type
Trolley catchers or retrievers	Earl No. 10
Trucks	Osgood Bradley type 25-96
Wheels	Griffin FCS

Recent Incorporations

Wichita Fall, Tex.—An electric railway from Wichita Falls to Burkburnett and thence to Wagoner City, is proposed. Representatives of eastern capitalists have been in Wichita Falls looking over the territory which would be served by the road. The line would be seventeen miles in length.

Houston, Richmond & San Antonio Traction Company, Houston, Tex.—The name of the Houston, Richmond & Western Traction Company, which plans to build an electric line from Houston to San Antonio, has been changed to the Houston, Richmond & San Antonio Traction Company. Work

on the road will begin shortly. H. A. Halverton of Houston is president of the company.

Spirit Lake Railway & Power Company, Vancouver, Wash.—Articles of incorporation were filed on Feb. 26 by the Spirit Lake Railway & Power company with a capitalization of \$350,000. The company is incorporated to operate railways, steamboats on the Columbia River, power plant, generate power, deal in real estate, maintain telephone and telegraph lines, etc. The stock is \$1 per share. The trustees are: Dr. Joseph Roane, C. C. Brown and James E. Rice, all of Vancouver.

Track and Roadway

Macon Railway & Light Company, Macon, Ga.—The Georgia Railroad Commission has refused to allow the Macon Railway & Light Company to discontinue service on its Rivoli extension. The company had asked permission to take up the tracks.

Paducah (Ky.) Railway.—The Paducah Railway and the Paducah Electric Company plan to make improvements in their facilities at a total cost of \$250,000. The city's car lines will be largely reconstructed. The cost of improvements to the power and light plant will amount to \$175,000.

Boston (Mass.) Elevated Railway.—The Boston Elevated Railway will make improvements to its line at Watertown Square.

Kansas City (Mo.) Railways.—The Kansas City Railways has begun work on a line in Eighteenth Street from Central Avenue to Kansas Avenue, Kansas City, Kan.

Cincinnati (Ohio) Traction Company.—The Cincinnati Traction Company has opened negotiations with a number of Norwood manufacturers looking to the extension of the Edwards Road line to connect with the South Norwood line.

Power Houses, Shops and Buildings

Sacramento Northern Railroad, Sacramento, Cal.—This company has opened a new passenger and freight station at Marysville, Cal.

Fitchburgh & Leominster Street Railway, Fitchburg, Mass.—The carhouse of the Fitchburg & Leominster Street Railway with two cars containing tools and other equipment, was destroyed by fire on March 5. The loss amounts to \$75,000.

Manchester (N. H.) Street Railway.—A carhouse of the Manchester Street Railway was damaged by fire recently.

Northwestern Ohio Railway & Power Company, Toledo, Ohio.—This company has under construction a transmission line from Curtis, along the shore of Lake Erie to Ryan a distance of twelve miles.

Trade Notes

Rhode Island Glass Company, of the General Electric Company, has begun work on an addition to its plant at Central Falls, R. I. The new building will be about 50 ft. x 96 ft. and will be three stories high.

Van Dorn Electric Tool Company, Cleveland, Ohio, is building a four-story addition of 30,000 sq.ft. of floor space for the manufacture of portable electric drills, reamers and grinders.

A. S. Winter, formerly connected as advertising and sales manager for the William Powell Company, has joined the sales force of the Fairbanks Company, of Pittsburgh, Pa., and will represent them in southern Ohio.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that J. G. Miles, head of the insulation section, has been transferred to the Seattle district office as manager of the supply department.

National Exposition of American Manufacturers, which was to have been held in April, 1920, at Buenos Aires, Argentine Republic, has been postponed until November, 1920, to allow more time for adequate preparations and shipments from other parts of North and South America.

Johnson Fare Box Company, Chicago, Ill., has received an order for 110 registering fare boxes and for metal tickets to be sold four for 25 cents from the Nashville Railway & Light Company. These are in addition to the fifty boxes which the company now has in use.

American Engineering Association will hold its 21st annual convention in Chicago on March 16 to 18. Except for the annual dinner on the 17th the time will be occupied entirely with consideration of the numerous committee reports. The usual exhibition of railway appliances and machinery will be at the Coliseum, March 15 to 18.

F. M. Nourse has joined the Charles L. Benjamin organization at Chicago. Mr. Nourse has been an engineer in the advertising department of the Cutler-Hammer Manufacturing Company, at Milwaukee, Wis., for the past two years and prior to that was associated with the Wisconsin Power, Light & Heat Company, at Portage, Wis.

Lapp Insulator Company, Le Roy, N. Y., announces that it is proceeding immediately to the erection of an additional factory and the installation of considerable new machinery to increase its capacity 60 per cent within the next five months. The capital is also being increased from \$150,000 to \$500,000 to take care of rapidly increasing business.

Century Electric Company, St. Louis, Mo., is proceeding to increase its manufacturing facilities about 60 per cent by the erection of a 180-ft. x 106-ft. six-story factory building near the present plant. The company has purchased sufficient ground to provide for the growth of its business for some years to come. The present addition is to

permit expansion in the lines of alternating-current motors.

Westinghouse Air Brake Company, Pittsburgh, Pa., Catalog unit No. 2021 describing its standardized UC brake equipment for steam road passenger trains, and which, with simple electric attachments, is claimed to comprise the highest development of electro-pneumatic train brake for both electric and steam road passenger trains. The pamphlet is well prepared both as to text matter and illustrations.

Green Fuel Economizer Company, Beacon, N. Y., announces the opening of an office at 1006 Finance Building, Philadelphia. The office will be in charge of W. F. Wurster, assisted by G. E. Kille. The company was formerly represented in this territory by the Baker-Dunbar-Allen Company. Mr. Wurster has been doing engineering and sales department work with the Green Fuel Economizer Company for the last six years.

Martindale Electric Company, 11,737 Detroit Avenue, Cleveland, Ohio, is the new name of what was formerly The Handy Supply & Manufacturing Company, the change dating from Jan. 1. E. H. Martindale is president and general manager and only recently resigned as sales engineer of the National Carbon Company to become president of The Handy Supply & Manufacturing Company. Mr. Martindale is a graduate of Case School of Applied Science, class of 1908, a member of the board of directors of the American Institute of Electrical Engineers and spent a year in France as captain in an engineering regiment. In addition to its business in commutator stones, commutator slotting files and insulating varnishes, the Martindale Electric Company will act as exclusive agent for Volk refillable fuses, Marble-Card direct-current motors and generators, St. Louis Electrical Works alternating-current motors as well as distributing products of the Efficiency Electric Company.

New Advertising Literature

Breeze Manufacturing Company, Newark, N. J.: A folder giving the many uses of "Fle-x-met," a flexible metallic tubing.

Magnolia Metal Company, New York, N. Y.: A twenty-four-page booklet "New Truths and Old Fallacies" containing instructive information concerning babbitt metals.

Laclede-Christy, St. Louis, Mo.: A forty-two-page bulletin, "Boiler Capacities with Chain Grates," showing the importance of fuel-bed temperatures in increasing the maximum capacity attainable.

Wellman-Seaver-Morgan Company, Cleveland, Ohio.: Bulletin 49. 8½ x 11 in.; illustrated. Description of this company's open-top railroad car dumper, showing some installations with working drawings of device.