MAINTENANCE ISSUE

ELECTRIC RAILWAY JOURNAL

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February 28, 1925

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CONTENTS

FEBRUARY 28, 1925

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Your Language

A LAWYER who becomes attorney for a railway remains primarily a lawyer. So also a doctor who does medical work for a railway is nevertheless a doctor still. But an engineer engaged in the publication of a railway magazine should be first of all a railway man. Every one of the technical editors of the ELECTRIC RAILWAY JOURNAL is an engineer. Yet it is not primarily as engineering that they consider their job — nor is it editorial work either. Theirs is railway work and they are railway men.

Every question requiring editorial consideration is viewed from the standpoint of the railway man. In this way the practices and ideas of the industry as described in the pages of the JOURNAL reflect the views of men thoroughly familiar and in sympathy with it.

Apparently the men of the industry understand this, for the average railway man in talking with an editor of this paper plunges right to the heart of his subject without preliminary explanations. Of course no one can know everything about every phase of the industry, but the editors of the JOURNAL have had first-hand experience in the railway game and they talk and understand the railway language.

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GENERAL ELECTRIC

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Published by McGraw-Hill Company, Inc.

MORRIS BUCK, *Managing Editor*

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Accurate Maintenance Costs Are Worth While

FROM a study of maintenance methods and practices in various shops, one is impressed by the lack of adequate cost figures. Questions regarding most of the technical phases of the work are readily answered, but accurate cost records are seldom available. This condition seems to be quite common except in some few shops where the master mechanic, apparently in sheer desperation, has set up a rough cost system of his own which enables him to judge to some extent in what direction he is headed.

Maintenance costs are collected in one form or another to compile the various accounts of the standard classification. The manner and degree to which they are utilized for the preparation of statements for the information of the maintenance departments determines whether or not this information becomes simply dead records or active guides and signals to direct the work of the maintenance forces.

The need for more detailed maintenance figures has been generally recognized. Last year a joint committee of the Engineering and Accountants' Associations prepared a tentative subdivision of the standard classification for the way and structures department. At the convention, however, this classification was questioned because it contained certain subdivisions to which it would be very difficult to make accurate charges. It was pointed out during the discussion of the report that it is difficult to get maintenance men to differentiate accurately between a large number of accounting subdivisions. This defeats the very purpose of the subdivision. It requires constant vigilance and supervision even to get charges made properly to the various accounts of the standard classification. An interesting pictorial guide made up by the Department of Street Railways of Detroit and described in the Aug. 16, 1924, issue of this paper, was devised to guide foremen and workmen in making such charges correctly.

There must be a definite purpose for an account subdivision to justify its use. Both in the shop and field it is important to avoid burdening maintenance forces with a top-heavy system of red tape. Mechanics should spend their time in productive work and not in keeping books or making out endless time tickets.

The need for detailed maintenance cost figures led to a decision to continue the work of the joint committee on engineering accounting, which is preparing a subdivision of the equipment group of accounts. This work might be carried still further to include a study of report forms designed to give the maintenance departments necessary cost information for their guidance in the most concise and intelligible form.

The extent to which subdivision is carried, and the form in which reports are prepared, should be determined by the concrete purpose for which the information is compiled. In the shop, for instance, the cost statements, to be of maximum value, would show on the one hand the relative maintenance cost for the various types of each major part of the car equipment. Thus if this cost for any particular class of equipment or important part becomes excessive due to obsolescence or imperfect design, the fact will at once be apparent. In the same way, the master mechanic who is manufacturing replacement parts in the shop should know from time to time the cost of the parts so manufactured in comparison with their market price. With changing conditions, such statements will show whether it is cheaper to manufacture the parts or buy them outside.

When new equipment is to be purchased, accurate records of past performances are invaluable as a guide in the selection of the equipment best suited to the needs of a particular property and a particular service. The cost of a few additional clerks is small compared with the savings that can be made.

All of this requires the supervision of men versed in the principles of cost accounting, and who at the same time are in touch with the maintenance forces and are familiar with their needs and their problems. In practically every railway organization of considerable size there seems to be a place for the engineer-accountant. He becomes the connecting link between the accountant and the maintenance forces so that their work may be co-ordinated to the end that the necessary cost information will be available in a form best adapted to guide the administration of maintenance work.

Modernizing the Shopman's Point of View

ONE subject that always arouses interest when equipment men get together is the improvement in machines and processes for lowering maintenance cost and making equipment more reliable. The men who make these economies possible have not received much attention. But the efficiency of a machine is no greater than that of the man who operates it, as was pointed out at the recent Dallas meeting of the Electric Railway Association of Equipment Men, Southern Properties. This was the keynote of a commendable discussion on the question: How can the shopmen best be educated so as to increase the efficiency of their work? Vocational training courses, the reading of technical books and publications, conferences and discussions on timely topics were suggested as some of the means to this end.

It is of little avail to re-equip a railway shop with modern labor-saving machinery if the point of view of the shop employees remains the same as it was

This is the issue in February that is devoted essentially to maintenance subjects

20 or 30 years ago. Their thinking must be made as up to date as the tools they are using. There has been in the past too much of the "We've always done it this way" attitude. In most cases methods that were adopted in 1895 are as out of date in 1925 as a car built at that time would be today.

This need of modernizing the point of view of the men in the shops is now receiving considerable attention from railway managements. Opinions differ somewhat as to how it may best be accomplished. To a certain extent the method must depend upon the conditions in the particular shop where it is to be applied.

It is of primary importance, however, that the educational idea be properly "sold" to the shopman. A definite relation between the teaching and its results must be demonstrated. These men are not likely to be interested in ways to improve their minds simply for the sake of mental improvement. But they are intelligent men, and if they can be convinced that the educational program will make their work easier and better they will grasp the opportunity eagerly. The increasing attention being paid to this subject indicates that the electric railway industry will soon see a development in modernizing the shopmen's point of view similar to that which has already been made in modernizing the equipment in the shops of the more progressive companies.

Better Maintenance Will Reduce Noise in Car Operation

INCREASED attention is being given by electric railway officials to the problem of reducing noise in car operation. This can be considered as one of the details of modernization and will have a far-reaching effect in promoting better relations with the public.

Much of the noise in car operation is caused by parts which have been allowed to become loose or excessively worn. Loose truck parts, brake rigging, brakeshoes, and journal boxes, or worn motor suspensions, trolley wheels, springs, bearings, gears and pinions are parts that cause noise in operation. A second cause is the noise produced by impact between the car wheels and the rail. Such noises result from worn and corrugated rails, loose or broken joints, grit and dirt on the rails, flat wheels and wheels out of round. Moreover, jarring and vibrations from impact loosen car parts and eventually cause creaking at the body joints. Still a third major cause of noise is that originating in vibration of the operating and braking equipment itself.

Other factors contribute to car noises. Although they do not actually make the noise, they accelerate and transmit it instead of damping it. The susceptibility of parts to take up and transmit sound waves and vibrations introduces a problem in design that hitherto has not received great attention. Construction of track and roadway as well as of the cars themselves should be included. Surrounding buildings and equipment outside the track area sometimes add to the noise, on the principle of a sounding board.

The best way to reduce noise in the car equipment itself and in the track and roadway is by means of a higher grade of maintenance. Instead of keeping gears and pinions in service until they are worn so sharp that there is danger of breaking before they are removed, noise reduction requires that they be scrapped as soon as they wear to a point where excessive vibration occurs. The same principle applies to all wearing parts of car equipment. Bearings should be replaced more frequently than is the present practice. If any considerable reduction in noise is to be accomplished extreme wear must be prevented and definite limits of wear for the various wearing parts of car equipment should be established and should be enforced.

A special study of noises that come from car operation is being made by the equipment committee of the American Electric Railway Engineering Association. After the various causes for noises are classified and tabulated, it will probably be found that many of them can be relieved considerably by simple remedies. If, in addition to this, improved types of equipment be adopted and construction designed with the thought of reducing noise, much improvement will be accomplished.

$12,000,000 Saving Vindicates Milwaukee Electrification

AT LAST figures are available to prove the wisdom of the directors of the Chicago, Milwaukee & St. Paul Railway in adopting electric motive power for 650 of the 880 track-miles between Harlowton, Mont., and Tacoma, Wash. They have been criticised for their judgment in this matter because traffic and other conditions on these long-drawn out stretches of single track seemed not as favorable for large savings as those which existed in other parts of the country. It is all the more encouraging, therefore, to the proponents of judicious electrification of steam railroads that the financial showing is so good. This good showing results from a number of causes, among which the following stand out prominently: Abundant water power, as compared with the scarcity of good coal; heavy grades, on which the motors of the electric locomotives act as generators and thus save energy and brakeshoes; greatly lessened maintenance cost of equipment and reduced yard expenses.

All of these advantages have been reduced to a cash basis, for which figures are presented in a statement just made public. An abstract is published on another page. While the figures may not prove the wisdom of the construction of the line itself and the expansion of the Milwaukee into a transcontinental line, they show that in the circumstances, even on items that can be measured in dollars and cents, the conversion of the line to electric power was justified. In addition, of course, electrification has made riding more enjoyable, a good merchandising point for passenger traffic, and greatly reduced the danger that the railway might cause forest fires, a very important argument, especially in the State of Washington, where there is a great deal of valuable standing timber.

These and other incidental advantages are not enumerated in the article already referred to, but even without them the saving effected by electricity during the 9 years since the first division was put in service amounts to more than $12,000,000, after full allowance had been made for depreciation and interest charges on investment. As a whole, the figures are the most nearly complete of any made public giving the results from electrical operation on an electrically equipped steam railroad. May the example of the directors of the Chicago, Milwaukee & St. Paul Railway in giving out these detailed data encourage those of other electrified steam railroads to do likewise.

Maintaining Car Springs in Twin Cities

Proper Maintenance of Springs Is Considered to Be an Important Item in Improving the Riding Quality of Cars, Keeping Down Step Heights and Reducing Noise and General Wear and Tear on Equipment—Special Machine Equipment Results in Better Springs and Lower Cost

The Spring Department in the Twin City Shops Is Arranged to Reduce Handling

The leaves are first heated in the oil furnace, *A*, and after forming and quenching in the adjustable forming machine, *B*, they are tempered in the end of the furnace at *C*. Spring bands are made in the machine at *D* and are put on in the machine shown at *E*. In the background at *F* is the rolling machine for tapering the ends of the spring leaves.

THE maintenance of car springs is considered of so much importance by the Twin City Rapid Transit Company, Minneapolis, Minn., that special equipment and machines have been developed in the company's Snelling Avenue shops for the work. In this way the costs have been held down to a point which makes it possible to replace springs on cars at the first indication of weakness. This renders it unnecessary to keep in service springs that have sagged, as is done sometimes by the expedient of inserting wooden blocks to maintain clearance between the car body and the apparatus underneath. Provision of proper facilities for the economical repair of defective springs eliminates the necessity of economizing in this particular way and thereby results in steps being maintained at the correct height, while the noise and general wear and tear on the equipment resulting from imperfect springs are reduced.

One Man Handles Each Operation

Much of the machine equipment used for spring work in the Twin City shop has been developed to meet the specific requirements of an operating company's maintenance shop, and the methods in use enable comparatively small lots of springs to be put through at reasonable cost. All of this equipment is located in one section of the forge shop and is arranged with a view toward efficient use of a minimum number of men. One of the features of this arrangement is that practically every step in the work is carried out as a one-man operation.

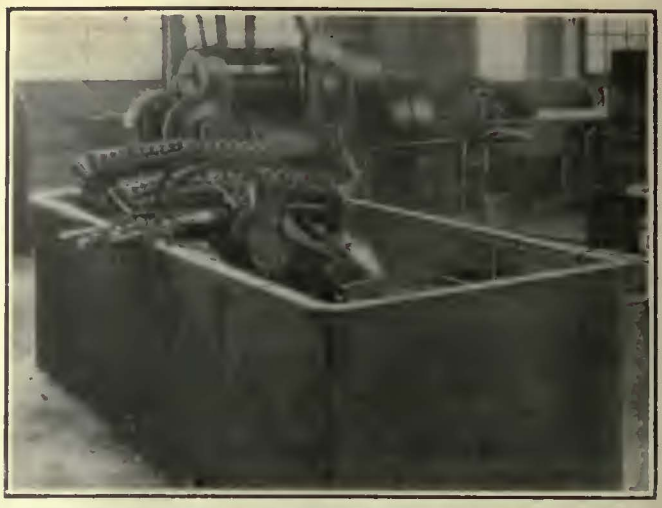
Spring steel is purchased in bars of the proper dimensions for making the leaves of elliptic springs. Physical and chemical specifications assure a high grade of material. The first step in the shop process is to shear this material to the correct length. The cut pieces are next taken to a power-driven rolling machine, shown in an accompanying illustration, where the ends are tapered. They are then trimmed to exact length.

After being trimmed the leaves are ready to be formed to the proper shape for the finished springs. They are heated to 1,550 deg. F. in an oil furnace, described later, and are formed and quenched automatically in a machine shown in an accompanying illustration. This combined forming and quenching machine, which was developed in the company's shop, is designed so that it can be adjusted to form any shape of spring used on the various cars in service. The die is made up of a series of slotted dogs, each of

which is held in place by bolts. To form a leaf of any given shape, it is only necessary to set the dogs against a standard template made for the purpose, which is shaped for that particular leaf. Then the various bolts are tightened and the die is ready for use.

A die of this type is mounted on each end of a tilting table, which is supported in the oil tank shown in the illustration. An air cylinder in the center has a piston at each end, so that manipulation of the air valve causes the movable part of the die to be pushed out, first on one end of the table and then on the other end. The whole apparatus is so balanced on a central pivot that the change in the distribution of weight, caused by change in the position of the piston and dies as one is pushed out and the other pulled back, causes the table to tilt first to one side and then to the other. Tilting of the table submerges the die with the hot spring leaf at one end and raises the one at the other end.

In practice, two different leaves are put through simultaneously, one man handling the entire operation, including the heating. The die at one end of the table is set to form one of the leaves of a spring and that at the other end is set to form another. The proper material for these two leaves is prepared and a number of each type are put in the oil furnace. The two dies are then used alternately to run through the two lots of spring leaves. The capacity of the machine is fixed only by the time required for the steel to cool in the oil. While this is taking place, after each leaf is immersed, the single operator has time to attend to the pieces of material heating in the furnace. As the piston is moved out, first toward one end and then toward the other end of the table, the leaf in the end that is raised out of the oil is released. It is readily removed from the die and set on a dripping screen to drain, preparatory to the next operation.



A Close-Up View of the Forming and Quenching Machine

This shows the adjustable dies for forming the leaves to proper shape. The tilting table carries a similar die at the opposite end, which is immersed in the oil; as the operating piston moves first to one side and then the other, the two dies are alternately dipped in the oil. Two different spring leaves are run through alternately by a single workman.

All Springs Are Tested to Uniform Specifications in This Standard Spring Testing Machine

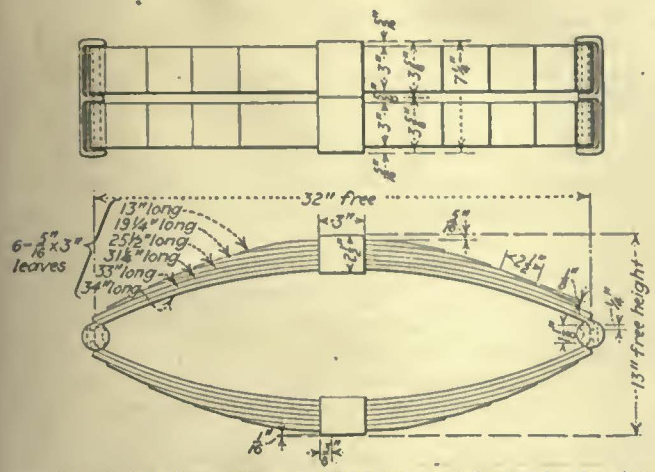
LEAVES HEATED AND TEMPERED IN ONE FURNACE

After forming, the leaves are ready for tempering. This is done in another compartment of the same furnace in which they are originally heated for forming. The furnace is shown in an accompanying illustration. It is rectangular in shape and is so arranged that the doors at the front open into a compartment which is heated to about 1,550 deg. F. for the forming and hardening operation. These doors are convenient to the forming machine just described. The general arrangement is shown in the illustration. In the end of the same furnace another pair of doors open into a tempering compartment, to which the heat from the one burner is deflected, the temperature being adjusted by means of a regulating damper. In this way a saving in fuel is made, as the one burner serves two heating operations at widely different temperatures.

The tempering end of the furnace is divided into two sections, each fitted with individual doors. Thus the material in one compartment may be allowed to soak at the proper temperature while spring leaves are being withdrawn from the other. The tempering compartments are loaded in two layers, on gratings provided to increase the capacity. This furnace was furnished by the Mahr Manufacturing Company of Minneapolis and was specially designed to meet the requirements of this spring work. A suitable stack outlet for the tempering compartment draws off any gases that form and keeps them out of the shop.

When the formed spring leaves have been reheated to the proper temperature they are withdrawn by a workman who handles this end of the furnace and are individually fitted together while hot. They are then allowed to air cool.

Spring bands are forged in a commercial type of machine which is on the market for the purpose and



Complete Detailed Drawings for Each Type of Spring in Use Are Furnished to Shop Foremen for Their Guidance

WORKING LOADS

Deflection	Loaded Height	Load in Lb.	Car Load
2½ in.	10½ in.	4,000	Empty
3 in.	10 in.	5,000	Seated
4 in.	9 in.	7,200	Standing

which is shown in one of the accompanying illustrations. These bands are then placed on the springs, in a special machine designed and built in the shop. This is also shown in an illustration. It is designed so that the spring leaves are held together in a clamp mounted near one end of a light structural frame which forms the bed of the machine. At the other end is an air cylinder carrying a clevis that slides in a slot between two horizontal angle members. A pivoted shoe on the clevis is arranged to force the band into place over the spring leaves when air is admitted to the cylinder.

In practice, new material is added to elliptic springs only as required. Any of the old leaves that are not too badly corroded are retempered and used again. Thus the amount of new steel required is held to a minimum consistent with putting the springs in proper condition for service.

Testing the Springs

All guesswork has been eliminated in this work by the installation of a modern spring testing machine. From the standpoint of securing satisfactory and uniform results, this testing work is considered second in importance only to the tempering of the material. It is considered to be impossible to determine just what results are being accomplished unless proper facilities for testing are available.

Shop foremen are furnished with detailed drawings showing the exact dimensions of each type of spring in use. In addition, specific test data showing the working loads and allowable deflections for the different springs on various cars have been worked up and are furnished in convenient data sheet form to those in charge of the repair and testing of springs.

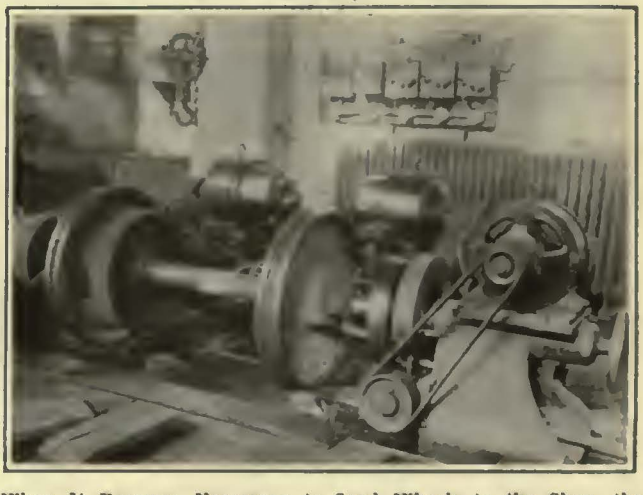
All springs going through the shop are tested for deflection under working load. A loaded height of ⅛ in. more than that specified is permitted, but a variation below the specified height is not allowed. Free height is determined after the maximum working load has been once applied and fully released. After this the permanent set is determined by again applying maximum working load and then completely releasing the spring a second time. The difference between the height after this second load is released and the original free height indicates the permanent set. This is not allowed to exceed 1/32 in. If, however, there is any permanent set (not exceeding 1/32 in.) the spring is again fully loaded and released twice, and must thereupon show no increase in the amount of permanent set.

Wheel Maintenance Practice in Denver

Pit Grinders Used for Truing Up Rolled Steel Wheels When Any Evidence of Wear Develops—Automatic Welder Builds Up Sharp Flanges

THE Denver Tramway has had considerable success in the use of automatic welding and grinding equipment in the maintenance of rolled steel wheels. The objective has been to minimize the amount of turning required so that as much as possible of the available metal of tread and flange will be actually useful in service, with resulting increased mileage for these wheels.

When this property adopted rolled steel wheels, the carhouses were equipped with pit-type wheel grinders installed for the maintenance of cast-iron wheels. Very favorable results have been obtained from these same grinders in maintaining rolled steel wheels. The practice is to true up wheels showing any evidence of worn flanges by running the car over the grinder and taking care of the situation before the wheels reach such a condition that they must be brought into the shop for turning. As a result, comparatively few wheels are turned, and this usually occurs only when it is necessary to match sizes of second-hand wheels for mounting them on a new axle. Besides the increased wheel mileage obtained by a reduction in the amount of turning, there is a substantial labor saving as a result of not



When It Becomes Necessary to Send Wheels to the Shop, the Flanges and Treads Are Trued Up on the Grinder

having to take the wheels out from under the cars several times during their life.

Most of the carhouse grinding work is done when the cars are in the house during the non-rush hours. The average time per pair of wheels is about three-quarters of an hour. This figure is taken from the average for a month on four divisions, and includes the time of shifting cars, jacking and preparation for grinding, as

well as the actual time involved in truing up the wheel. The object of the pit grinding being to catch the wheel as soon as it shows any evidence of wearing a sharp flange and to true up the flange and tread before the condition becomes so serious as to require the wheel to be taken out, the wheels are largely worn out in service and the average mileage obtained has been materially increased. At the present time, the average mileage for 31-in. nominal diameter wheels with 3-in. treads is approximately 125,000 miles per wheel.

The practice of grinding wheels at the carhouses has reduced considerably the amount of work done at the shop. At present one man in the shop, working only part time, performs all the wheel work which is done, and which formerly required two men working long hours in shifts. No wheel-turning lathe is considered necessary, and what little wheel turning is required is done on a large engine lathe that has been fitted up for this purpose.

A small proportion of the wheels develop sharp flanges when allowed to go too long without grinding at the carhouses. When this occurs these wheels are brought into the shop for welding and grinding. A General Electric automatic welding outfit, with single head, is used. The welding equipment and control panels were purchased from the manufacturer and the driving lathe was built in the company's shop. The lathe is equipped with individual motor drive and external gear speed control gears so as to rotate the wheels at proper speed for welding. The welding head is carried on a specially designed carriage which may be moved laterally on the bed of the machine and also has a screw adjustment for setting the head at the correct height.

This welding work is done in a compartment partitioned off from the remainder of the shop with corrugated sheet steel. An opening in the partition back of the welder allows the wheels to be moved readily in and out of the machine. This is closed by a large canvas curtain mounted on an overhead roller so that it may be raised and lowered readily. The general arrangement is shown in an accompanying illustration.

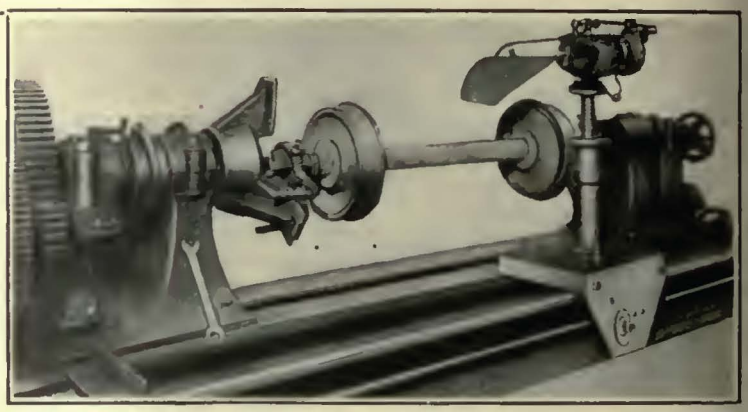
Welding Time Varies with Condition of Wheel

The time of welding varies with the condition of the wheel. Usually it has been found necessary to weld only one flange of a pair of wheels. An average thin flange on a 31-in. wheel is welded with the single head machine in about 2½ hours. The welding material is laid on with a current of about 225 amp. and with the wheel rotating at a peripheral speed of about 7 in. per minute. The wheels are cleaned in advance with a steel brush. No material is turned off the wheel and the welding material is applied with the flange just as it comes in to the shop. No difficulty from chipping of flanges has been experienced after welding. Before the installation of this outfit the welding was done by hand. In that case some difficulty from chipping occurred. No attempt is made to weld the tread.

After welding, the wheels are set up in the shop grinder shown in an accompanying illustration. This is a number 0 machine made by the Springfield Manufacturing Company, Bridgeport, Conn., and has been found entirely satisfactory for this work. The time of grinding varies with the condition of the flange and tread. Usually, only one flange of a pair of wheels is welded, and then both flanges are ground and the tread trued up if necessary. The time of grinding in the shop varies from one-half hour to one hour per pair of wheels, and the work is done by one man, working only part time. An accompanying illustration shows the condition of a welded flange just after metal is applied and before grinding.

At Right, the Single Head Wheel-Welding Machine

This is made up from an old lathe bed with the automatic welding head mounted on an adjustable carrier. A canvas curtain mounted on an overhead roller covers the openings in the partition back of the welder, which permits wheels to be moved readily in and out of the machine.



Below, Miscellaneous Hand-Welding Work Is Done in the Welding Room, in Which the Automatic Machine Is Located

Condition of a Welded Flange Before Grinding

Specialized Inspection Reduces Pull-Ins on Kansas City Railways

Designation of Certain Trained Men to Do Inspection Work Exclusively Has Resulted in Eliminating Many Street Failures—Cars Are Inspected Both Before and After the Work Is Done and Each Man Is Held Responsible for the Group of Cars Assigned to Him—Graphic Records Help to Check Performance

ADOPTION of what might be called specialized inspection methods by the Kansas City Railways has had a material effect in producing a simultaneous reduction in both maintenance costs and pull-ins chargeable to mechanical defects. This specialized inspection consists in so subdividing and standardizing the work that it can be carried out by specially trained men who have become highly expert inspectors and go over each car in accordance with carefully planned routine methods. This practice, together with that of working toward standard maintenance methods in the various carhouses and in the shops, the use of high-grade materials and a spirit of frank co-operation between the shop and the inspection carhouses have all contributed materially toward the favorable results accomplished.

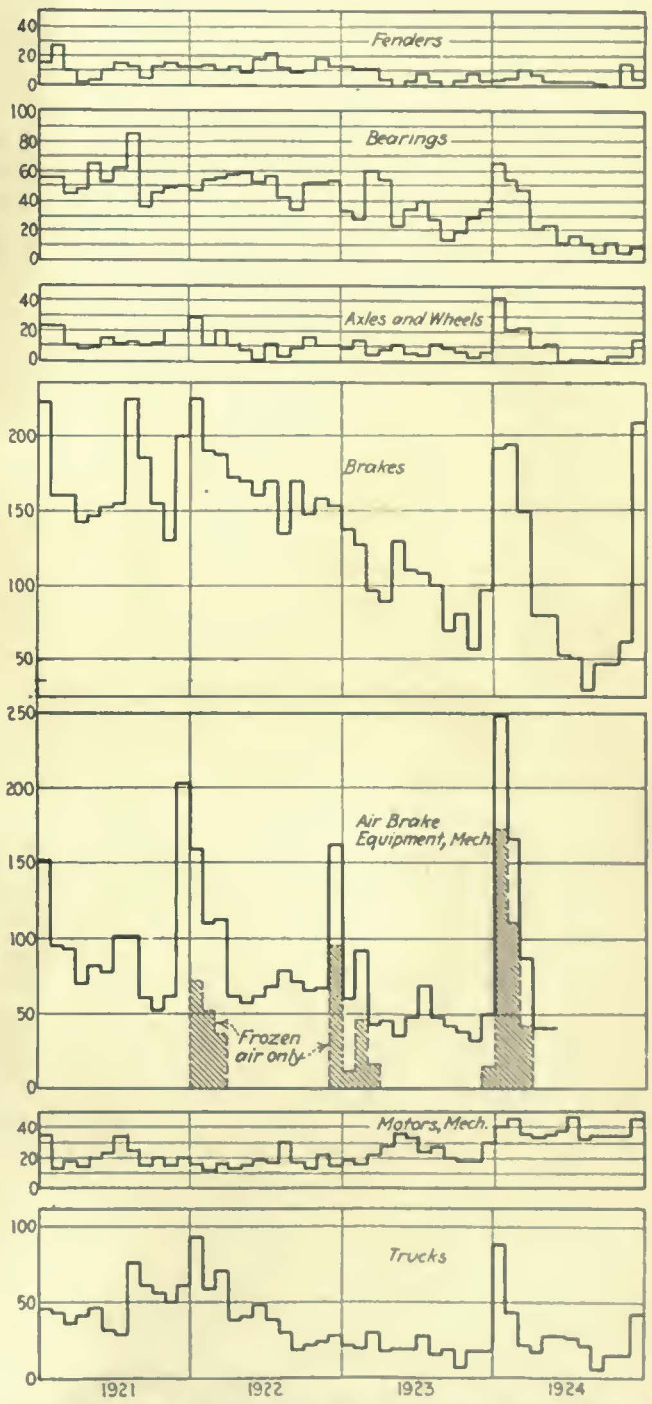
Foremen Have Regular Meetings

Foremen's meetings held on a regular schedule, in which a spirit of democracy is carefully cultivated, are considered to be no small part of the general scheme. Care is taken to avoid giving them the atmosphere of a series of lectures from the superintendent of the department. The men are encouraged to take part actively in frank discussion of any maintenance or operating difficulty that develops in the various carhouses and a particular effort is made to encourage the discussion of methods of improving the practices of the department.

Along with these meetings, a general open-door policy is maintained in the superintendent's office. Each foreman is encouraged to take a general interest in department activities. New policies and practices are freely discussed both in individual conferences and in the foremen's meetings. Full records of maintenance costs are made available to the foremen so that each may not only check up his own performance in comparison with the other men but may also be familiar with the results accomplished by the department as a whole. New ideas are checked up in advance by being discussed in the foremen's meetings. In this way the benefit of the experience of the men in actual contact with the maintenance work is obtained. If the new method is to be adopted, the co-operation of all the men is assured by making them entirely familiar with all of the factors connected with the adoption of the change in practice and the procedure to be followed.

Complete Motors Changed at Carhouses

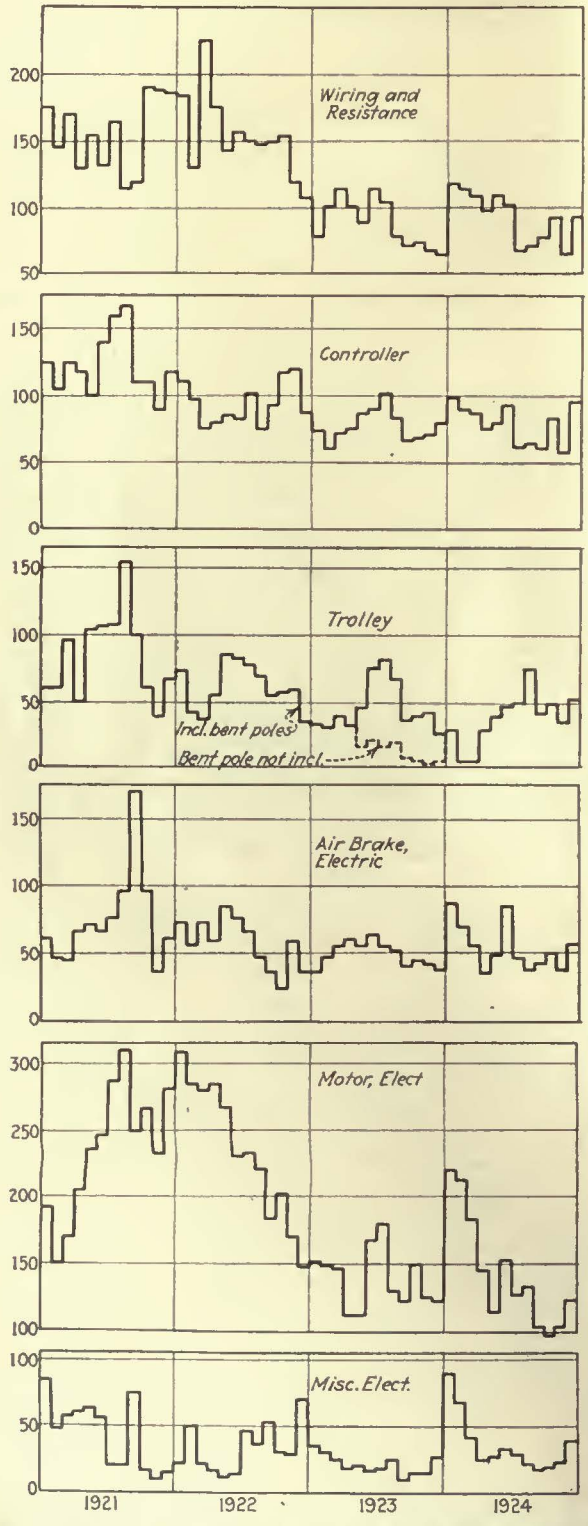
At one time cars were brought to the shop for making wheel and armature changes. Subsequently it was found that this work could be carried out more economically by changing the wheels at the carhouses and by making replacements of complete motors when any



Defects Found on Air Brake Apparatus and Motors Are Divided Into Both Electrical and Mechanical Groups. Some of the Other Principal Subdivisions of Mechanical Defects Are Shown by These Curves. Unusually Severe Weather Encountered in January, 1924, Is Reflected in the Sudden Rise for that Month

parts such as armatures, fields, bearings or pinions required repair or replacement. It was decided that the practice of changing armatures at the carhouses does not properly safeguard the condition of the fields and the fit of the end housing in the frame. It also creates a hazard through rough handling of armatures or bearings when they are shipped back and forth between carhouse and armature room.

It was found perfectly feasible and economical to ship the complete motors back and forth between shop and carhouses. Thus all motor work is concentrated in a group of specialists in the shop. A proper condition of fields is assured each time an armature is changed. Then, too, the practice gives a shop check of the axle bearing wear, and in a number of other ways helps to maintain the motor in the best possible condition. As each motor is brought into the shop the leads, fields and brush holders are inspected by shop experts. The fit of the end housing in the motor frame is carefully checked from time to time. Another result which has accompanied the practice of bringing all motors into the shop has been the elimination of shims of one kind and another, toward the use of which there is always a tendency when part of the motor maintenance is carried out in the carhouses, where insufficient tool equipment is available to enable worn surfaces to be properly built up and remachined.



Graphic Records Facilitate Analysis of Causes of Car Failures. Class A Pull-Ins Include Only Those for Which Mechanical Department Is Responsible. Subdivision of Electrical Defects Is Shown in the Above Curves

Less Work by Changing Complete Motors

After the adoption of the practice of sending complete motors to the shop, it was found that there is really less carhouse work involved in changing complete motors than in removing and replacing armatures, pinions and bearings at the carhouses. When the change in procedure was made the general overhaul period for cars was reduced to 50,000 miles in order to put the cars into the best possible condition by eliminating considerable deferred maintenance. As the cars were put in better condition the general overhaul period was gradually extended until it is now on an 80,000-mile basis. At these general overhauls the trucks as well as the car bodies are also completely gone over and put in first-class condition.

An important part of the general scheme for reducing pull-ins is the carefully worked out system of records which are compiled graphically in such form as to enable an analysis of the causes of pull-ins to be made. These records enable the head of the department to make comparisons of the results obtained by various divisions, and also of the troubles experienced with different types and classes of equipment. Examples of the method of subdividing pull-ins are shown in the accompanying illustrations.

A careful check is made through both the transporation and mechanical departments to make sure that car defects are properly reported. These reports are the basis for the pull-in records. In each operating carhouse is a division log book in which each trainman going off duty is expected to record any defects that come to his attention while operating the car for which he signs off. The trainmen also report these defects to the carhouse hostler or car shifter when the cars are brought in from service. The hostler makes out a ticket report in duplicate, one copy of which goes to the carhouse repair foreman and the other to the transportation department division superintendent.

Transportation Department Reports Failures

Transportation irregularities from any cause, including equipment failures, are reported over the transportation dispatching system telephones. These are summarized each day by the chief dispatcher in a daily transportation department statement. Each carhouse repair foreman also compiles a daily pull-in report from the hostler's tickets, indicating the cause reported for the pull-in and the exact condition found by the inspectors. The carhouse foremen also indicate on their reports the classification under which each pull-in should be grouped.

Car No._____

KANSAS CITY RAILWAYS COMPANY

CAR RECORD CARD

Type _____ Weight _____ Type Motors _____ H. P. Motors _____ Trucks _____ Date Purch. _____

No. 1			No. 2			No. 3			No. 4		
DATES In / Out	Armature Serial No.	Pinion Serial No.	DATES In / Out	Armature Serial No.	Pinion Serial No.	DATES In / Out	Armature Serial No.	Pinion Serial No.	DATES In / Out	Armature Serial No.	Pinion Serial No.

DATES In / Out	COMPRESSOR Type	Serial No.	DATES In / Out	AIR MOTOR ARM Type	Serial No.	DATES In / Out	SHOP REPAIRS DESCRIPTION OF WORK DONE

Car No._____

DATES In / Out	AXLE No. 1	GEAR No. 1	WHEEL No. 1R	WHEEL No. 1L	DATES In / Out	AXLE No. 3	GEAR No. 3	WHEEL No. 3R	WHEEL No. 3L	CLASS "A" PULL IN RECORD DATE	NATURE OF FAILURE

DATES In / Out	AXLE No. 2	GEAR No. 2	WHEEL No. 2R	WHEEL No. 2L	DATES In / Out	AXLE No. 4	GEAR No. 4	WHEEL No. 4R	WHEEL No. 4L		

MISCELLANEOUS DATA

ITEM	REMARKS	ITEM	REMARKS
Controller		Motorman's Cab	
Circuit Breaker		Motorman's Railing	
Trolley Stand		Folding Steps	
Fender		Folding Doors	
Head Light		Sliding Doors	
Dest. Signs		Safety Air Valve	
Motorman's Valve		Brake Cylinder	
Air Governor		Braking Ratio	
Slack Adjuster			
Door Signals			
Door Engine			
Dia. Drawbar—Front			
Dia. Drawbar—Rear			

Above—Front Side of Car Record Card Shows Complete History of the Main Items of Equipment on Each Car. At Bottom—Back of Record Card Provides Space for Log Record of Pull-Ins and Shows Up Recurring Defects on Individual Cars

Copies of both the carhouse repair foreman's report and the transportation dispatcher's report are forwarded daily to the mechanical department office, where any discrepancies that may have occurred can be checked by a comparison.

As these pull-in records are received from day to day, the mechanical department office makes up a daily summary, classifying them into three main groups. The first, comprising what are known as Class A pull-ins, includes those attributable directly to failure of some part of the apparatus or equipment on the car. The second group, known as Class B pull-ins, includes cars pulled in for the same causes as those in Class A, but which are found O.K. when inspected. Cars pulled in for any other causes, in which the mechanical department is not directly responsible, such as damage from collisions, derailments, etc., are grouped into Class C. Any car which is taken out of service, because of defects of any kind, before completing its regularly scheduled service is classed in one or the other groups of pull-ins.

Each carhouse repair foreman carefully analyzes each case of pull-in and posts a record on the carhouse bulletin board indicating not only the results found by the inspection but also the man who was responsible for work on the defective car.

Most of the inspection work is done during the day. The inspectors report the conditions found, but do not actually make repairs themselves. This practice is followed in order to make the men more critical than would be the case if they made the repairs themselves. As a result of this specialization of the inspection work, the number of men required properly to supervise the condition of the cars has been reduced approximately 10 per cent. Each man thoroughly inspects approximately seven cars per day.

Two general inspectors report to the supervisor of the division mechanical forces in addition to the in-

dividual carhouse foremen. These general inspectors have direct supervision of the inspectors in the various carhouses. This arrangement gives the individual foremen full charge of the labor forces in the carhouses, as well as the work which is carried on, but the inspectors do not report to these foremen for orders. The inspection forces are kept separate from the maintenance forces, but the work of both is co-ordinated through the supervisor of the division mechanical forces.

Card Records Made from Pull-In Summary

A copy of the summary of pull-ins, made up in the equipment department office, goes to each chief inspector. He checks over the cases which involve equipment in his charge, and thereby supervises the work of the

Form 602—10m—

DIVISION CAR INSPECTION

Car No.............. Date .... Division.................. Inspector..................

Trucks

Frame.................. Side and Center Bearings..................
Wheels .... Axles ....
Brakeheads .... Shoes ....
Journals .... Splitcollars ....
Brake Rigging..................
Turnbuckles or Slack Adjusters..................
Hand Brakes..................

Motors

Armature Clearance..................
Commutators and Stringbands..................
Bearings .... Pinions ....
Brushes .... Gear Cases..................
Gears .... Brush Holders..................

Air Equipment

Compressor .... Brake Cylinder..................
Motorman's Valve .... Governor ....
Safety Valve.................. Door Engines..................
Piping .... Reservoirs ....

Car Wiring

Motor Leads.................. Compressor Wiring ....
Heaters .... Lighting.................. Switches ....
Battery .... Relay.................. Buzzer ....
Controller .... Automatic.................. Fuse Box..................
Resistance .... Lightning Arrestor..................
Trolley ....

Car Body

Register .... Glass.................. Seats ....
Floors .... Curtains.................. Signs ....
Fender .... Paint.................. Roofs ....
Grab Handles.................. Stanchions ....
Doors ....
Steps ....
Remarks ....

All Items Marked O. K. Have Been Repaired. Foreman ....

Date..................

Inspection Form Must Be Signed by Repair Foreman Before Car Is Released for Service. Each Car Is Inspected Both Before and After Repair

individual inspectors. Another copy of this report goes to the record room of the mechanical department for tabulation on the individual car card record, shown in an accompanying illustration. The records thus indicate any recurring defects on individual cars and give a ready check of the performance of individual inspectors assigned to those cars. Outstanding cases of repeated trouble, either on individual cars or on certain classes of equipment, are handled by memoranda sent out from the office to the carhouses, or are taken up for discussion in the carhouse foremen's meetings.

Steel Vestibule Window Posts Allow Broader Outlook

IN THE design of the latest light-weight one-man, two-man surface cars bought by the Boston Elevated Railway an innovation suggested by the legal department of the company has been incorporated. In order to give the least possible interference to the outlook of the motorman the vestibule window posts are narrow sections of pressed steel. All vestibule window sash is of metal, so that between the belt rail and the roof

Narrow Window Posts and Metal Sash Have Increased the Vestibule Window Area on This Car

the end of the car is nearly all glass. This modification is expected to reduce materially the number of accidents. The appearance of the end of the car is shown in the accompanying illustration. In other respects these cars are the same as the light-weight one-man, two-man cars which have been in service on the Boston Elevated for several years past.

Emergency Equipment in Street Boxes

WRECKING and emergency equipment for use in the event of a car derailment or minor accident is provided by the City Railway in a number of substantial locked boxes located at various points in the business district of Dayton, Ohio. This equipment includes rerailing shoes, a heavy chain and a heavy-duty jack. A similar practice in New Bedford was described in this paper Jan. 17.

The boxes are kept locked to prevent tampering or theft but in addition to providing keys for authorized railway employees, keys to these boxes are also furnished to traffic officers on duty near the points where the emergency boxes are located. Consequently in the event of a disabled wagon, derailment or other accident that would cause delay in car schedules, emergency equipment is made available at the earliest possible moment, and bad delays are frequently avoided.

Old Rail Used for Ties in Bangor

Rigid Reinforced Concrete Track and Paving Construction Is Employed—Wood Ties Are Alternated with Steel Ties, Which Are Welded to the Base of the Running Rail—Joints Are Thermit Welded

By E. W. Jennison
Engineer Maintenance of Way Bangor Railway & Electric Company

A TYPE of track construction in which old 60-lb. T-rail was used for ties has been quite extensively employed by the Bangor Railway and Electric Company. Placement of concrete in a single course between the ties and up to the head of the rail produced a rigidly reinforced structure.

Removal of Old Track

The old structure consisted of light T-rail, ranging in weight from 58 to 70 lb. per yard, laid on cedar or hemlock ties, spaced 20 in. center to center. Little or no ballast was used under the ties. The space between the ties and up to the top of the rails was filled with bank-run gravel or crushed-stone macadam without any binding material on the wearing surface. The rail was fastened to the ties with 5½-in.x⅞-in. drive spikes and the joints were of the four-bolt Weber type.

No traffic was maintained on the track under construction, even while the excavating was going on. In the case of double track, traffic was routed to the second track with Lorain Steel Company's portable crossovers built of 60-lb. stringer type of rail. In the case of single track, provided the rail itself was not to be changed, a temporary track was built alongside. If new rail was to be installed the old track was pulled to one side by a 5-ton Holt tractor and used as a temporary track.

A Russell special scarifier drawn by the 5-ton Holt tractor was first run over the track two or three times, with the teeth of the scarifier set low enough just to clear the tie tops. When a rail was straddled one tooth was removed from the scarifier. This loosened all material above the ties. Next, pockets were dug under the rails and the track jacked up, after which it was either pulled one side for temporary track or taken apart. This left the ground clear for completing the excavation under the most favorable conditions, which was done by loosening the material with a construction plow, tractor drawn, after which it was shoveled by hand onto flat cars and distributed on the shoulders of suburban lines. Excavating was to a depth of 15 in. below grade.

Joints Welded and Track Ready for Concrete

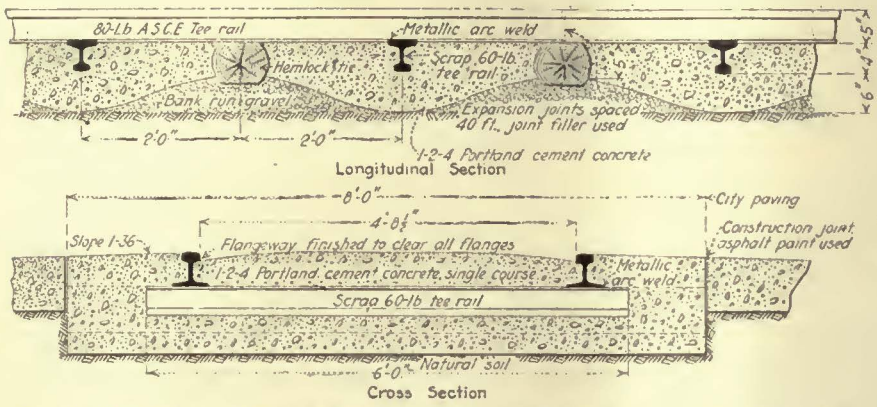
In nearly all cases there was no preparation of the subgrade except to level it off, the track slab resting on the natural soil, except that bank-run gravel to the depth of 4 in. was placed under the ties for use in tamping. Where seepage conditions appeared in the subgrade, trenches were dug below the froat line. The trenches were filled with rocks and tile pipe was then installed to drain to the sewer. The sub-

Track Slab Finished—Note Temporary Track

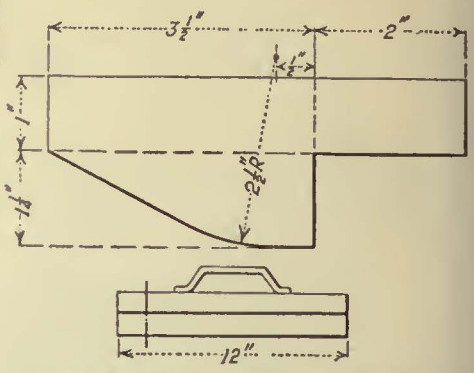
Appearance of Finished Concrete Pavement

grade was not rolled, as the natural soil was already very thoroughly compacted.

Native hewn hemlock ties were laid out on the subgrade on 4-ft. centers. Between these were placed 6-ft. lengths of 60-lb. scrap T-rail to serve as cross-reinforcing members for the paving, the running rails serving as longitudinal reinforcing. The running rails were next laid and fastened with 5½-in.x⅞-in. drive spikes to the ties. Joints were made up temporarily with angle splice bars, using only one bolt. At this time the steel inserts used in thermit welding were placed between rail heads. Then the track was surfaced in the usual manner by hand tamping with shovels, using the gravel placed under the ties, and lined, after which thermit welds were made.



Longitudinal View and Cross-Section of Track Construction Using Old Rail for Ties

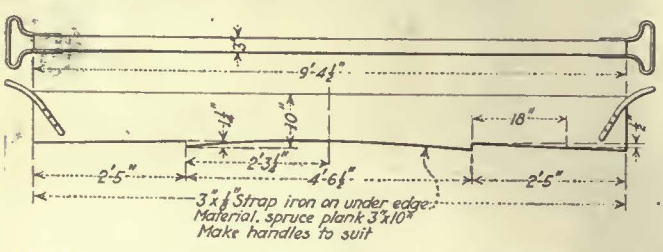


Flangeway Template for Concrete Paving

Cross-reinforcing members were lifted into place under the rail by means of small tongs and a chain on one end of a long lever. One man held the member in place while the welder spot welded it to the rail. The entire stretch of track under construction was covered in this manner and later the welder returned alone and finished the welding. This was done by the metallic arc process, using a Rail Welding & Bonding Company type B B dynamotor with ⅜-in. grade 30 steel rod. It required ½ lb. of steel rod per cross-reinforcing member. These cross-members take care of cross-bonding in a very thorough manner. After welding and just previous to pouring the paving the track was given a final surfacing and lining.

Concrete Is Poured in a Single Course and Hand Tamped

Actual paving was done by a city crew and mixer, although the railway paid the cost. This consisted of actual labor and material charges plus a rental of $20 a day for the mixer. Concrete was mixed 1-2-4 and was laid in a single course. Particular care was taken to have the mix dry enough and to have it thoroughly tamped under the rails and cross-members. Tamping under the rail was done by hand, using ordinary rail-way tamping bars, while the paving surface was tamped with a plank of the shape shown in the accompanying sketch. Final finishing of the surface was done by hand floats and the template shown was used as a guide in finishing the flangeway. Care was exercised that neither new nor worn flanges could hit the concrete. If this happens the finished surface of the paving is damaged and rapid disintegration caused by vehicular traffic will take place in the flangeway. After its initial set calcium chloride was spread on the pavement surface to hasten the final set of the concrete. After 10 days the track was opened to electric car traffic.



Concrete Tamper Used by Bangor Railway & Electric Company

Welds Ground Without Lifting Wheel

Grinding the welds is one of the most important steps in track construction where the thermit process is used, because if it is not properly done a cup may develop. The joints when welded were given a slight crown. When the paving had been poured 2 days the grinding of the welds was started. The running surface was ground with a Universal rotary track grinder and the gage side with a type M-8 flexible shaft grinder, both made by the Railway Track Work Company. The guides of the Universal were not warped. This, together with the joint crowning, allowed a perfectly flat cut, running off to nothing, to be made without lifting the grinding wheel. Particular care was taken on the first cut to hit only the high spot at the insert and at no time to force the grinding in the least. It was found that forced grinding left a high spot on the finished surface at the insert, which in a very few months showed bright and later caused a slight cup beyond.

A little more than 2,000 ft. of single track area 8 ft. wide, as shown in the accompanying drawing, was constructed during the 1924 season, in three separate locations, at a total net cost of from $5.97 to $6.68 per foot of single track. In the case of the low figure the rail was not renewed, the battered ends being cut off with an oxyacetylene torch. It is interesting to note that in this case the thermit welds consumed 12 per cent of the total net cost, whereas in the case of new rail the percentage was 6 and 7. The cost of the thermit welds was $9.95 each with old rail as against $6.70 with new rail. The largest of these three jobs contained only 51 welds, and it is reasonable to suppose that on larger jobs the cost per joint could be lowered. The paving cost ranged from $2.18 to $2.83 per square yard, which is approximately equivalent to a figure of $7 to $9 per cubic yard. Total labor charges were from $1.64 to $2.21 per foot of single track. Common labor was obtained at a cost of $3.50 per 9-hour day.

Jigs Expedite Multiple Drilling

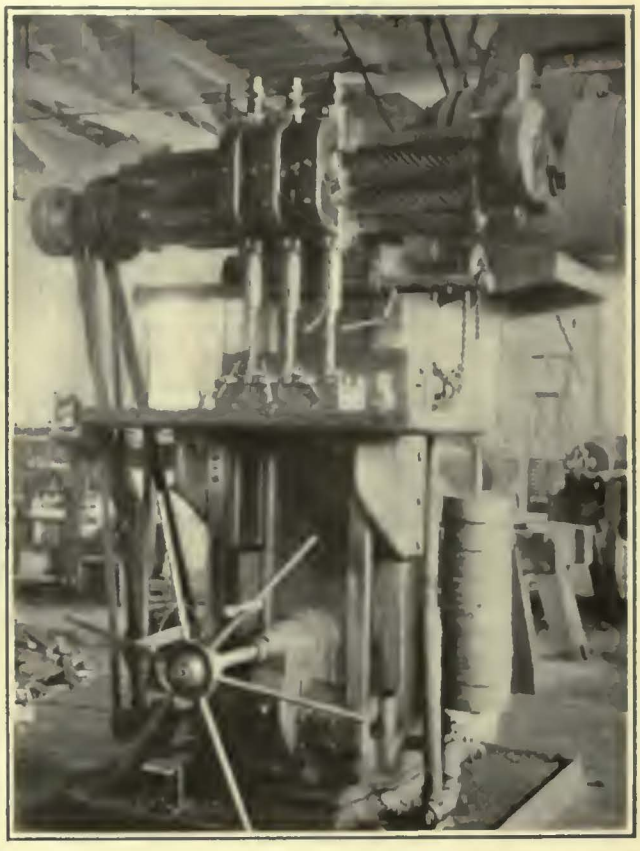
Variety of Operations Performed on Three-Spindle Drill in Columbus Railway Shop by Use of Proper Jigs

HOLES in brake levers, adjusting nuts and other similar parts are drilled three at a time in the repair shop of the Columbus Railway, Power & Light Company. The machine used, a Moline "Hole Hog," has proved particularly useful due to the jigs that have been designed and made in the shop for it.

The machine has three spindles mounted on a stationary crosshead. The table may be raised or lowered approximately 30 in. by hand or by power to feed the work to the drills. The spindle heads may be moved laterally the width of the table, which is approximately 30 in. Due to the width of the spindle head, the minimum center-to-center distance between adjacent drills is 5 in. The machine has a separate motor drive and a capacity of three 1¼-in. drills in 0.050 carbon steel.

The three holes in brake cylinder levers and in truck brake levers are drilled at one operation. As used on this property, air-brake cylinder live levers are approximately 18 in. long and are made of 1-in. x 3½-in. steel. Two end holes in these levers are 1$\frac{7}{16}$ in. diameter, while the center hole is 1$\frac{3}{8}$ in diameter. The jig made for use on this job has a base of 1-in. x 3½-in. steel, mounted on three legs, one at each end and the third at the center of the base. The jig guide plate is mounted approximately 1 in. above the base, this being sufficient to allow the insertion of a brake cylinder lever blank. Two stops at the back and a pair of clamps at the front hold the lever in the proper position. These front clamps swing down out of position to allow the blank to be inserted and removed.

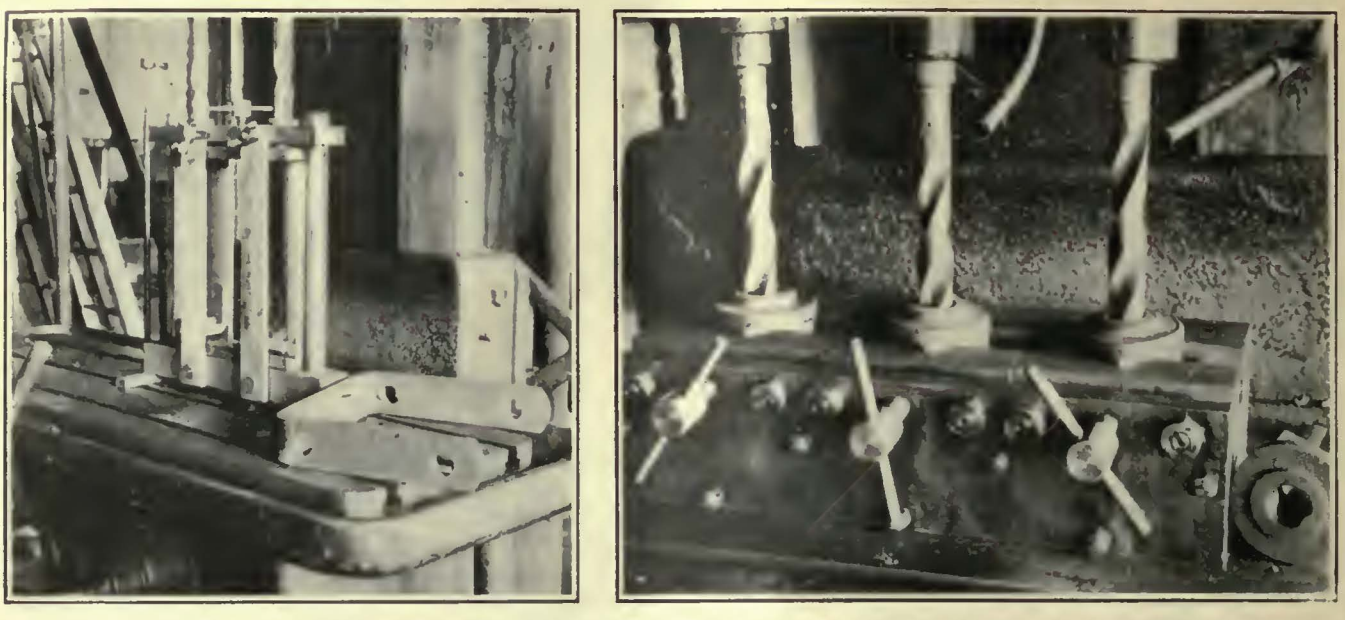
A different type of jig is used when drilling the three holes in a brake lever for a Brill No. 22 truck, in which two of the holes are located less than 5 in. apart. Consequently, it was necessary to make a special jig for drilling simultaneously two holes in one lever and the third in another lever, in order to work the machine at full capacity. This resulted in a jig of right-angle construction. The main portion, containing the bushed guides for two holes in the lever, is identical in construction with the jig used for drilling the air brake cylinder lever. However, at one end is a right-angle extension, which holds a second lever in a box-like holder. Two removable pins fit into the two holes drilled in the blank in the first position, thereby aligning it for the third hole. Thus after two holes have been drilled in the first blank of a given lot, it is possible to drill three holes at a time, one being drilled in the first lever while two holes are being drilled in another piece.



Various Drilling Operations Are Performed on This Moline "Hole Hog," for Which Numerous Jigs and Fixtures Have Been Made. It Is a Three-Spindle Drilling Machine with Individual Motor Drive

This jig is made up of a 1-in. steel base supported on four legs. The top guide plate, stops and clamps are similar in design and construction to those on the jig for air-brake cylinder levers. The main part of the jig is provided with an adjusting set screw for aligning the blank for the first two holes. This is shown in an

At Left, Simple Jig Holds Air Brake Cylinder Lever While Three Holes Are Drilled Simultaneously. At Right, Where the Holes Are Closer than the Minimum Spacing of Spindle Centers an Angle Jig Allows the Full Machine Capacity to Be Used by Drilling Two Holes in One Lever While the Third Is Being Drilled in Another



At Left, Two Holes Are Drilled in Each Side of Ash Grate Links While They Are Held in This Jig. At Right, Brake Rod Adjusting Nuts Are Drilled Three at a Time in This Simple Fixture

accompanying illustration, which gives an idea of the jig and also of the finished product.

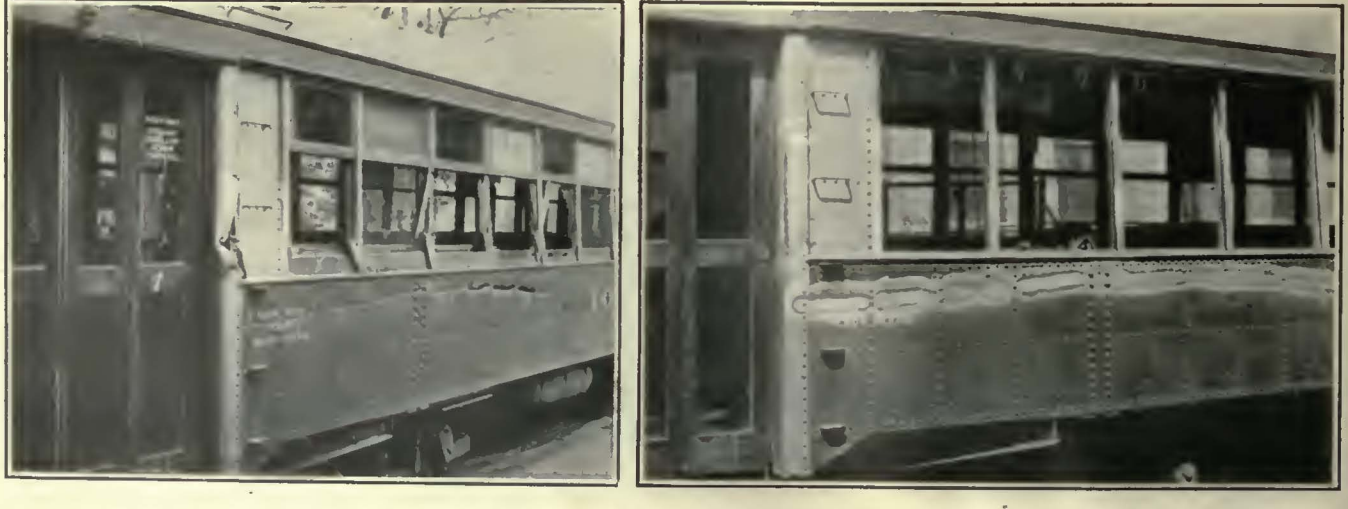
Another handy jig used in conjunction with the same machine is one for drilling grate links for the power house of the company. Although not a railway maintenance or replacement part, reference is made to it because this jig increased the scope of work that can be done with the drilling machine. The base of the jig is of such dimensions as to accommodate one side of the drag link. The top is similar and is mounted so as to allow room for the U-shaped link. On the back of the jig two uprights permanently fastened to the top and bottom members serve as stops for the blank. In front, two similar uprights are fastened so they can be swung out of the way when a link is inserted. Hardened bushings guide the drills which pass through the top member of the jig and also through two angle brackets fastened to the rear supports just above the lower leg of the link. Two long $\frac{13}{16}$-in. drills are used to drill the two holes through both the upper and lower sides of the link.

In addition to such jigs as those described, a variety of fixtures are also used in conjunction with the Moline machine. One of these, which may be taken as representative, is a fixture clamp which holds three brake-rod adjusting nuts for simultaneous drilling. This fixture has its bottom and sides made of 1-in. steel. The back and front of the fixture are held together by $\frac{1}{2}$ in. bolts, which serve as guides for the clamp portions of the fixture, which are moved back and forth by means of small hand screws in the front plate. The clamp jaws are cut out to engage the square shanks of the adjusting nuts. Three $\frac{13}{16}$-in. drills are used simultaneously with this particular fixture and the time of drilling the nuts is about one-half what it was when each nut was drilled separately.

Oxyacetylene Torch Used to Good Advantage in Omaha

IN THE shops of the Omaha & Council Bluffs Street Railway T. E. Wood, master mechanic, has found that careful study of the various types of repair jobs to which the oxyacetylene torch can be applied yields rich returns in reduced maintenance and repair costs.

An example of the large savings that can be made



An Oxyacetylene Torch, in the Hands of a Skilled Operator, Made Possible a Substantial Saving in Cost of Repairing This Damage
At left, the car as it came in after an accident. At right, use of the welder eliminated the necessity of removing the damaged side plate

through the use of the torch in the hands of a properly skilled workman is brought out in the accompanying illustrations. In this case a glancing blow received by a car from a vehicle on the street cut a deep gash in the side girder sheet, tore a piece out of the steel corner post and also damaged the side posts.

Ordinarily, this damage would have called for a major repair job. To replace the side girder sheet it would have been necessary to tear out the interior trim of the car to get at the rivets. Drilling and fitting a new plate would have been far from a simple or inexpensive job. To have attempted to replace the corner post or the damaged side posts would have added increased work, delay and expense.

Skillful welding work accomplished the results shown in the second illustration. Extreme care was required to avoid buckling the thin side sheets under the heat action of the welding torch, but the success with which the job was carried out is clearly shown by the final condition of the plate as shown in the illustration. A similar welding operation on the damaged steel corner post and splices in the damaged side posts transformed what would ordinarily have been a costly job into a comparatively simple and inexpensive repair.

New Cyanide Hardening Process in Chicago Shops

Improved Process Provides for Heating the Cyanide Solution from the Top and Thereby Effects Substantial Economies in Cost and Eliminates All Danger to the Operator

A MATERIAL improvement in the cyanide hardening process in general use has been perfected in the forge shops at the West Shops of the Chicago Surface Lines by Charles Ringstrom, foreman of that department. This improved process not only assures uniformly good results but also effects material economies in cost and amply protects workmen against the dangers of inhaling cyanide fumes.

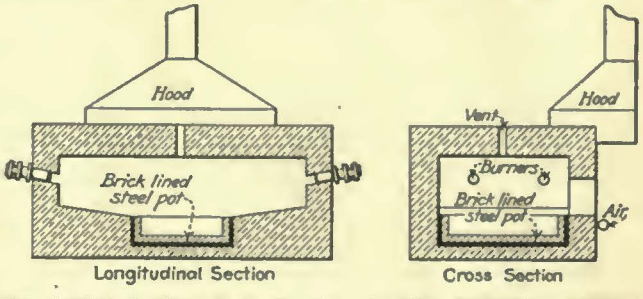
In the steel pot bath method of cyanide hardening, which is used by most steel treaters of the present day, the parts are preheated in a forge or furnace and then submerged in a pot containing the red-hot melted cyanide solution. They are then taken out and quenched in water. Although this method gives a uniform treatment to the part, it does not produce that glass-hard surfacing that cyanide is capable of imparting to steel where the entire process is carried through in one atmosphere and one temperature. Carbon steels case harden best at their critical temperatures, 1,500 deg. to 1,700 deg. F., due to the high affinity of iron for carbon in its second allotropic state. It is not possible to attain safely more than 1,450 deg. F. in a cyanide solution in a bottom-heated steel pot. In the newly developed furnace the cyanide pot is heated from above, and it is this idea that permits a combination of all the ideal conditions for the practical, safe and economical hardening of steel with cyanide base carbonizers.

The new furnace is of the oven type. The brick-lined steel pot is located in the center of the floor, which is laid with a 10-deg. rise from the pot to the side of the oven, as shown in the accompanying illustration. Uniform temperatures in the 1,500 to 1,800 deg. F. range are maintained by the four No. 3 Hyperbo gas burners. It was found, after many changes and tests, that this burner steadily delivered a finely controlled flame which maintains an even, uniformly circulated heat. Particular attention was given to the circulation current to confine their direct flow to a location above the cyanide solution in the pot, thereby maintaining a high temperature in the solution without agitation and consequent high volatilization.

All operations are performed inside the heat chamber. Large parts, weighing up to 12 lb., and small parts, down to ½-in. washers, are uniformly treated with equal facility in quantities up to 40 lb. per hour. The procedure is to place the parts to be treated on one of the inclined planes, where they are heated to 1,600 deg. F., then to submerge them in the cyanide pot for the required length of time, after which they are pulled out on the opposite incline plane, drained free of the solution and finally heated for penetration. They are then ready for quenching.

It will be noted that all operations are performed under a constantly maintained temperature, thereby insuring a very effective penetrative action; that the fumes from the cyanide mingling with the gas flames exclude all other air from the furnace, thus eliminating oxidation, and finally, that the liquid cyanide drains from the work into the pot after submerging, thus actually saving 50 per cent of the cyanide required for the same amount of work by the ordinary cyanide process.

The service life of the ordinary bottom-fired, pressed-steel cyanide pot is limited to a month or less. The corrosive effect of the cyanide solution, combined with heat, causes a rapid deterioration of the pot. The heating of the pot from the top, as is done in the new furnace, greatly diminishes the corrosive action of the solution on the container. After six months of operation the pot in this furnace, costing $4, was found to be as serviceable as when first installed.



This Sectional Diagram of the New Cyanide Hardening Furnace Developed in the West Shops of the Chicago Surface Lines Illustrates the Arrangement for Heating the Solution from the Top, Using Gas as Fuel

A record of production under the old and under the new processes shows the following results: For a period of 11 months, using the ordinary type process, 21,988 truck wear plates, each weighing 7 lb., were treated at a total cost of $6,629.26. This is an average cost of $0.0402 per lb. In the new process, under the same manufacturing conditions, miscellaneous parts weighing from one ounce to 12 lb. were treated during a 5-month period. In this case 69,500 lb. were treated at a total cost of $1,490.78, giving an average cost of $0.0214 per lb. of metal treated.

A material saving in the cost of steel pots is made with the new process, and it is conservatively estimated that 30 per cent of the carbonizing agent required in the common process is saved. There is a 50 per cent gain in the wearing quality of the metal treated. In addition to this, an operator produces 50 per cent more work during the 8-hour day with absolutely no danger of breathing cyanide fumes.

Electrical Equipment Causes Big Saving

Comparative Data from the Chicago, Milwaukee & St. Paul Railway Show Definite Economy from Electrical Operation on Both Electrified Divisions, Though Traffic Conditions Differ Greatly

THIS week the Chicago, Milwaukee & St. Paul Railway made public for the first time detailed figures of the relative costs of operating its Rocky Mountain divisions by electricity and by steam locomotives. The report was prepared by C. E. Oliphant, assistant to the comptroller in charge of statistics, under the direction of W. W. K. Sparrow, vice-president, and in consultation with R. Beeuwkes, electrical engineer in charge of the electrical installation. The figures include both operating expenses and carrying charges (the latter including depreciation) and have been brought to the same basis. This was done for the operating expenses as follows:

The electrical operating costs are the actual costs for the year ended Dec. 31, 1923. The steam operating costs are based on the costs of the last year of steam operation, corrected where known to be incomplete as for some of the minor items, and then recalculated to cover the differences which have occurred in labor and material costs. In other words, the figures are restated so as properly to represent the price levels of 1923, or what the cost would have been if the divisions had been operated by steam. With regard to the savings with the electrical system through the use of regenerative electric braking, it was found that no existing data were available which would enable the brakeshoe wear to be determined with any accuracy for the condition of continuous and long application which, under steam operation, occurs on mountain grades. Therefore, a wear figure, believed at least to be conservative of 1 lb. of wear per 100,000,000 ft.-lb. of energy dissipated, was used. There is also a saving in draft rigging brake apparatus and wheel wear, all of which, for evident reasons, are indeterminable where cars move over many divisions. The amount of savings on account of these items was assumed to be the same as that resulting from the reduction in brakeshoe wear. This estimate is believed by the officers of the railway company to be conservative.

The comparisons of costs for the two motive powers are published in the accompanying tables and charts, the figures for which include only those accounts for both steam and electric operation which are affected by the type of motive power. Operating costs common to both steam and electric operation and carrying charges on investment in property commonly necessary to both forms of operation were omitted from these tables for the sake of simplicity.

The selection of accounts used was made after a careful study of the expenditures under each of the primary accounts of the operating classifications. Some of the accounts excluded as not being affected by change in power are without doubt affected to some extent by such a change, but the effect is so slight as to be negligible in comparison with the effects produced by other causes. Thus, "Maintenance of Track" is admitted by the company to be an expense unquestionably affected to some extent by the class or kind of power. It was felt, however, that the effect from other causes, such as weather, availability of money, cycles of renewal of parts, maintenance program, labor conditions, etc., are so much greater and so impossible of exact ascertainment for elimination, that this expense

SAVINGS RESULTING FROM ELECTRICAL OPERATION—COST LEVEL OF 1923

Years	Harlowton to Avery Electrical Operation began April and Nov., 1916		Othello to Tacoma Electrical Operation began March, 1920		All Electrified Sections	
	Volume of Traffic-Gross Ton Miles Frt. and Pass.	Net Savings by Electrification	Volume of Traffic-Gross Ton Miles Frt. and Pass.	Net Savings by Electrification	Volume of Traffic-Gross Ton Miles Frt. and Pass.	Net Savings by Electrification
1916	†1,639,054,000	†$ 1,098,166			1,639,054,000	$ 1,098,166
1917	2,677,097,000	1,641,369			2,677,097,000	1,641,369
1918	2,759,178,000	1,734,687			2,759,178,000	1,734,687
1919	2,894,063,000	1,888,037			2,894,063,000	1,888,037
1920	2,710,745,000	1,679,623	*691,674,000	* $249,003	3,402,419,000	1,928,626
1921	1,812,714,000	658,651	664,238,000	12,363	2,476,952,000	671,014
1922	2,109,858,000	996,485	734,121,000	103,301	2,843,989,000	1,099,786
1923	2,247,102,000	1,152,508	746,406,000	119,285	2,993,507,000	1,271,793
1924	2,129,426,000	1,018,721	691,476,000	47,808	2,820,902,000	1,066,529
Total		$11,868,247		$531,760		$12,400,007

†Tonnage and savings for 6½ months.
*Tonnage and savings for 9 months

OPERATING EXPENSES DIRECTLY AFFECTED BY CHANGE IN POWER—HARLOWTON TO AVERY

I.C.C. Accts.	Classification of Expenses Description	STEAM OPERATION Costs of the Year 1918 Adjusted to the Price Levels of 1923			ELECTRICAL OPERATION Actual Costs of the Year 1922		
		*Variable		*Constant	*Variable		*Constant
		Freight	Passenger	Frt. & Pass.	Freight	Passenger	Frt. & Pass.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Maintenance of Way and Structures:						
201	Superintendence			$ 94,472			$ 95,208
231	Water Stations			23,900			
233	Fuel Stations			9,930			
235	Shops and Enginehouses			42,383			23,927
249	Signals and Interlockers			52,131			47,671
255	Power Substation Buildings						1,530
257	Power Transmission Systems						2,913
259	Power Distribution Systems						40,763
261	Power Line Poles and Fixtures						18,379
271	Small Tools and Supplies (for M. of Elec. Prop. only)						647
	Total Maintenance of Way and Structures			222,716			241,238
	Maintenance of Equipment:						
301	Superintendence			120,194			105,440
306	Power Substation Apparatus						19,163
308-11	Locomotive Repairs—Train	$ 687,824	$ 218,725		$ 190,390	$ 125,349	
308-11	Locomotive Repairs—Switch	37,105			12,510	77	
314-17	Brake Shoe and Rigging, Wheel and Draft Rigging Wear	21,352	11,622				
326	Trolley Maintenance Cars—Only						2,767
	Total Maintenance of Equipment	746,281	230,347	120,194	202,900	125,426	127,360
	Transportation:						
371	Superintendence			70,240			61,407
377	Yardmasters and Yard Clerks			17,055			17,055
378	Yard Conductors and Brakemen	61,533			37,174	166	
379	Yard Switch and Signal Tenders			1,189			548
380-81	Yard Enginemen—Yard Motormen	39,644			17,990	110	
382-84	Fuel for Yard Locos.—Yard Switch. Power Purchased	43,316					9,489
383	Yard Switching Power Produced						1,052
385	Water for Yard Locomotives	1,257					
386	Lubricants for Yard Locomotives	777			394	1	
387	Other Supplies for Yard Locomotives	808			202	1	
388	Enginehouse Expense—Yard	12,431			4,131	25	
389	Yard Supplies and Expenses			712			328
392-93	Train Enginemen—Train Motormen	400,421	121,341		231,352	77,778	
394-96	Fuel for Train Locos.—Train Power Purchased	396,009	270,693				754,231
395	Train Power Produced						87,135
397	Water for Train Locomotives	24,939	7,556				
398	Lubricants for Train Locomotives	14,534	3,360		2,979	4,811	
399	Other Supplies for Train Locomotives	19,018	5,381		4,831	2,470	
400	Enginehouse Expense—Train	142,283	66 330		42,341	40,531	
401	Trainmen	317,041	94,649		197,067	64,649	
402	Train Supplies and Expenses (Train—Light and Heat)					12,863	
404	Signal and Interlocker Operation			40,841			31,617
	Total Transportation	1 964,010	569,310	120,037	535,561	233,425	962,763
	Work Train Expense—All Other than included Above in M. of W. & S. adjusted to 1923 Work Train Miles			74,721			62,415
	Totals for Operating Expenses Directly Affected (Gr. Tot. Stm. $4,057,616; Gr. Tot. Elec. $2,501,088)	$2,710,291	$ 799,657	$ 547,668	$ 738,461	$ 368,851	$1,393,776
	Gross Ton Miles in Thousands—the Work Performed (Gr. Tot. Stm. 2,178,631; Gr. Tot. Elec. 2,247,102)	1,758,726	**419,905		1,827,197	419,905	
	Cost per 1,000 Gross Ton Miles	$ 1.54105	$ 1.90438		$ .40415	$ .87842	

*"Variable"—Expenses considered to vary practically directly with volume of traffic: "Constant"—Expenses considered to remain practically constant for all volumes of traffic within a reasonable range.
**The actual for the period, 354,054,000, adjusted to the tonnage of electrical operation as the difference rests solely in the number of cars per train: Expenses adjusted to conform.

INVESTMENT IN AND CARRYING CHARGES ON THE PROPERTY PECULIAR TO EACH MODE OF OPERATION—HARLOWTON TO AVERY

ITEMS	Investment *	Carrying Charges: Interest 5%	Carrying Charges: Depreciation S. F. Basis 6%	Carrying Charges: Total
Steam Operation:				
Fixed Property:				
Fuel and Water Stations, Cinder Pits, Etc	$ 630,000	$ 31,500	$ 16,696	......
D. C. Signal System........	ƒ	..	...	....
Totals—Fixed Property....	$ 630,000	$ 31,500	$ 16,696	$ 48,196
Locomotives:				
Freight (incl. all Pusher and Work Service Locomotives).....	$ 2,470,628	$ 123,531	$ 28,166	...
Passenger	356,039	17,802	4,060	....
Switch........	78,598	2,930	896	....
Totals—Locomotives ..	$ 2,905 265	$ 145,263	$ 33,120	$ 178,383
Totals—Steam Property......	$ 3,535,265	$ 176,763	$ 49,815	$ 226,578
Electrical Operation:				
Fixed Property:				
Roadway Buildings	$ 89,545	$ 4,477	$ 2,282	......
Power Substation Buildings	535,157	26,758	3,361	......
Power Substation Apparatus	1,859,353	92,968	21,383	....
Power Transmission System...........	715,181	35,759	5,435	......
Power Distribution System...........	3,890,812	144,531	23,269	....
Power Line Poles and Fixtures.......	1,091,721	54,586	50,110	....
A. C. Signal System........	ƒ 197,446	9,872	1,274	....
Engr.—Int. during Construction and Misc! ...	325,671	16,284	3,354	....
Maintenance Equipment........	37,000	1,850	422	......
Sub-Total........	$ 7,741,689	$ 387,065	$ 111,090	$ 498,175
Rental of Transmission Lines—Credit	....	$Cr. 2,760	....	$Cr. 2,760
Totals—Fixed Property......	$ 7,741,689	$ 384,325	$ 111,090	$ 496,418
Locomotives:				
Freight (incl. all Pusher and Work Service Locomotives)........	$ 2,881,112	$ 144,056	$ 32,845	.....
Passenger........	927,408	46,370	10,573	....
Switch........	111,564	2,578	1,272	....
Totals—Locomotives........	$ 3,920,084	$ 196,004	$ 44,690	$ 240,694
Totals—Electrical Property	$11,661,773	$ 580,329	$ 155,780	$ 736,109
Increase in Carrying Charges—Account Electrification........	....	....	....	$ 509,531

*Electrical operating property at actual cost 1914-15-16: Steam operating property priced as of the costs obtaining during the same period (1913).

ƒNet increase in investment chargeable to electrification included under electrical operation

INVESTMENT IN AND CARRYING CHARGES ON THE PROPERTY PECULIAR TO EACH MODE OF OPERATION—OTHELLO TO TACOMA

ITEMS	Investment *	Carrying Charges: Interest 6%	Carrying Charges: Depreciation S. F. Basis 6%	Carrying Charges: Total
Steam Operation:				
Fixed Property:				
Fuel and Water Stations, Cinder Pits, Etc	$ 507,010	$ 30,421	$ 12,436	.
D. C. Signal System	612,000	36,720	9,793	..
Totals—Fixed Property	$ 1,119,010	$ 67,141	$ 20,229	$ 87,370
Locomotives:				
Freight (incl. all Pusher and Work Service Locomotives)......	$ 2,135,785	$ 128,147	$ 24,348	..
Passenger	430,231	25,814	4,905	..
Switch..	144,224	8,653	1,644	..
Totals—Locomotives	$ 2,710,240	$ 162,614	$ 30,897	$ 193,511
Totals—Steam Property	$ 3,829,250	$ 229,755	$ 51,126	$ 280,881
Electrical Operation:				
Fixed Property:				
Roadway Buildings	$ 114,215	$ 6,853	$ 3,027	..
Power Substation Buildings	452,808	27,168	2,878	.
Power Substation Apparatus	1,476,964	88,618	16,985	.
Power Transmission System	549,521	32,971	6,072	.....
Power Distribution System	2,190,401	131,424	16,822	......
Power Line Poles and Fixtures	966,562	57,994	40,896	....
A. C. Signal System	780,000	46,800	8,658	....
Engr.—Int. during Construction and Misc!	621,510	37,291	7,645	....
Maintenance Equipment....	27,000	1,620	306	....
Sub-Total......	$ 7,178,991	$ 430,739	$ 101,988	$ 532,727
Rental of Transmission Lines—Credit........	....	$Cr. 25,842	....	$Cr. 25,841
Totals—Fixed Property........	$ 7,178,991	$ 404,897	$ 101,988	$ 506,886
Locomotives:				
Freight (incl. all Pusher and Work Service Locomotives)........	$ 3,065,280	$ 183,917	$ 34,944	......
Passenger........	1,035,690	62,141	11,807	......
Switch........	48,520	2,911	553	....
Totals—Locomotives........	$ 4,149,490	$ 248,969	$ 47,304	$ 296,273
Totals—Electrical Property........	$11,328,481	$ 653,866	$ 149,292	$ 803,158
Increase in Carrying Charges—Account Electrification........	....	....	....	$ 522,277

*Electrical operating property at actual cost 1917-18-19: Steam operating property priced as of the costs obtaining during the same period (1916).

should be classified as not being affected by change in power, though other items in the primary account of maintenance of way and structures were included. Work train expenses have been separated and included as expenses directly affected by change in power for several reasons, one of which is that certain standby losses under steam operation are eliminated by the use of electric motors in work train service. The costs of the two periods have been adjusted to the same amount of work train service.

Costs of electric power for the electric division are based upon a minimum total payment corresponding to the respective amounts of energy for which the railway company had exercised options during 1923 for the different sections. Where these amounts were not sufficient to handle the increased traffic, the power cost was increased on the basis of the additional power required.

COST AS AFFECTED BY VOLUME OF BUSINESS

Of course the total tonnage moved in the year selected was not the same for steam and for electric operation. Therefore, to make the comparison exact, the cost items affected by a change from steam to electrical operation were separated between those which within reasonable limits remain constant for different volumes of traffic and those which vary directly with the volume of traffic. The latter items were further separated between the passenger and freight services. With these separations, it was easy to make a comparative statement of figures on investment and depreciation based on the same tonnage. In determining the figures on investment, only the power equipment facilities and appurtenances directly related to each system of motive power were considered.

In tabulating the investment in the property involved,

OPERATING EXPENSES DIRECTLY AFFECTED BY CHANGE IN POWER—OTHELLO TO TACOMA

I.C.C. Accts. (1)	Classification of Expenses — Description (2)	STEAM OPERATION Costs of the Year, August, 1912, to July, 1913, inclusive, Adjusted to the Price Levels of 1923 — *Variable Freight (3)	*Variable Passenger (4)	*Constant Frt. & Pass. (5)	ELECTRICAL OPERATION Actual Costs of the Year 1923 — *Variable Freight (6)	*Variable Passenger (7)	*Constant Frt. & Pass. (8)
	Maintenance of Way and Structures:						
201	Superintendence........	....	....	$ 48,293	....	....	$ 49,777
221	Water Stations........	....	....	8,272	....	....	....
233	Fuel Stations........	....	....	5,218	....	....	....
235	Shops and Enginehouses........	....	....	16,234	....	....	12,813
249	Signals and Interlockers........	....	....	33,202	....	....	31,343
255	Power Substation Buildings........	....	....	....	....	....	2,047
257	Power Transmission Systems........	....	....	....	....	....	3,179
259	Power Distribution Systems........	....	....	....	....	....	19,723
261	Power Line Poles and Fixtures........	....	....	....	....	....	11,066
271	Small Tools and Supplies (for M. of Elec. Prop. only)........	....	....	....	....	....	366
	Total Maintenance of Way and Structures........	....	....	111,219	....	....	132,013
	Maintenance of Equipment:						
301	Superintendence........	....	....	31,100	....	....	22,306
306	Power Substation Apparatus........	....	....	....	....	....	7,891
308-11	Locomotive Repairs—Train........	$ 326,467	$ 129,174	....	$ 78,549	$ 60,703	....
308-11	Locomotive Repairs—Switch........	24,141	....	....	2,658	....	....
314-17	Brake Shoe and Rigging, Wheel and Draft Rigging Wear........	16,000	7,000	....	....	....	....
326	Trolley Maintenance Cars—Only........	....	....	....	....	....	714
	Total Maintenance of Equipment........	366,608	136,174	31,100	81,207	60,703	30,911
	Transportation:						
371	Superintendence........	....	....	33,097	....	....	34,126
377	Yardmasters and Yard Clerks........	....	....	6,708	....	....	3,208
378	Yard Conductors and Brakemen........	40,560	....	....	10,036	....	....
379	Yard Switch and Signal Tenders........	....	....	2,047	....	....	578
380-81	Yard Enginemen—Yard Motormen........	25,629	....	....	6,206	....	....
382-84	Fuel for Yard Locos.—Yard Switch. Power Purchased........	34,763	....	....	....	....	2,714
383	Yard Switching Power Produced........	....	....	....	....	....	447
385	Water for Yard Locomotives........	902	....	....	....	....	....
386	Lubricants for Yard Locomotives........	506	....	....	106	....	....
387	Other Supplies for Yard Locomotives........	536	....	....	44	....	....
388	Enginehouse Expense—Yard........	8,845	....	....	1,186	....	....
389	Yard Supplies and Expenses........	....	....	314	....	....	62
392-93	Train Enginemen—Train Motormen........	232,222	89,874	....	92,294	38,005	....
394-96	Fuel for Train Locos.—Train Power Purchased........	493,207	186,446	....	....	....	**319,634
396	Train Power Produced........	....	....	....	....	....	33,301
397	Water for Train Locomotives........	11,710	4,548	....	....	....	....
398	Lubricants for Train Locomotives........	8,604	1,754	....	4,804	2,171	....
399	Other Supplies for Train Locomotives........	7,211	2,778	....	3,485	1,999	....
400	Enginehouse Expense—Train........	45,998	23,263	....	14,554	16,127	....
401	Trainmen........	264,328	60,644	....	107,162	47,898	....
402	Train Supplies and Expenses (Train—Light and Heat)........	....	....	....	....	7,729	....
404	Signal and Interlocker Operation	....	....	19,348	....	....	14,390
	Total Transportation	1,161,265	355,100	63,414	340,019	113,813	424,510
	Work Train Expense—All Other than included Above in M. of W. & S. adjusted to 1923 Work Train Miles.			50,452			30,676
	Totals for Operating Expenses Directly Affected (Gr. Tot. Stm. $2,277,457; Gr. Tot. Elec. $1,126,852)	$1,529,993	$ 491,274	$ 256,190	$ 421,226	$ 174,516	$ 631,110
	Gross Ton Miles in Thousands—the Work Performed (Gr. Tot. Stm. 1,014,511; Gr. Tot. Elec. 746,405)	805,830	***208,681	.	537,724	208,681	....
	Cost per 1,000 Gross Ton Miles	$ 1 89865	$ 2 35419	....	$ .59728	$ .83628	....

*"Variable"—Expenses considered to vary practically directly with volume of traffic; "Constant"—Expenses considered to remain practically constant for all volumes of traffic within a reasonable range.

**Constant up to a total of 806,097,000 Gross Ton Miles for Freight and Passenger Services; thence increased in freight service as estimated necessary for greater volumes of traffic: (The amount to be added at 1,014,511,000 G. T. M. is $38,307.00.)

***The actual for the period, 186,232, adjusted to the tonnage of electrical operation as the difference rests solely in the number of cars per train due to difference in train routing: Expenses adjusted to conform.

the same practice was followed as with the operating expenses, namely, to include only the equipment facilities and appurtenances directly related to each type of equipment. For example, in steam operation, the steam locomotives and the fuel and the water stations were included, and in electrical operation the locomotives, the transmission and distribution systems, substations, etc. The signal systems were also included, as it was necessary to change the d.c. system formerly used with steam for the a.c. system when the road was electrified.

The figure taken as the investment for the property peculiar to electrical operation was the actual cost of installation—i.e., on the Coast division the prices obtaining in 1918 (1917 to 1919), and on the Rocky Mountain and Missoula divisions the prices obtaining in 1915 (1914-1916). The investment in the property peculiar to steam operation was based upon the actual cost, modified and adjusted to the price levels as of the electrical installations—i.e., on the Coast division as of 1918 and on the Rocky Mountain and Missoula divisions, which extend from Harlowton to Avery, as of 1915.

The carrying charges computed interest and depreciation. The interest rate has been taken as the rate paid by the railway during the different periods of installation—for the Coast division 6 per cent and the Rocky Mountain and Missoula divisions 5 per cent. Depreciation has been computed upon the sinking fund basis, using an interest rate of 6 per cent.

THE SYSTEM INVOLVED

The miles of track involved in electrification are as follows:

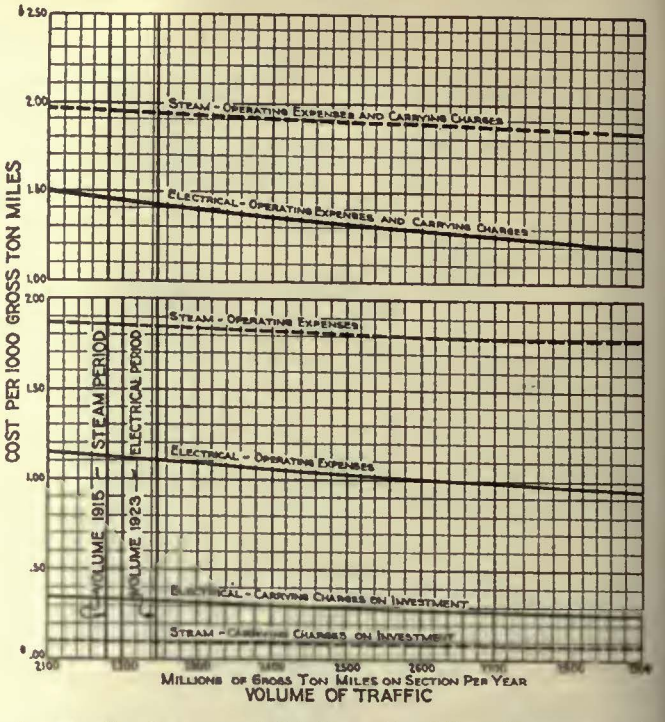
MILES OF ELECTRIFIED TRACK CONSIDERED, CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

	—Miles of Track— First Main	Other	Operation Dates
Harlowton to Deer Lodge	226	66	April, 1916
Deer Lodge to Avery	212	62	November, 1916
Othello to Tacoma (helper service)	...	...	August, 1919
Othello to Tacoma (through service)	208	72	March, 1920
Tacoma Junction to Tacoma (passenger)	2	...	April, 1920
	648	200	

The direct-current overhead trolley system of electrification is used. This current is not generated by the railway, but is purchased from hydro-electric stations along the line. It is received at taps in the company's high-tension lines, transmitted to substations where it is stepped down from three-phase a.c. at 100,000 volts to a working voltage of 2,300 and then converted to motor-generators to d.c. at 3,000 volts for distribution on the trolley. The motors of the locomotives are so constructed as to act as generators when descending grades, thus returning current to the line and controlling the speed of trains without mechanical braking. Full technical details of the electrification have been published in this paper.

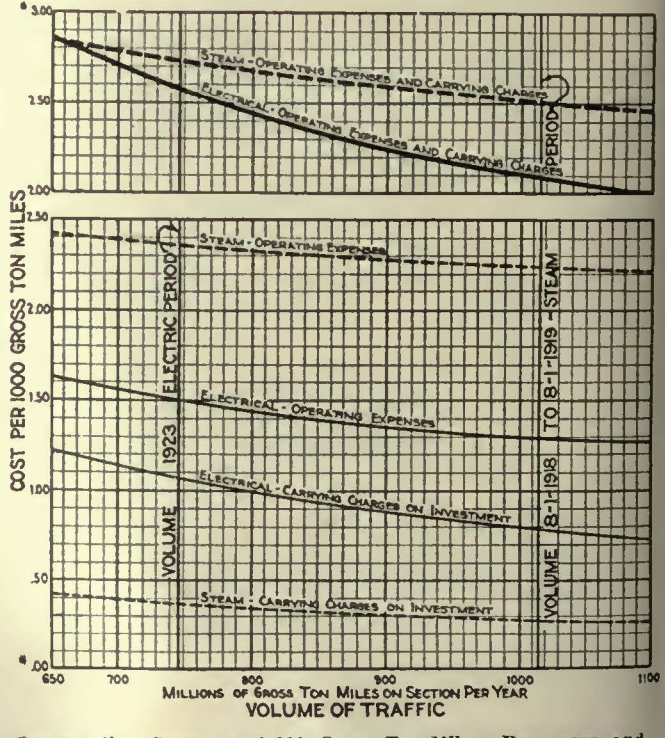
STATISTICS

The first of the accompanying tables shows for the years since the beginning of electrical operation the net saving from electrical operation, using for steam operation the actual cost of the last 12 months of such operation—adjusted to the cost obtaining in 1923; and for electrical operation, the actual cost as determined for the year 1923. The net savings shown are obtained by deducting from the savings in operating expenses the carrying charges of interest depreciation on the additional investment required by the electrification, which, as shown in two of the subsequent tables, amounted to $15,625,739.



Comparative Costs per 1,000 Gross Ton-Miles—Passenger and Freight—Of Operating Expenses and Carrying Charges on Investment in Property Directly Affected by Change in Power—Harlowton to Avery

From this table it will be seen that for the year 1923, with its comparatively low tonnage, the net saving from electrical operation of the two sections amounted to $1,271,793. For the minimum tonnage so far experienced, which was in the year, 1921, the savings amounted to $671,014. The maximum tonnage so far experienced was in 1919. Had the section from Othello to Tacoma been under electrical operation during that year, the savings for the two sections would have amounted to $2,355,199. Detailed figures of cost



Comparative Costs per 1,000 Gross Ton-Miles—Passenger and Freight—of Operating Expenses and Carrying Charges on Investment in Property Directly Affected by Change in Power—Othello to Tacoma

on the bases described are given in the other tables shown.

The two charts present the savings per 1,000 gross ton-miles, freight and passenger, resulting from electrical operation in place of steam. In these charts it will be seen that the volume of traffic in the steam and electrical operating years were nearly the same for the Rocky Mountain and Missoula divisions, but in the case of the Coast division the steam operating year included a considerably greater volume of traffic than did the electrical operating year—a situation favoring steam operation to some extent in the comparative figures.

No Indirect Savings Credited

No savings were credited to electric operation which were not directly ascertainable, as for example the possible increased revenue due to the release of equipment used in the transportation of coal under steam operation. Similarly, no credit was given electric operation for the better utilization of freight equipment due to faster movement, less wear and tear on road and equipment, reduced station expenses and similar expenses affected by the number of trains required to handle a given tonnage. In the case of all of these items it was impossible to determine an exact monetary value for these incidental advantages. In the same way, no credit is given for the increase in passenger revenue resulting from the attractiveness and greater comfort of travel under electrified operation.

German Comment on Foreign Practice Report

A Supplement of the Report of the Foreign Practice Committee at Atlantic City Convention of the American Electric Railway Association, Prepared by a German Writer

THE report of the committee on foreign practice of the American Electric Railway Association, presented at Atlantic City last October, has attracted considerable attention on the continent of Europe as well as in England and the United States. The German comment is instanced by an extended abstract of the report, extended through three issues of *Verkehrstechnik*. It was written, with comments, by General Manager Stein of the Hamburg Elevated Railway, who was recently in the United States on a tour of inspection of American electric railways. Mr. Stein says many complimentary things about the report of the committee on foreign practice, among them that the members were careful observers and that while they may have seen many things through American spectacles, they accumulated a vast amount of valuable data. The omission of Germany from the itinerary, however, Mr. Stein says, is hard to understand, in view of the fact that so many American railway men have visited Germany during the last three or four years. Evidently he did not realize the limited time at the disposal of the committee.

The author then mentions a number of developments of electric railway interest which the committee might have seen in Germany, and this summary is published here somewhat condensed, as it may serve as a possible unofficial supplement, by a prominent German engineer and railway manager, to the report of the committee. Mr. Stein says:

They could not only have seen interesting historical objects, like the first electric car in the world, made by Siemens, but also developments which constitute today a decided advance in electric railway engineering and operating developments. Some equipment of chiefly German character was seen by the visitors in Switzerland, such as single-phase, main-road electrification and the bow type of trolley for surface cars. Notable developments in overhead line construction and locomotives for single-phase main-line operation, however, could have been studied to better advantage in Germany, particularly unusually large single-phase motors. It would have been possible on the urban and suburban lines in Berlin to have observed the latest types of direct-current equipment. Mercury-arc rectifier sets, much larger than those in France and Switzerland, could also have been inspected in Germany. The American visitors would have had an opportunity of observing the excellent results obtained on surface lines with brakes of the short-circuit, disk or solenoid types, which have given in this service better general results than air brakes or magnetic rail brakes. Of the latter kind of brakes, some notable models could have been seen in use on track with heavy grades, so arranged as to permit regeneration.

The visitors could also have learned how Germany has succeeded in economizing in the use of material and electrical energy. They would have found very interesting improvements in armature bearings and axle bearings, particularly in the use of roller and ball bearings and new types of inexpensive anti-friction bearing metal such as Lurgi metal. Oil-electric cars and storage-battery cars could have been seen in operation. Data could have been obtained in regard to progress in the development of rail sections. It should be remembered that the first rolled girder rail was produced in Germany (in 1873) and that the thermit-welding process was a German invention. The committee could have seen, in Dortmund, a four-wheeled car with a 4-m. (13-ft. 2-in.) wheelbase, equipped with a high-speed motor and automobile type of gear transmission. If they had visited Hamburg, they would have seen a new six-wheel auto bus. They would also have had an opportunity to observe important developments in signaling systems, such as the trouble signals in Hamburg, new methods of fare collection and accounting.

But most important of all, the committee would have found how common the practice is in Germany to plan the extension of city railway systems so as to fit in with future building operations. In many countries this is considered a practically unattainable ideal, but in Germany laws have been passed in this respect and good results are being obtained. Finally, they would have been able to see how engineer and architect, when working together, can design such attractive structures for use with subways and elevated railroads that these structures harmonize with the general architecture of the city.

Aurora-Elgin Time-Table Carries Much Local Information

INSTEAD of carrying advertisements, the back of the new time-table folder of the Aurora, Elgin & Fox River Electric Company contains useful information for commercial men as well as regular patrons. The interurban service time-table is printed on one side of an eight-page folder which measures 6¾ in. x 3½ in. On the other side of the sheet is information relative to Aurora, Elgin and the small towns through which the interurban line passes. Lists of clubs, theaters, hotels, hospitals, parks, banks and manufacturers are given. In the tabulation of manufacturers in Aurora and Elgin opposite each manufacturer's name is the name of the local street car line which passes near it. This information gives the commercial traveler an alphabetical list of manufacturers, their addresses and how to reach them.

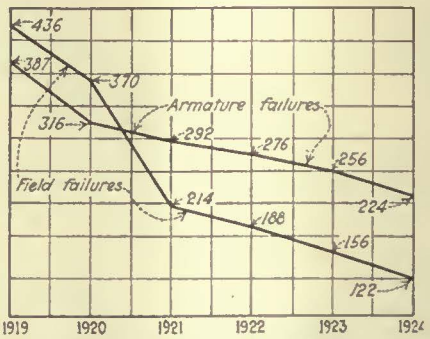
In addition to this information, schedules of city car operation in Aurora and Elgin appear in the time-table. These schedules give the time of departure at the center of town and at the terminals for cars on all lines.

Equipment Maintenance Notes

Dipping and Baking Motor Frames Reduces Field Failures

A REDUCTION to about one-quarter of the former number of field failures has been made by the Washington Railway & Electric Company, Washington, D. C., during the past 5 years. Dipping and baking of armatures and fields was begun on an extensive scale in 1920 and dipping and baking of frames with fields in place was started in 1922. Although many factors have contributed to this result, it is felt by the company that the practice of dipping and baking motor frames with the fields in place has been an important reason for the improved performance record.

For this purpose an electric baking oven and dipping apparatus, as shown in the accompanying illustration, was built by the railway and installed in its P Street shops in 1922. Just before the motor frames are to be returned to service and after the new fields have been installed they are baked and dipped. The frame is preheated at 200 deg. F. for 7 hours in the electric oven.



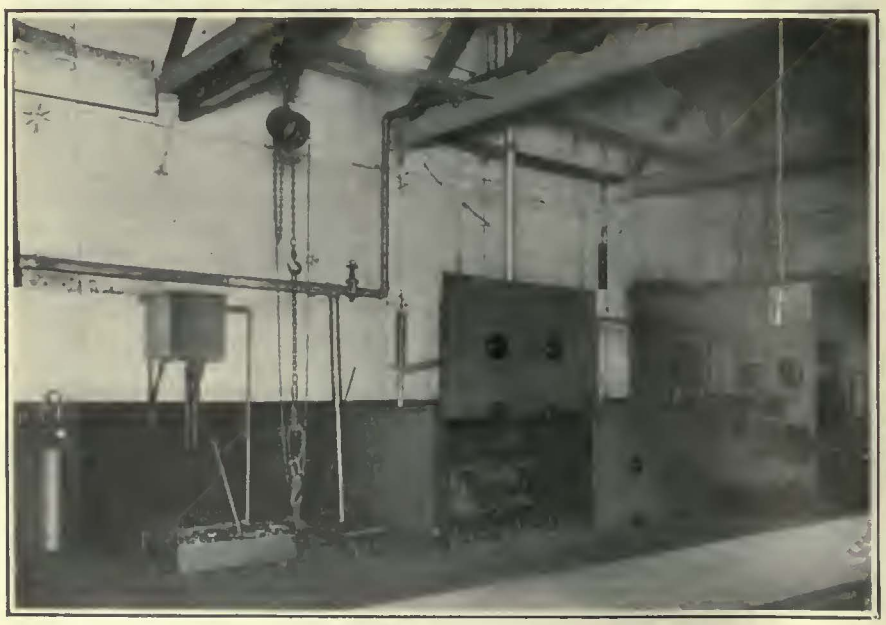
Total Armature and Field Failures

The effect of dipping and baking on the number of field and armature failures is clearly shown by the marked reduction since 1920.

Small trucks used to move motors around the shops are run right into the baking oven.

After the frame has been preheated all holes are plugged and it is suspended by the chain hoist above a shallow varnish pan. Wooden disks cover the openings usually occupied by the bearing housings. The frame is then filled with varnish from a tank above the pan. This is allowed to remain for 10 or 15 minutes until all bubbling ceases, when the varnish is allowed to run out into the pan. From the pan it flows through a pipe to an underground tank. After the pan is empty, a valve closes the pipe opening. A storage air tank located near by on the wall is connected to the underground varnish tank, so that the liquid can be raised by compressed air to the tank shown in the accompanying illustration.

After the frames have been thus impregnated with varnish they are allowed to cool. It is not thought necessary to return them to the ovens for further baking. The heat which the iron has accumulated during the 7 hours previous baking is retained for a sufficiently long time to dry out the varnish properly. All motor frames are treated in this way when they are returned to the shop for their regular 60,000-mile overhauling.

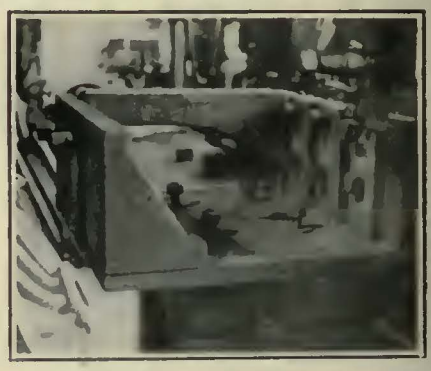


Apparatus for Dipping and Baking Motor Frames with Fields in Place

On the right are the plugs which are used to stop up openings in the frames. In the center is the electric baking oven, containing two motor frames. To the left is the varnish tank and the pan into which the varnish is emptied after the frames have been treated. Air control equipment is shown at the extreme left.

Pedestal Jaws Finished in Shaper

IN THE shops of the Gary Street Railway, Gary, Ind., cast-steel, bolted-type pedestal jaws, when badly worn, are replaced with new castings. These replacement castings are finished four at a time in a fixture attached to the bed of a shaper. These are held at one end by means of square-headed bolts and at the other end by setscrews. The fixture consists of a heavy steel base with uprights at two edges. The base is a piece of 1-in. rolled steel approximately 24 in. square. One upright is of 1¼-in. steel, grooved out to receive the shoulders on the top of the pedestal casting. Two ¾-in. square-headed bolts are used to fasten each casting to this upright.



Four Pedestal Jaw Castings Are Machined at One Time in This Fixture

Dick Visits the Centerville Shop

And Makes a Suggestion

DICK PRESCOTT and Steve White of the Consolidated Railway & Light Company finally reached the Centerville railway shop. The master mechanic proved to be a very pleasant fellow. After Dick and Steve had explained to him that their inspection trip was for the purpose of gathering new ideas and information on current methods, the three started out through the shop. As they went over the work of various departments, many questions of maintenance practice were freely discussed between the two visitors and the master mechanic.

After several hours they found themselves in the armature room with the foreman of that department. While awaiting the return of the master mechanic, who had been called to the telephone, the subject of bearing maintenance came up.

"How do you decide when bearings should come out?" asked Dick. "Do you have definitely established limits of wear?"

"Why, let's see; I don't know how the stations are handlin' that now; wait'll I see. Oh, John, come 'ere a minute, will yuh?"

A husky, grimy workman approached the group in response to the foreman's call, wiping his hands on a piece of waste as he came.

"Say, John, how do those fellahs out at the station tell when bearin's have to come out?"

John hesitated a moment. Then he replied, "Why, they put a bar up under th' pinion and feel when she's gettin' pretty loose."

"Well, do they have a definite limit of wear allowance?" asked Dick.

"Sure, they take 'em out before th' armature tears up on th' poles. They feel when she's pretty loose with the bar. Sometimes they look at the armature to see if she's rubbin'."

"How about axle bearings?" questioned Dick.

"Oh, you can tell when they're gettin' pretty thin by heavin' up on th' motor with a bar."

"Well, then, you don't set a certain limit of wear and then take them out when they've reached that point?"

"Huh?—Oh, they jus' take 'em out when they look pretty loose."

As the master mechanic rejoined the group, the armature room foreman nodded to John, who returned to his bench, still wiping his hands on the piece of waste.

"What mileage do you get from gears and pinions?" asked Dick, addressing the master mechanic.

"Why, we don't have a record of the mileage of each one. I think we're gettin' pretty good mileage from the gears we've got, but I'm afraid they're a little too hard. We do have lots of trouble from broken teeth. Sometimes, when one piece breaks out it gets jammed in the teeth and bungs up the whole gear, and we've had some shafts break when they jammed. It sure makes a mess of the armature when a pinion breaks."

"We've just been talking about axle bearings," replied Dick. "Don't you think letting the bearings go too long might cause some of that breakage?"

"I don't know," replied the master mechanic. "There may be somethin' in that, though—we do get a ridge worn in the pinion face sometimes, out near the end of the tooth."

"I'm beginning to believe," said Dick, "that we've all been too economical on this matter of bearings, and that establishment of definite limits of wear would not only keep our gears fitting better but would reduce a lot of noise and vibration."

"I don't know but what there's some truth in what you say. If you get any more dope on that, I'd like to get hold of it."

"Fine!" said Dick. "I'll be glad to drop you a line when we get back."

The other upright contains four setscrews of ¾ in. diameter for steadying the small ends of the pedestal jaws. This upright may be removed from the base so that the castings may be easily mounted in the permanent upright. The jaws are first fastened to the permanent upright, after which the movable upright is placed in position. The setscrews are then run in to hold the castings. This set-up requires less than 10 minutes to make and allows four jaws to be machined at one time. The entire fixture was constructed in the shop from materials on hand and has proved handy in expediting this particular machining job.

Clamp for Holding Armatures Vertically

ARMATURES are dipped with the commutator end up in the shops of the Department of Street Railways, City of Detroit. For holding the armatures while supported by the hoist and also during handling, a clamp has been designed to fit the upper end of the armature shaft. This method of support keeps the clamp free from the compound during dipping and also facilitates rapid handling.

Clamp Applied to Armature Shaft to Support It in Vertical Position

The clamp consists of a casting with hook top. Two copper jaws are arranged to slide inside the casting, one being of V-shape, which is stationary, the other having ends which fit in slots of the casting to act as guides. After placing the clamp over the end of the shaft, it is tightened by means of an eyescrew. The copper pieces which bear against the shaft prevent injury and at the same

time insure a tight clamping action, so that there is no danger of the clamp slipping.

Testing Drawbars on Cars

DRAWBARS on the cars of the Milwaukee Electric Railway & Light Company are tested by coupling and uncoupling with stationary drawbars mounted on pillars between tracks at both ends of the transfer table bay. The tests are made at the Cold Spring shops. A rack on each side of the bay is equipped

A Rack Mounted on a Carhouse Pillar Between Tracks Contains Two Types of Drawbars to Which a Car on the Transfer Table May Be Coupled for Testing the Coupler and Draft Rigging

with one city type and one interurban type drawbar head. Both of these are identical in every detail with the types of couplers used on the cars. The rack is so mounted that the height of the drawbar heads on the rack is the same as the height of the drawbars on the cars.

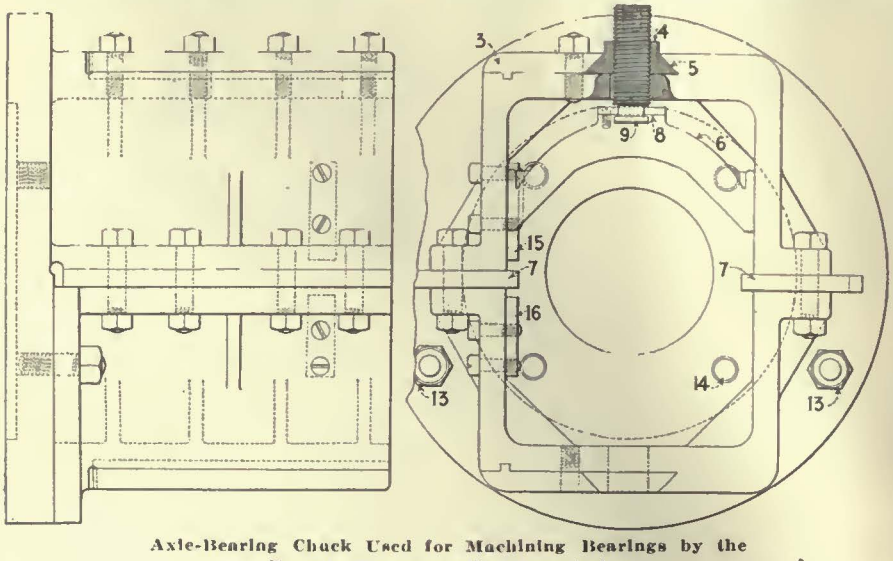
Inasmuch as all cars entering and leaving the repair shop floor are handled by the transfer table, they must necessarily pass by the racks. In this method of testing it is only necessary to stop the table at the proper place to line up the drawbars. Coupling and uncoupling are accomplished in the usual manner, the car being moved back and forth on the transfer table under its own power.

It has been found that visual inspection, or inspection with especially designed gages will not always disclose defects in the draft rigging, so that a more reliable system was needed. This practical method of testing by actually coupling with stationary drawbars has proved very reliable and actually discloses irregularities in the coupling devices which would be difficult of detection by any other system.

Lathe Chuck for Axle Bearings

THE difficulty frequently experienced in chucking axle bearings for boring is overcome in the Hillcrest shops of the Toronto Transportation Commission by use of a special chuck, shown in the accompanying illustration, which holds the bearing securely for reboring. The self-centering arrangement makes adjustment easy and saves much time and labor.

The chuck is bolted to the face plate of the lathe by stud bolts through the holes, No. 14 in the accompanying drawing. When in position the locating pads, which are No. 7 in the sketch, have one surface on the center line of the face plate. The axle bearing when placed in position has its split surface resting on the locating pads. The clamping screw at the top is then screwed down, which forces the clamping body down so as to hold the bearing firmly in position. After this has been done, the clamping screw is held firmly by the nut No. 5 and also by a nut clamp No. 3, which prevents any loosening.

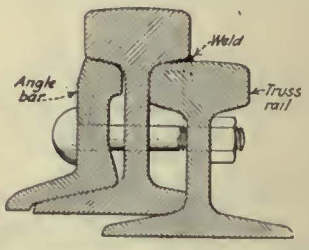


Axle-Bearing Chuck Used for Machining Bearings by the Toronto Transportation Commission

(3) Cast-iron nut clamp, (4) clamping screw, (5) bronze nuts, (6) cast-iron bearing clamp, (7) locating pads, made of tool steel, (8) retaining plates of machine steel, (9) tool steel wearing plates, (13) chuck studs, (14) face-plate studs to hold chuck in position, (15) top key, (16) bottom key.

Truss Rail for Repairing Rail Joints

ABOUT 200 rail joints with angle bars worn so badly that they did not give proper support were reconstructed by the Lincoln Traction Company, Lincoln, Neb. They were repaired by using a 6-ft. length of scrap T-rail of the same section as the rail to be repaired. The section of rail was drilled with the same spacing of holes as the angle bars, and was then driven under the out-



Truss Rail Construction Used for Repairing Worn Joints

side at the joint as is shown in the accompanying illustration. One angle bar was used on the inside of the joint which was bolted through the running rail tightly to the truss rail. In addition, the two rail heads were welded along the seam. This made a very firm joint almost equal to continuous rail. The length of the truss section was sufficient to rest on four ties.

Precautions in Replacing Field Coils

THE following points are well worth following while overhauling or repairing the field windings of railway motors:

1. The field coils and motor frames should be cleaned and painted.

2. Care should be used to make certain that field coils are placed properly in the frames, so as to give the proper polarity.

3. The use of a winding diagram will aid the man who is connecting the field coils, and assist in preventing wrong connections.

4. The polarity of each pole should be checked after coil is installed.

5. Where coils are connected by means of cable leads, connections between coils should be made by butting the ends together and then covering the joint with a copper sleeve, which is soldered in place.

6. When coils have terminals, the end of the cable which fits into the terminal should have a metal sleeve soldered over the wire. This will prevent damage to the ends of the wire and insure a tight connection when the terminal screws are in proper position.

7. The ends of cables which connect to brush-holders should also be provided with metal sleeves or terminals that can be securely clamped and locked to the brush-holder casting.

8. All wiring around the frame should be securely anchored to the frame to prevent vibration and keep the insulation from being rubbed or cut by rotating parts.

9. Motor leads coming out of the frame should be protected by insulated bushings.

10. Coils should be spring-supported, and where necessary they should be backed up by washers of either metal or fiber, well painted.

11. Springs and washers should be taped temporarily to the coils while they are being replaced in order to keep the parts from working out of place and getting in between the pole and pole seat during assembly.

12. The surface of the pole and pole seat should be cleaned carefully in order to insure a good close fit when the bolts are drawn up tight.

13. A lock washer should be placed under each nut, and white lead added over the nut after tightening to prevent the entrance of water.

14. Poles should never be pounded into place with a sledge. The use of a wooden block or piece of soft metal will prevent damage.

15. After assembling, the poles should be sounded with a small hammer to insure that they are drawn up tight.

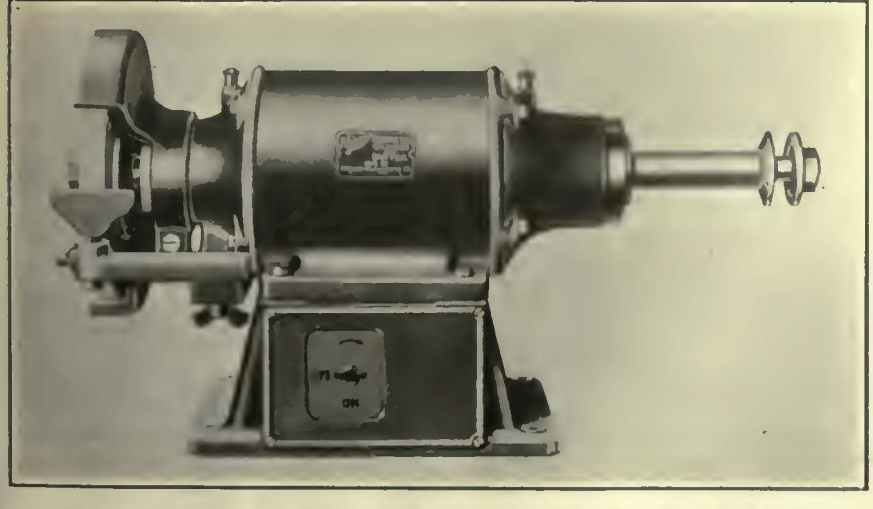
16. Where dipping and baking are carried out, best results are obtained from dipping and baking the entire frame after the coils are in place.

New Equipment Available

Grinding and Buffing Machines

A COMBINATION grinder and buffer of bench type and with floor-stand combination is being placed on the market by the Hisey-Wolff Machine Company, Cincinnati, Ohio. The bench machine is made in ½-hp. and 1-hp. sizes and is designed with an open type of spindle extension. The floor type machine is also made in ½-hp. and 1-hp. sizes, but is regularly furnished with encased spindles. These machines can be used for a large variety of shop work requiring the use of a grinding wheel, buffing wheel, wire brush or rotary wire rasp wheel. The machines with encased spindle are fitted with four ball bearings, while the open-spindle machines require only two. All bearings are completely inclosed, and are provided with heavy felt washers on each side of the bearing housing to keep out dust and grit.

The spindles are unusually heavy and are made of high-grade steel, accurately ground. Flange washers are machined all over to provide accurate balancing. All inner flanges are firmly keyed to the spindle, but can be removed easily by hand. The machines are furnished with either direct or alternating current motors.

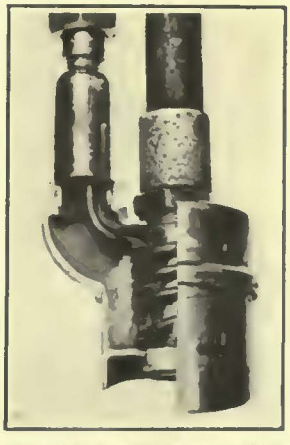


This Bench Type Combination Grinder and Buffer Has an Open Spindle Extension

Electric Sandpipe Heater

A TYPE of electric sandpipe heater for use on electric cars and locomotives to keep the lower end of the sandpipe dry and prevent clogging is being marketed by the Universal Electric Sandpipe Heater Company, Philadelphia, Pa. This heater is

Electric Sandpipe Heater as Installed on Locomotive



Section of Sandpipe Heater Showing Interior Construction

arranged to screw into the end of the sandpipe and a separate connection is provided for the conduit which carries the electrical connections. Standard armored cable can also be used. The function of the device is to keep the end of the sandpipe dry, as in stormy weather wet sand will not flow freely from the lower end of the sandpipe and the particles which stick to the sides of the pipe will eventually close the outlet.

The method of mounting and the construction of the device are shown in the accompanying illustrations. Inside the shell of the main heater

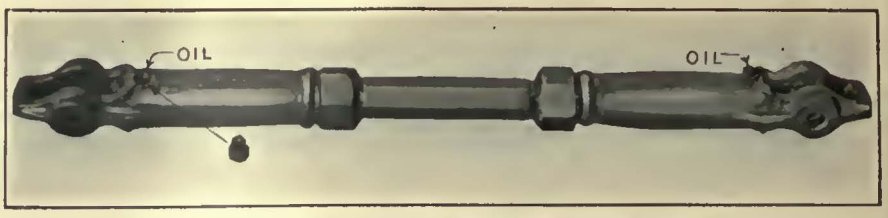
casting and around the lower end of the sandpipe is fitted the heating element. This consists of a length of Nichrome wire inclosed in but insulated from a metallic tube. This heating element is bent to a spiral form so as to surround the sandpipe, and the two leads for electrical connections are brought out through a separate opening in the casting. The heating element is made by the General Electric Company, Schenectady, N. Y.

When installed on electric cars or electric locomotives, the heating element is connected in series with one of the lighting circuits. The voltage and amount of current which passes through the element are thus reduced without the necessity of providing an additional external resistance.

A dependable flow of sand is essential to safe operation of electric cars and this sandpipe heater overcomes the difficulty of stoppage due to moisture and freezing conditions.

Lubricated Brake-Rod Casting

A FORM of brake-rod casting used by the J. G. Brill Company, Philadelphia, Pa., for the past two years on its type 79-E truck is now being applied to pivotal trucks wherever possible. In the design of this casting the lever end is closed so as to provide an oil chamber, access to which is through an opening tapped in the top of the casting. With the lever end closed the threaded brake rod is protected from dirt, water and snow. Being lubricated, it is safeguarded against rust. These advantages will be readily appreciated by the railway operating men as difficulties due to brake rods rusting tight are prevented and brake adjustments can be made more easily.



Closed Brake-Rod Casting with Provision for Lubrication

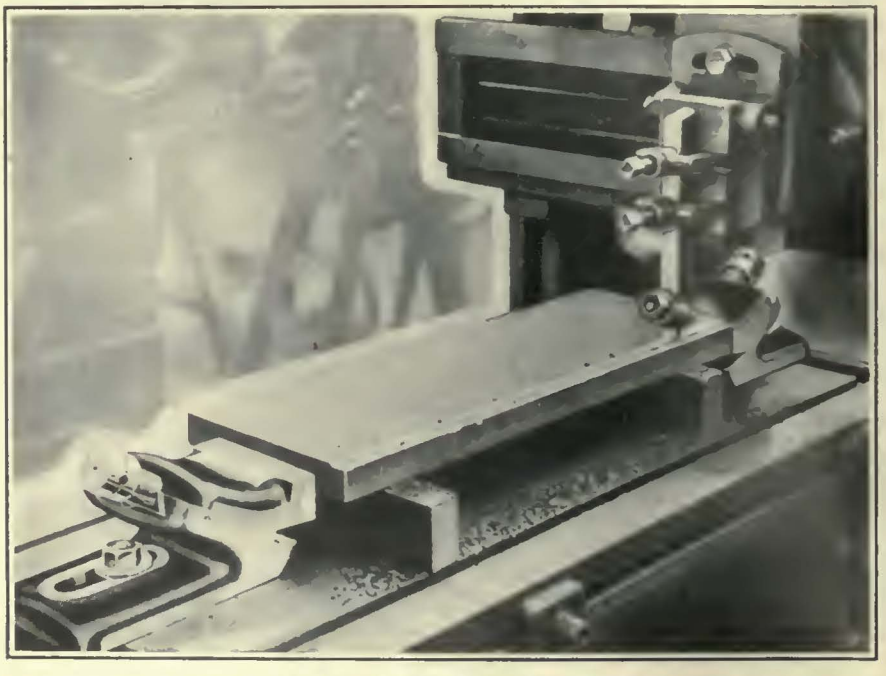
Divided Machine Vise

IN ORDER to overcome difficulties from clamping irregular shaped pieces for work on various machine tools, the Coats Machine Tool Company, New York, N. Y., has developed a divided machine vise. It is designed to hold tapered or irregular work in a parallel position and combines adjustability in height with an unlimited span. Through use of a compound parallel and downward movement of the jaws, the work is bedded on its support and eliminates the use of a hammer. The downward thrust of the jaws also permits the clamping of comparatively thin plates, so as to keep them lined up accurately on their packing pieces.

The body and jaws of the vise are made of close grained cast iron and the jaws are faced with hard steel serrated surfaces to insure a good grip. Screws are of steel and have right and left-hand threads, the left-hand thread running in a solid nut on the moving jaw, and the right-hand thread in the nut which is secured to the body. Each revolution of the screw produces a movement of the jaws equal to twice the pitch of the screw.

The jaws can be used either singly, in pairs, or in threes or fours, where necessary to clamp irregular shapes firmly. They may be placed in an offset position, as is frequently required by the shape of the work. Their main field of usefulness in electric railway shops is on the tables of planing, milling, drilling, shaping and slotting machines.

The vises are made in three sizes, with the width of jaw ranging from 2½ in. up to 10 in. and the diameter of the screw from ½ in. to 1½ in. The approximate weights per pair are 6 lb., 40 lb. and 220 lb. respectively, which takes care of all sizes of irregular work.



Divided Vise Clamping Work on Planer for Machining

Controllers for Shop Motors

AMONG the recent developments in control equipment for shop motors are three new types of starters being marketed by the General Electric Company, Schenectady, N. Y. These include an inclosed magnetic switch for starting two and three-phase alternating-current motors and two types of automatic starters for synchronous motors, one for full-voltage starting and the other for reduced-voltage starting.

With the inclosed magnetic switch, overload protection is provided by means of a relay which follows the heating curves of the motor. This switch can be operated by push button, pressure governor, float switch or similar device, and when used as a primary switch the only accessory needed is a drum switch.

Special features of the automatic starter include a temperature overload relay for close protection of the motor from overload, and a definite time relay which determines the accelerating period.

Association News & Discussions

Southern Equipment Men Meet in Dallas

Ways to Reduce the Number of Pull-Ins, Car Painting, Education of Mechanical Employees, and Motor Maintenance Were Among the Subjects Discussed

A VARIETY of practical questions was discussed at the seventh semi-annual meeting of the Electric Railway Association of Equipment Men, Southern Properties, held in Dallas Jan. 21, 22 and 23. On the second day a joint meeting was held with the mechanical division of the Southwestern Public Service Association, and on the third day a trip was made to Fort Worth on the invitation of the Northern Texas Traction Company to inspect the shops.

A new system of overhauling cars on a 40,000-mile basis at New Orleans was described by R. M. O'Brien. This plan was outlined in ELECTRIC RAILWAY JOURNAL for June 21, 1924. Mr. O'Brien said that it is costing the New Orleans Public Service, Inc., $75,000 to start the system. In this is included the cost of extra parts, such as extra trucks, extra motors and extra line breakers. These will be changed every 40,000 miles. When cars are brought into the shops for overhauling, other trucks will be ready and other motors, line breakers, etc. The old equipment will be sent to be repaired by the practical railway shopmen and then to be tested by an engineer. The motor going out of the shop will be in as good condition as when first it came from the factory, Mr. O'Brien said. This new system is expected to result in a saving of about $450,000 per year.

After considerable discussion as to what really constitutes a "pull-in" the following definition was adopted: "A car which has to be removed from service prior to the completion of its regular prescribed run for any mechanical, electrical or man failure or accident will be termed a pull-in."

CAR PAINTING METHODS

Speaking on the subject of car painting, A. Taurman said that the painting of a car being repaired or rebuilt should begin when the parts are being assembled. In the painting of new steel cars, the inspector should pay special attention to the steel before it is assembled to see that it is carefully sandblasted and cleaned free of all dirt and grease, and that the primer is placed on this steel immediately after it has been sandblasted before rust has an opportunity to begin. He should also see that all concealed parts are painted before the steel is assembled.

Similar care should be exercised, Mr. Taurman said, in the assembling of wooden parts. All joints should be carefully white-leaded and all surfaces that are covered up or lapped should be given a coat of paint. As a strictly preservative precaution, the painting of the concealed parts adds more to the life of the car than any other detail of painting. Most painters, however, are prone to pay more attention to the finished and exposed surfaces than to the hidden parts. After all surfaces have been thoroughly primed and all creyices, cracks, nail and screw holes puttied up, the appearance of the finished job will be much better if all uneven parts are sanded off smoothly.

While it is very essential to have the best material possible, too much thought cannot be given to the manner in which the painting is done. The surroundings and temperature of the paint shop are very important items, Mr. Taurman said. The paint shop should be kept warm and as dry as possible at all times. In fact, it is much better to have the cars thoroughly dried out before the painting is begun. Good results can be obtained from a number of the standard painting systems, and enamel has good features, too, Mr. Taurman thought, especially because it saves time. Flat color and varnish, however, are preferred by him because it is possible to use more varnish than with the enamel system.

EDUCATING SHOPMEN

Effective methods of educating the employees in the mechanical department were considered at length. Mr. Taurman said that the best way was to arouse the interest of the men, and to inform them of what the company is trying to do. This makes their work easier and more pleasant. The practice of the Shreveport Railways, according to C. D. Rushing, is to explain to every man his mistakes. This company also urges its employees to read ELECTRIC RAILWAY JOURNAL and other publications. If any employee has a good suggestion, the company is glad to try it. Putting a new man with an old man who is familiar with mechanical work is recommended by I. E. Kinser. Ideas along somewhat the same lines were outlined by W. Silvus, C. B. Lane and J. J. Vaughn.

In Fort Worth, the Northern Texas Traction Company has night classes for mechanical men. The I. C. S. course is taught to the employees at classes held two nights a week. If a man finishes his course, he is reimbursed for the cost, according to J. T. Porter, but if he does not finish it, he must stand the expense himself. Advantages of the I. C. S. courses and other vocational training courses were described by H. C. Pressler and W. W. Holden.

Mr. O'Brien stated that he holds a meeting of the foremen once a month. At this meeting they select some one subject and discuss it. Mr. O'Brien displayed a textbook which is furnished to every man in the mechanical department of the New Orleans Public Service, Inc. The men are allowed to take these books home to study. Good results have been obtained by this means, he said.

Having few pull-ins is a good indication that the equipment is well maintained, in the opinion of Richard Merriweather, vice-president and general manager Dallas Railway, who addressed the meeting. The Dallas Railway has profited by belonging to the Electric Railway Association of Equipment Men, Scuthern Properties, he said. Records of pull-ins during the past 3 years indicate that this company is progressing, and it is due to the fact of belonging to the association, he believes, because attention was thereby directed to the matter of pull-ins.

Mr. Meriwether also emphasized the importance of educating the shop men. It makes very little difference how good a mechanic the man at the head of the equipment department may be; if he is not an executive and cannot organize his forces and inspire them in a way to get the best work from them, he is a failure. Although he may be the best mechanic in the world, he is worth nothing to his company unless he has ability as an organizer. Work in the mechanical department is likely to get stale unless the interest of the men is maintained. A man working at a bench gets into a rut easily, but education will go far to develop him and push him along, Mr. Meriwether said.

MOTOR VENTILATION STUDIED

Methods of installing exterior ventilators on non-ventilated railway motors were described by Mr. Rushing. His company has installed a ventilator furnished by the Westinghouse Electric & Manufacturing Company on the commutator end of Westinghouse No. 306 motors. Two cars were equipped in this wny 5 months ago and a recent inspection showed that the motors were in much better condition than the motors without ventilation. A new shaft is furnished with the commutator end tapered to fit the new housing necessitated by the ventilator. As far as ventilation is concerned Mr. Rushing said that it is entirely satisfactory and the motor is much cleaner inside.

Considerable variation in the period of inspection among the different companies was indicated by the discussion on this subject. The frequency when based on mileage varied from 500 to 2,000 miles. Companies making inspection on a time basis generally do so every 7 days, but a few use 8 or 10 days as the inspection period.

A brush-holder designed by the Westinghouse Electric & Manufacturing

Company to prevent dirt getting in between the brush and the holder in ventilated motors was exhibited by W. C. Looney. He said that by using this brush-holder the Houston Electric Company had increased the mileage from 1,500 to more than 8,000.

The comparative life of armatures as a result of dipping and baking was discussed. Mr. Taurman said that his company got three times as much life out of armatures that had been dipped and baked. F. Wampler said that the Cincinnati, Newport & Covington Railway had been obtaining an average life of 76,000 miles per armature before dipping and baking and that this had been increased to 342,000 miles. M. B. Osborne estimated that this process doubles the life of armatures. Mr. Pressler agreed with this view and W. K. Curtis estimated the increase in efficiency at 20 per cent.

The frequency with which it is necessary to renew motor leads developed considerable divergence of opinion. Estimates of their useful life varied between 4 and 10 years.

At the end of the Thursday afternoon meeting officers were elected for the coming year. The present officials —A. D. McWhorter, president, and A. Taurman, vice-president and secretary-treasurer—were unanimously elected. On the invitation of J. M. Kington it was decided to hold the next meeting of the association in Knoxville, Tenn., on July 22, 23 and 24.

Members present at the meeting were: A. D. McWhorter, A. Taurman, G. D. Rushing, E. D. Wright, Frank Wampler, E. W. Jenkins, F. T. Dawkins, W. Silvus, I. E. Kinser, W. H. Curtis, J. J. Vaughn, R. M. O'Brien, J. M. Kington and J. L. Brown.

L. B. Stillwell to Head Engineering Foundation

AT THE 10th annual meeting of the Engineering Foundation board, held in New York recently, L. B. Stillwell was elected chairman of the Foundation. He succeeds C. F. Rand, who declined re-election after serving for 5 years. E. D. Adams, who has been first vice-chairman since 1915, was re-elected to that office. E. A. Sperry was chosen second vice-president. Other officers named were: Treasurer, J. S. Langthorn; assistant treasurer, H. A. Lardner; director and secretary, A. D. Flinn.

Mr. Stillwell is a past-president of the American Institute of Electrical Engineers and the American Institute of Consulting Engineers. He is a member of the American Society of Civil Engineers, the American Engineering Council, the National Academy of Sciences, the Institution of Electrical Engineers of Great Britain, the Royal Society of Arts of Great Britain, the American Philosophical Society and the Franklin Institute. He is also a trustee of Princeton University and a director of the United States Chamber of Commerce. For several years he was connected with the Westinghouse Electric & Manufacturing Company. Later he was identified with the electrification of the Manhattan Elevated Railway and the rapid transit systems in New York city and elsewhere.

Announcement was made at the same meeting that the four founder societies of civil, mining, mechanical and electrical engineers had begun the study of plans to increase the endowment of the Foundation, established by Ambrose Swasey with a gift of $500,000, and recently supplemented by a bequest of $50,000 under the will of Henry R. Towne.

Hoover Sees Progress in Highway Safety Program

REAL progress toward better control of traffic to prevent accidents has been made since the recent conference on highway safety, according to Herbert Hoover, Secretary of Commerce. On this subject Mr. Hoover said:

"Legislation to improve safety on the highways has been introduced into 38 state legislatures since Jan. 1. The various classes of legislation and the number of states in which each class has been introduced can be summed up as follows: Licensing of drivers, 11 states; driving while intoxicated, 17; failure to stop after accident, 6; speed, 12; impounding or confiscation of the car as a penalty for violations of the motor vehicle law, 2, and for transporting liquor or other illegal use, 7; compulsory stopping at railroad crossing, 12 (one legislature is considering a bill to repeal an existing railroad crossing stop law); certification of title, 10; compulsory automobile insurance or bond, 20.

"Recently a law has been introduced in one state legislature amending a law of 1858 with regard to 'the passage of each other by vehicles on the highway,' thus showing that the traffic problem is by no means a new one.

"This legislation, if adopted, will increase to 23 the number of states which require that all drivers of motor vehicles shall be licensed. Fourteen more states will require licenses for drivers of vehicles for hire, while there would remain 11 states without operators' license laws of any kind. Twenty-two states will require some sort of examination before the issuance of license to the applicant.

"In addition to state activities, movements are being started in a large number of cities for carrying out the recommendations of the conference for the co-operative organization of communities for public safety. While many of these cities have had safety programs in the past, these are being revised and an effort is being made to have them conform to the national program as far as local conditions will permit.

"At the present time 12 states have laws requiring the certification and registration of automobile titles, while similar laws are being introduced in the present sessions of the legislatures of four others. The conference designated this class of legislation as 'one of the most important and effective means for reducing thefts, and, by virtue of this result, owing to the relation between the theft and accident hazards, also a measure for improving the present public accident situation."

Pacific Claim Agents' Association

THE next meeting of the Pacific Claim Agents' Association will be held at the Hotel Biltmore, Los Angeles, Cal., July 22 to July 25, inclusive. This date was set at a meeting of the executive committee of the association, held at the offices of the claims department of the Market Street Railway, San Francisco, on Feb. 14. A tentative list of subjects follows:

"Will Periodical Physical and Mental Examinations of Trainmen Reduce Accidents? How Often Should These Examinations Take Place and What Should Be the Scope of Such Examinations?"

"Methods of Facilitating Vehicular Traffic in Cities."

"The Advantages and Disadvantages of Presenting Claims Against Automobile Owners and Others Responsible for Damage to Company Property."

"Perfecting Plans for Reference so that the Claims Department in an Emergency Can Be Readily Enlarged to Meet Any Catastrophe that May Arise on Company Property."

"Training of Men for Positions as Investigators and Adjusters."

American Association News

A. E. R. A. in New Quarters

NEW OFFICES are now being occupied by the American Electric Railway Association. They are in the Johns-Manville Building, 292 Madison Avenue, New York, at the southwest corner of East 41st Street. The move from the former quarters at 8 West 40th Street was made over the holiday which included Feb. 23. The change was made with great celerity.

The space now occupied comprises the whole 14th floor. The quarters are plainly but comfortably and efficiently furnished and arranged. Partitions, the upper half of which are glass, separate the various offices. The lighting system is semi-direct. As for the building itself, it is about 5 minutes walk from the Grand Central Terminal, 3 minutes from the subway system and surface lines, and close to the Engineers' Club and the Transportation Club.

More than 2 years ago the former office space became overcrowded, and the association took over two additional rooms on the same floor. The volume of work continued to increase, and a year ago additional space was taken on the fifth floor of the building. This arrangement was not satisfactory since it separated the Bureau of Information and Service from the rest of the headquarters, but it was the best that could be done at the time.

L. S. Storrs, the new managing director of the association, will have his headquarters in the Johns-Manville Building, but their location has not been definitely determined. His suite, however, will probably be on the 12th floor of the building, the one immediately below the floor now occupied by the other officers of the association. There is no 13th floor.

The News of the Industry

Home Rule for Buses Up Again in Ohio

The hearing before the Public Utilities Commission of Ohio on the applications of the People's Motor Bus Company and the Cleveland Railway for operating rights in Cleveland, scheduled for Feb. 11, was postponed indefinitely to give the State Legislature, now in session, a chance to consider amendments that have been proposed to the existing law under which the operation of buses is regulated. One of these amendments will take control of motor bus transportation in cities and in municipalities contiguous thereto from the State Public Utilities Commission and place it in the hands of the local governments. A bill to do this has already passed the State Senate, and lacked but one vote of passing the House on Feb. 19. On reconsideration the measure was to come up again during the week ended Feb. 28.

Unlawful for City to Pass Ordinance Against One-Man Cars

Judge Isaac Wolf in the Superior Court at New Haven, Conn., recently granted a permanent injunction restraining the city of New Haven from interfering with the operation of the one-man double-truck trolley cars used by the Connecticut Company in that city.

In handing down his decision Judge Wolf made it plain that the issue did not involve whether the ordinance in question should be adopted and enforced upon the ground of public convenience and safety, but merely whether the city by provisions of its charter is vested with power to pass such an ordinance. The city protested the operation of the one-man double-truck trolleys with "An ordinance to prevent accidents, facilitate traffic and preserve good order in the streets of the city and highway districts and to secure the safety of persons using said streets."

No Abandonment on Five Lines in Buffalo

The Public Service Commission issued an order directing the International Railway not to abandon service on Feb. 22 on five of its local lines in Buffalo as had been threatened.

In a conference with members of the Public Service Commission in New York city 48 hours prior to the time the abandonment order was to go into effect Coleman Joyce, chief counsel for Mitten Management, Inc., although consenting to withdraw the order, said that no court or commission could force the company to undertake the operation of a non-paying enterprise and that the International Railway has been operating its system at an annual loss of $660,000. The commission, however, issued a mandatory order directing continued operation of the five lines which were scheduled for abandonment.

One-man cars were placed in operation on Feb. 22 on three additional lines in Buffalo—Niagara Street, Broadway and Elmwood Avenue. These are three of the heaviest patronized lines in the city. The economy program was announced by the company in a brief statement to car riders.

There is now pending before the Public Service Commission an application of the company for a higher rate of fare and a similar action is pending whereby the city seeks to have the fare reduced to 5 cents. The present fare is 7 cents or four tokens for 25 cents. A rate of 8 cents cash with two tickets for 15 cents has been suggested.

The International Railway is considering the abandonment of the Main Street car line in the city of Niagara Falls and has asked for a 7-cent fare or four tokens for 25 cents in that city. The company now charges a 5-cent fare in Niagara Falls.

Bus Report Presented in New York

Transportation Board Makes Suggestions for Guidance of City—Routes for Private Operation Recommended—Many Railway Companies Seek Operating Rights

THE Board of Transportation of New York City filed with the Board of Estimate and Apportionment on Feb. 20 its second report on the pending petitions for omnibus franchises in the city of New York. The report deals with 80 applications by 52 corporations or individuals, many of them local railway companies, for franchises to operate 113 routes.

The report was made in response to a resolution of the Board of Estimate on Nov. 3, 1924, requesting the Board of Transportation to conduct a further examination and investigation of all applications for omnibus lines in the five boroughs and to embrace in the report information which the Board of Transportation deemed should be in possession of the Board of Estimate for its guidance in considering omnibus franchise applications.

If the right of the city to own and operate omnibus lines is upheld a series of routes and lines that may properly be established in all the boroughs is laid out and recommended in the report. If the right of the city to engage in municipal operation of omnibus lines is denied, it is recommended that a grant, either in the form of a permit or a franchise, be made to petitioners desirous of providing such operation. In this event, the board believes a definite plan of routes and franchise conditions should be considered so that all those seeking franchises may have a standard form of application and the Board of Estimate have for its consideration proposals that are comparative and competitive.

The report points out that if the city cannot undertake municipal omnibus operation the Board of Estimate could tentatively, at least, approve the routes and the form of proposed franchise and invite applications which would be uniform.

As a basis for standard proposals for franchise grants the board recommends that the following factors be adhered to:

(a) Duration of franchise.
(b) Fare to be charged and transfer conditions.
(c) Compensation to be paid to the city for the franchise.
(d) Service or headway to be offered at the beginning of operation.
(e) Type of vehicle to be employed.

In its treatment of the question of fares the report states:

> Most of the petitioners for omnibus franchises express willingness to operate and maintain service for a 5-cent fare. Some offer to grant transfers for that fare without extra charge for transfer, and others stipulate that a charge shall be permitted for transfers. Others of the petitioners, including some of the surface railroad corporations and the corporation that now operates a comprehensive omnibus system in Manhattan under perpetual franchise and temporary permits for a 10-cent fare, demand a 10-cent fare for longitudinal or trunk line service, with a 5-cent fare for crosstown or short route service. Those corporations that offer service for 5 cents are for the most part newly created, and some of them are not at present in the transportation field. There is no present reason, however, to question their financial ability to carry out the proposals submitted.
>
> Records of omnibus operation in this city and elsewhere show that such operation is being maintained over certain routes for a 5-cent fare. On some routes the return for a 5-cent fare may be inadequate because of light patronage or length of haul, but for a system embracing both short and long haul traffic several of the petitioners state that they are prepared to operate for a 5-cent fare.

The report indicates that the estimated initial cost of equipping and housing 1,259 buses will be approximately $11,000,000, of which $3,000,000 will be for garages. The estimates for bus equipment are:

	Buses	Cost
Manhattan	439	$3,130,900
Bronx	73	497,100
Brooklyn	422	2,743,000
Queens	325	2,112,500
	1,259	$8,483,500

In dealing with the cost of operation the report says:

> From most carefully compiled statistics it would thus appear that in order to meet all necessary expenses on the basis of a 5-cent fare eight or more passengers per mile must be carried, or "picked up," for double-deck service and six or more passengers per mile for single-deck service.

Forty of the 52 corporations or individuals that have petitioned for bus franchises seek to obtain grants for single routes or for from two to six routes. These applications are classified as miscellaneous largely for the reason that in many cases the routes are disconnected or that generally no comprehensive system of bus transportation is indicated by the applications.

Among the applicants for bus routes to be operated in conjunction with existing rapid transit lines are the Brooklyn-Manhattan Transit Corporation, the New York Railways and the Staten Island Rapid Transit Railway.

The application of the New York Railways discloses that the company proposes to abandon 20 miles of trolley lines and substitute 40 miles of bus routes. The railway officials suggest payment of $5,857,577 out of omnibus earnings in return for discontinuance of surface railway property that cost originally $7,857,405. Part of the surface railroad track proposed to be paid for under this amortization scheme has been unused and practically abandoned for some time past. It is estimated by the company that the salvage that will accrue to it from sale of this scrapped surface railroad property will be 5 per cent of original cost. Franchise rights are asked for practically 100 per cent more mileage for omnibus service than it is proposed to discontinue as surface railroads.

While a 5-cent fare can only be charged for railroad operation, a 10-cent fare is proposed for longitudinal or trunk lines of omnibuses. The only free transfer proposed in connection with omnibus service is from 10 cent lines to 5 cent lines.

The Interborough Rapid Transit has not filed formal application for a bus franchise, but the company has expressed a desire to operate crosstown or other feeder lines as may be agreed upon for a 3-cent fare. The Third Avenue Railway, operating in Manhattan and the Bronx, has also signified its willingness to run buses.

Express Bus Service Between Fairmont and Morgantown

De luxe express bus service between Fairmont and Morgantown, W. Va., is being planned by the Monongahela-West Penn Public Service Company as an added feature to its Morgantown-Rivesville service. If the State Road Commission concurs in the arrangement, the service will be started in about 6 weeks.

A modern Fageol bus of 25-passenger capacity has been purchased and the contemplated schedule provides for four or more round trips each day with running time between the two cities 1 hour and 15 minutes.

Bus Lines Will Supplement Railway in Minneapolis

Although it has been ruled that a proposed ordinance granting the Minneapolis Street Railway, Minneapolis, Minn., an exclusive franchise to supplement its trolley system with bus lines will require a special enabling act from the Minnesota Legislature the city attorney holds that by agreement Council may require the company to establish certain bus lines. The company now is operating buses between the Twin Cities and between St. Paul and Stillwater, Minn., a suburb.

The railway expects to spend $500,000 for bus equipment after the ordinance is passed, in addition to buses already planned to fit ordinances already effective and those now in service in north Minneapolis. A garage will cost $100,000 additional. Universal transfers will be given, but the bus fare will be higher than the car fare, which is 6 cents.

Chicago Mayor Wins

Prospects for $600,000,000 Traction Program Believed to Be Enhanced by Election on Feb. 24

Mayor Dever and Samuel Insull have agreed on $85,000,000 as the price to be paid by the city for the Chicago elevated lines. The conclusion of the deal was announced on Feb. 25, after 8 months of dickering. The compromise was reached the day after the forces aligned behind Mayor Dever had succeeded in electing an outright majority of the City Council to back up his $600,000,000 traction ordinance. This measure called for the construction of elevated lines by the city in the event that a deal with Mr. Insull could not be arranged. The city yielded several points in the ordinance and the redraft was at once submitted to the Council for passage.

The outstanding feature of the election on Feb. 24 was the decisive approval of the policies of Mayor Dever as reflected in the results at the polls. Mr. Insull's attitude is that so urgent is the necessity for an adequate transportation plan that he cares not what the scheme may be that is proposed, provided it embodies a co-ordination of the local transportation facilities and the development of rapid transit in the largest sense of the word.

Hostility of the old ring of Chicago politicians who ran on a "5-cent fare" platform in the days of William Hale Thompson has taken a new turn in relation to the $600,000,000 Chicago traction ordinance. Governor Small has entered the arena with an order to the Illinois Commerce Commission to make a thorough investigation of the ordinance before it comes to referendum. He is also having a traction bill drafted for the Legislature.

Small acted at the behest of Fred Lundin, who "made" Thompson and had to retire from politics when the notorious Chicago graft trials broke Thompson's grip on the machine. Thompson and Lundin split. The latter now seeks to take away the foundation for Thompson's 1927 mayoralty candidacy by stealing the transportation issue.

The bill which Small is having drawn is likely to provide for the creation of a "transportation district," a tax-assessing government functioning similarly to school governments. Thompson once sponsored such a plan, but Lundin now says he was the author of it. The price of political preference is again being expressed in terms of patronage.

Rockford Mayor Awards Franchise to New Company

The city traction problem in Rockford, Ill., became acute recently when Mayor J. Herman Hallstrom cast the deciding vote awarding the railway franchise to the Rockford Public Service Company, headed by T. M. Ellis, Jr., in opposition to the Rockford City Traction Company, now operating in the city. The Council was divided eight and eight on the two franchises submitted. Final action is dependent upon a referendum at the city election on April 7.

Prior to the Council's action the Rockford City Traction Company ran a series of advertisements addressed to the public and Council in which it set forth its side of the case.

The City Traction Company for 2 years has been operating under a temporary franchise, but has been negotiating for a franchise ordinance embodying railway and bus services, and had apparently come to an agreement on terms when Mr. Ellis came forward with his offer. The Rockford City Traction Company does not consider the problem settled. W. C. Sparks, manager; F. W. Walker, representative of the bondholders, and Judge R. K. Welch, attorney for the company, issued a statement expressing surprise at the hasty action of the Council "without giving all parties interested a chance to be heard and which, if it prevails, works a gross injustice on those who now have their money invested in this property." The various steps in the Rockford controversy have been followed in the ELECTRIC RAILWAY JOURNAL.

Insurance Measure Dead in New York

Compulsory insurance for all motor vehicle owners is dead at Albany for this year at least, in the opinion of Lewis G. Stapley, chairman of the motor vehicle committee of the Assembly and chairman of the joint legislative committee on motor vehicle legislation, who presided at the hearing at Albany on Feb. 24 on the various motor vehicle bills before the Legislature.

The New York State Auto Bus Association, however, through James J. Dadd of Rochester, its secretary-treasurer, has recommended the amendment of section 282-b of the highway law, so that all motor bus concerns carrying passengers for hire would be subject to the provisions. At the present time the law excepts corporations. While the Public Service Commission is requiring liability insurance as a stipulation to the certificate of convenience and necessity this ruling is not retroactive as to old corporations. The Bus Association feels that what is fair for one is fair for another and that it is unfair to except a bus owner because he is a corporation. An amendment to the law covering this feature is expected to be introduced at an early date.

Passage of Moorhead Bus Bill Awaited

The Moorhead bus regulation bill was advanced another step toward passage in the Indiana Senate on Feb. 9. The bill would place commercial motor vehicles under the regulation of the Public Service Commission. Bus interests want their vehicles under the direction of the State Highway Commission.

The Moorhead bill was amended so as to exclude private truck owners. Another amendment made provision for continunnce of city bus lines under the control of city boards where already so established. The third amendment was to the clause taking care of existing bus companies in the matter of issuing certificates of convenience and necessity. It made that clause refer to bus lines that were in existence ninety days prior to the taking effect of the act instead of ninety days prior to Jan. 1, this year. The fourth amendment struck out the emergency clause. This will delay the enforcement of the act, if it is passed, until the proceedings of this Legislature are published, which will be some time in May. With the emergency clause attached, the bill would be in effect immediately after the Governor appended his signature.

Goldsboro to Have Buses

The Board of Aldermen of Goldsboro, N. C., recently granted an exclusive franchise to H. G. Bales, for the operation of buses beginning March 1, 1925, for a period of 10 years. Mr. Bales is president of the Highway Motor Transit Company, a concern operating buses between Goldsboro and Warsaw. Transportation will now be available to the residents of Goldsboro, who have been denied service since the Goldsboro Electric Street Railway abandoned service a few years ago.

A recent statement from the city said that the Goldsboro Electric Street Railway was no longer in existence since the city took over its holdings; that the property was now in charge of C. W. Grantham as city manager, and that the greater portion of the trackage and equipment had been dismantled. Further, it was the purpose of the city to dispose of all the equipment. The new proposed operation will consist of not less than three buses of the street car type with a passenger carrying capacity of between 20 and 27 passengers. Mr. Bales said he could loop the city with five buses run on regular schedule. The rate of fare will be 10 cents, but books of 20 tickets will be sold to school children for $1. It is said that the original investment requires $50,000.

Albany Company Seeks 10-Cent Fare

The United Traction Company, operating in the cities of Albany, Troy, Cohoes, Wntervliet and Rensselaer, N. Y., filed a petition with the Public Service Commission on Feb. 21 asking for an increase in its fares from 7 to 10 cents, effective on short notice. The 7-cent fare was fixed by order of the commission on July 5, 1922.

The petition of the company declares that the fair value of the railway now exceeds the sum of $15,000,000 and that the revenues have not been sufficient to meet the costs. A table submitted shows for 1922, from June 30, a total railway operating revenue of $1,524,814 and operating expenses and taxes of $1,461,939, leaving net operating revenue of $52,875; 1923, operating revenue, $3,234,149, operating expense, $3,084,437, with net revenue of $149,-711; 1924, operating revenue, $3,205,-856, operating expense, $3,076,247, with net revenue of $129,608, all before the payment of fixed charges and taxes.

More Bus Rights Sought in Rochester

Independent bus owners of Rochester, represented by James J. Dadd, secretary of the New York State Auto Bus Association, have petitioned the City Council for permission to operate a belt bus line over 30 streets in the city of Rochester. The proposed line will cross thirteen of the local lines of the New York State Railways, but only in a few minor instances will it parallel the railway routes. It is planned to operate with six sedan type buses.

Rochester now has virtually no cross-town lines and the proposed route circling the city would connect with all parks, golf links, etc. Its backers profess themselves willing to furnish transfer privileges with the railway.

As has been explained previously, the New York State Railways has petitioned to run buses over the Ridge Road, a route now served by Buckley & Buckley, operating under the name of the Ridge Road Bus Lines. Officials of the state bus men's association opposed this plea at public hearings. Following announcement that the Manitou railway line would suspend operation, the New York State Railways proposed to establish a network of bus lines along the lake shore serving towns along the railway. The independent owners, headed by Mr. Dadd, now propose to operate buses from Nine Mile Point to Manitou, serving virtually the same route. They have petitioned the town boards along the line for operating rights.

The Council has referred the belt line petition of the independents to a committee. Council members, it is said, are loath to authorize any competition with the New York State Railways, which operates in Rochester under the service-at-cost contract and for 4 years straight has failed to make its guaranteed return.

Expansion of the bus system of the railways is looked for as the outcome of the rivalry. Purchase of the Buckley line by the traction interests is regarded as another possibility.

Canadian Government Suggests Electrification.—Electrification of railroad lines in Quebec Province is forecast by Premier Taschereau, who recently suggested such a plan and promised that if railway companies adopted the proposal the province would do all in its power to assist. Abitibi Southern, which is now obtaining its charter, is the first road to indicate it would take advantage of government suggestion.

Question of Paving Responsibility Considered

The New York Transit Commission reserved decision on Feb. 24 on the question whether the New York Railways in its reorganization should be permitted to abandon lines on which service has been discontinued and thus probably escape responsibility for its share of the cost of repaving and resurfacing the streets when the tracks are torn up. The cost to the company, if it is held responsible, is estimated at about $500,000.

The matter came before the Transit Commission at a hearing on the form of deed of sale of the company's properties, which were sold in foreclosure proceedings last summer. In this deed from the New York Railways to the New York Railways Corporation, as the reorganized company will be known, there has been omitted the Delancey and Spring Streets lines and parts of the Avenue C, Madison Street and Sixth Avenue lines, service on which was discontinued soon after the late Job E. Hedges was appointed receiver. Under the law, a receiver can discontinue service on an unprofitable line but cannot surrender the franchise, as such action can only be taken by the directors of a solvent company.

Assistant Corporation Counsel Edgar J. Kohler objected to approval of the deed without the inclusion of the discontinued lines. Mr. Kohler said that the Manhattan Surface Coach Company, which he said was a subsidiary of the New York Railways, had applied for bus franchises on the streets occupied by the discontinued lines and contended that the company wanted the city to stand the entire expense of resurfacing the streets and then permit its subsidiary to operate buses upon them.

George H. Stover, assistant counsel of the commission, also opposed the approval of the deed without inclusion of the discontinued lines. Joseph P. Cotton, counsel for the company's reorganization committee, advocated approval of the deed, as did Hugh J. Sheeran, the present receiver.

Madison Company Adopts Bus as Auxiliary

The Madison Railways, Madison, Wis., will begin on March 1 the operation of a bus line from the Capitol square to the residential district of Nakoma. This will be its first experience in the operation of buses as an auxiliary. Dudley Montgomery, vice-president of the railwny, announced that three street car type buses, seating 29 passengers, would be purchased from the Yellow Coach Manufacturing Company, Chicago. The proposed schedule provides for 25 trips each way daily. It is believed that as traffic warrants bus lines will be established in other parts of the city.

Some time ago the Wingra Bus Company, Madison, applied to the Common Council for an exclusive franchise to operate buses in the city. With the proposed activity in the bus field by the railway it is generally thought that this application will not be favorably acted upon.

News Notes

Fare Increase Deferred.—The Cleveland Railway, Cleveland, Ohio, has postponed the raising of car fares from 5 to 6 cents in Lakewood, a suburb, in accordance with a recent agreement with that city. This action was taken by the railway in view of the attitude of the City Council of Cleveland in refusing to approve the change, even for a year.

Considers Improved Service in Remote Sections.—The City Council of Portland, Ore., in a public hearing, recently discussed the problem of improving railway service in remote sections of the city, especially in the St. Johns district. F. I. Fuller, vice-president of the Portland Electric Power Company, stated that his company was willing to co-operate in any way that would give the patrons of the district the best service. He called attention to the fact that last year 4,500,000 passengers were carried on the line, with receipts of more than $250,000. The report of Commissioner Mann on proposed improvements was heard. Mr. Fuller stated that the improvements suggested in the report would cost more than $250,000, but believed the service should be given.

Must Explain Platform Extension Neglect.—The Chicago Rapid Transit Company, operating the elevated lines in Chicago, has been cited by the Illinois Commerce Commission to explain the failure to lengthen the elevated platforms in the loop district as authorized by the commission. The company has an application pending with the city for permission to extend the platforms, but action has been delayed for the last 6 months pending negotiations between Samuel Insull and Mayor Dever over the purchase of the elevated lines. The city has final jurisdiction.

Bus Operator Protests Grant to Railway.—The Columbus & Marysville Bus Company, Columbus, Ohio, has filed a protest with the State Utilities Commission against granting the Columbus, Urbana & Western Electric Railway a certificate to operate a bus line over Riverside Drive from Fishinger's Bridge, 8 miles north of Columbus, to the center of the city. The protestant claims that residents in the community north of Columbus have easy access to the city on its buses, also on city street cars and on Columbus, Urbana and Western interurban cars. There is not enough business for two bus lines, the complaint says.

Traction Solves Puzzle.—There will be no more unmerciful chewing of innocent lead pencils over a lost word on the de luxe trains of the Illinois Traction System. Cross-word puzzle dictionaries have been installed in the parlor car coaches of the Capitol Limited, the de luxe train running between St. Louis and Peoria. The sleeping car Illini, from St. Louis, Decatur and Champaign, which has reading tables, will also be equipped. The old faithful game of "rummie" is becoming a lost art among railway passengers. Every one is working cross-word puzzles, so the company is supplying dictionaries to solve its patrons' puzzles.

Bus Service Grows.—Another Pierce-Arrow de luxe passenger coach has been placed in service on the Niagara Falls - Lewiston - Queenstown route of the Gray Bus Line of Niagara Falls. This is the second of these buses placed in service over the Niagara Scenic Highway since the Niagara Falls Power Company took over the Niagara Gorge Railway, which controlled the Gray Bus Line. The company's buses are painted a very light shade of gray with vermilion trim.

Use the Trolley and Save Money.—The fact that the price of gasoline has increased in Detroit more than 44 per cent since the first of the year is pointed out by officials of the Detroit Department of Street Railways in placards on all municipal cars which carry the sign "Gas up 44 per cent; save by trolley." With the price increases put into effect by the gasoline producers and the 2-cent gasoline tax, which recently went into effect in the state when the bill was signed by Governor Groesbeck, D. S. R. officials have used the placard to advise motorists to save by using the trolley cars for city riding and leaving their automobiles at home.

Substitution of Municipal Buses for Private Ones Approved.—Plans for the operation of buses by the Seattle Municipal Railway on Tenth Avenue Northeast and branch lines in the University district have been approved by D. W. Henderson, superintendent of railways, who expresses the belief that the buses in time would yield a profit. The buses will replace those now being operated by a private concern. Under the present private operation patrons of the buses pay 10 cents cash fare with transfer, the city receiving 2½ cents of this amount. If the city takes over the buses the fare will be reduced to 8½ cents, with transfer privilege to the street cars.

Three-Cents-a-Mile Tickets Valid.—The Public Service Commission has approved a new regulation of the Buffalo & Erie Railway, Buffalo, N. Y., providing for the sale at all ticket offices of the company of books, each containing two one-way tickets, valid for transportation of persons presenting ticket between points named on ticket, at 3 cents per mile per trip. No ticket will be sold for a distance of less than 5 miles. This ruling became effective Feb. 20.

Contract Approved.—An application filed with the Public Service Commission by the Philadelphia Rapid Transit Company, Philadelphia, Pa., for approval of a contract with the Township of Upper Providence was considered recently. A representative of the transit company, lessee of the Darby, Medina & Chester Street Railway, explained that by payment of $13,000 the transit company was relieved of all liability with respect to the paving and maintenance of the streets in the township occupied by railway tracks. There was no protest and the matter was referred to the entire commission.

Course in Public Utilities Offered.—A new course in public utilities will be offered in the Indiana University in Indianapolis in the spring semester. The course, under the supervision of Marvyn Crobaugh, will include the history, development and present status of the industry. Besides the regular course of study there will be a series of lectures by public men familiar with public utility problems. The speakers include Martin J. Insull, Middle West Utilities Company, Chicago; Arthur W. Brady, Union Traction Company of Anderson; Dean Heilman of Northwestern University, and prominent engineers and public service commissioners.

Motorman Absolved in Accident Case.—Although held responsible by the Interstate Commerce Commission for the rear-end collision between two trains on the Buffalo-Niagara Falls high-speed division of the International Railway on Oct. 19, when many excursionists were injured, Howard Foreman, motorman of the second section, was absolved from all blame by Coroner J. E. Helwig of Tonawanda. Failure of the equipment of the car to function properly was given as the cause of the accident by the coroner.

Resolution Praises Retired President.—Charles L. Kurtz, whose resignation as president of the Columbus Railway, Power & Light Company, Columbus, Ohio, was recently referred to in the ELECTRIC RAILWAY JOURNAL, will be presented with an engrossed copy of a resolution passed by stockholders and directors of the company which expresses their appreciation of the manner in which he conducted the business of the company during his presidency. The resolution regretted the loss of his advice and interest and assured Mr. Kurtz of the well wishes of his former associates in the years to come.

Accident on Pennsylvania at Newark.—Three persons were killed and thirty-two others were injured, several seriously, when a Philadelphia local train on the Pennsylvania Railroad rammed into the rear of an Atlantic Coast Line express standing at the platform of Manhattan Transfer early on Feb. 24 on the New Jersey Meadows. The accident occurred on the electric division of the road.

Use of Tokens Extended.—The North Carolina Public Service Company is now using tokens on all of its cars in Salisbury instead of cardboard tickets. They are being sold at the same price that has prevailed for tickets, 7 cents each or four for 25 cents. Tokens have been used by the company in Greensboro for some time.

All-Night Service Unprofitable.—Operation of all-night service over the Stark Electric Railroad between Alliance and Canton, Ohio, is a losing venture, according to company officials. The service was started several months ago to accommodate railroaders who live in Alliance and report for work at the company shops near Canton. A contract between the Stark Electric Railroad and the Pennsylvania Railroad which resulted in establishing the all-night service expired Jan. 1. Railroad officials have made no move to renew the agreement.

Buses Replace Cars.—Word has been received from Leavenworth, Kan., that all local trolley service has been suspended and five Mack 25-passenger buses are now providing the local transportation facilities. Last December the Kansas City, Leavenworth & Western Railway applied for and was granted permission to abandon street car service in Leavenworth and substitute bus service in its stead, to operate over the two routes formerly covered by the trolleys. The traction company formed a separate bus operating company known as the Leavenworth Transportation Company, which placed buses in service recently. The two routes, which are between 3 and 4 miles in length, are now being covered by the buses, operating on an 8-cent fare.

Action Prohibiting Bus Operation Restrained.—A writ restraining the county courts from taking action in the case of the Union Traction Company, Anderson, Ind., against Donald Lake and others, involving their right to operate buses in Muncie, Ind., has been issued by the Indiana Supreme Court. The case has been pending in the courts for some time.

Widow Wins Case.—A verdict of $10,000 was recently awarded to Mrs. Eva Chrampanis for the killing of her husband by a trackless trolley operated by the city of New York on Staten Island in March, 1923. The corporation counsel interposed the defense that as the city was operating illegally it was not answerable in damages. When Justice Strong had sustained the city's defense the attorney for Mrs. Chrampanis countered this move by amending the complaint so as to join Mayor Hylan and the members of the Board of Estimate and Apportionment individually as defendants. A jury before Supreme Court Justice May in Staten Island on Feb. 18 decided that the city was answerable to the widow and children.

Fare Boxes in Little Rock.—The Arkansas Central Power Company recently adopted the system of fare boxes on its cars in Little Rock, Ark. To help passengers have the exact fare ready a 6-cent token or metal ticket has been provided.

Wants Enforcement of Paving Ordinance Restrained.—Suit has been filed in the Federal court in Indianapolis, Ind., by the Terre Haute, Indianapolis & Eastern Traction Company against the city of Newcastle, John H. Morris, Mayor, and Robert S. Hunter, city attorney, asking an injunction restraining the enforcement of a city ordinance which would require the company to lay new tracks and pave a part of a street in Newcastle. The complaint alleged that the ordinance is in violation of the Federal constitution in that it deprives the plaintiff of its property without due process of law and is contrary to a contract held by the company with the State of Indiana.

Both Companies Secure Permits.—The Board of Public Service of St. Louis, Mo., following a public hearing, decided to issue permits for a bus line on West Florissant Avenue to both the People's Motor Bus Company and the St. Louis Bus Company, an auxiliary of the United Railways.

Foreign News

Auckland Uncertain About Buses

The City Council of Auckland, New Zealand, is adding to its bus equipment, but believes that "tramways remain supreme for mass transportation of dense communities of the cities." The tramway system in Auckland was taken over by the city in 1919 and serves a population of 170,000. To carry this traffic 186 cars are used and these operate over 30.35 miles of route. Though a municipal enterprise jitney buses were allowed to run, and these, with the great increase in private automobiles, have caused a strain on the finances of the tramway system.

The Council decided to put the matter before the public, and late last year published a statement giving an official review of its tramway policy. In this review the Council expresses its belief that no other vehicle can adequately or satisfactorily replace the tramway cars, so far as regards the transportation needs of 90 per cent of the community. The question, it says, is whether it is proper to allow the tramway service to be impaired by senseless competition because of the habits of the remaining 10 per cent of the population. Buses alone are inadequate to serve the situation.

The city has decided to expand its bus service. Last fall it had 10 on order and it has decided to order 20 more to take the place of any further track extensions, for the present, though 10 additional cars are to be added for the 1925 season.

Traffic Congestion a Problem in Glasgow

A traffic survey for the relief of street congestion was suggested to the members of the Glasgow Town Council, Scotland, at the annual inspection of the tramways undertakings. Referring to the suggestion to eliminate all tramways from the central area of Glasgow, ex-Bailie Laing said that instead of more than 1,000 tramcars, it would take between 2,000 and 3,000 buses to transport the people into the center of the city, and if the tramways were barred congestion would be increased. He urged the adoption of one-way streets and utilization of certain roads for fast traffic. He also suggested that the railway companies provide an electric shuttle service between the city and suburban areas.

Fares Cut on London Buses

A drastic reduction in fares was put into effect on Dec. 3 by the Association of London Omnibus Proprietors, under which so-called pirates are run. The cuts amount to approximately one-third of the previous fares.

The object of these cuts, according to A. Kemp-Gee, managing director of the Cambrian Company, is to meet the competition of the London General Omnibus Company, following its introduction of combined bus, tram and tube tickets, and combined season tickets. This competition has been further accentuated by the opening of the new section of the City & South London Railway. Mr. Kemp-Gee said in an interview that while his company could not offer similar facilities to its patrons, it could reduce fares to a point even below the monthly or quarterly season ticket rate.

It is understood that the London General Omnibus Company does not intend to take any action at present, but will proceed with its plans to offer the public a co-ordinated traffic service along the lines already outlined.

Operations Show £63,598 Balance.—The accounts of the Cape Electric Tramways, South Africa, for the year to June 30, 1924, show a profit of £81,535, and after providing for debenture interest, redemption of debentures and taking into account balance brought forward a net credit of £63,598 remains. The reserve fund has been credited with £20,000, leaving £43,598. The directors recommend a final dividend of 3 per cent, making 6 per cent, free of tax, for the year, carrying forward £14,125. During the year the tramways carried 31,794,150 passengers, with gross receipts of £398,896, as against 32,094,580 passengers, with gross receipts of £408,753, in 1922-23. Although a falling off of slightly under 2½ per cent has been experienced in traffic receipts, there is a corresponding reduction under various headings of expenditure; the net result, therefore, comes out practically the same as last year.

Franchise of Paris Transports en Commun to Be Revised.—The question of the revision of the Transports en Commun franchise was discussed at a recent meeting of the Council General of the Seine. An agreement that will be acceptable to both parties is being sought. The final proposition is that the Transports en Commun shall renounce its remuneration of one-fourth of 1 per cent on receipts exceeding 250,000,000 francs, the bonus on economies exceeding 0.85 of 1 per cent of the receipts, a quarter of the bonus running from 0.85 to 0.95 of 1 per cent, half of the bonus between 0.90 and 0.95 and three-fourths of the bonus exceeding 0.95 of 1 per cent of the receipts. The economies resulting for the Department of the Seine by this new agreement are expected to amount to approximately 500,000 francs during 1925. The franchise now in effect was outlined previously in these columns.

Japanese Electric Railway Plans Changed.—The franchise right for construction of underground railways in Tokyo, Japan, has been canceled by the Tokyo government. The franchise was formerly held by the Musashi Electric Railway. This company has been reorganized as the Tokyo-Yokohama Electric Railway and proposes to build a suburban railway from Tokyo to Yokohama.

Financial and Corporate

$3,000,000 Philadelphia Stock Issue

Passenger Partnership Campaign Started by Mitten Management to Secure Additional Funds

Users of the service of the Philadelphia Rapid Transit Company, Philadelphia, Pa., are being afforded an opportunity to become stockholders of that company under a new plan which makes investment easy. It is explained that the issue which the car riders are to be permitted to buy is to consist of $3,000,000 of preferred stock paying a 7 per cent cumulative dividend. It is to be split up into 60,000 shares with a par value of $50 each. Passengers are to be permitted to apply for from one to ten shares. The proceeds from the sale of the stock will be used to finance extensions and additions to property and to retire or acquire prior obligations. It is explained that the earnings applicable to the preferred dividends for 1925 appear to be more than 15 times the sum necessary to pay them. In this connection the company says that "conservative bankers consider a preferred stock a good investment where the dividend is earned only three times."

After the stock has been allotted purchasers will be permitted to pay for it in full in cash or at the rate of $1 per share per month. The partial payment plan is intended to make it easy for men and women who desire to save as they go to become part owners in the property. P. R. T. employees asked the right to buy the preferred stock, but they have agreed to wait until the car riders have had the first opportunity to buy.

Men and management at Philadelphia together now own more than one-third of the common stock of the company, through which ownership they may subscribe to more than one-third of the preferred stock. They have waived this right so that more than $1,000,000 of the new preferred stock will be available for sale to the car riders as soon as it has been authorized and issued. All other stockholders will be asked to give up their rights of subscription so that all of the $3,000,000 issue may be sold to the car riders.

As to the partial payment plan, the payments will be due each Saturday, but it is explained that they can be made on any week day or for as many weeks in advance as desired. Should any payment become 5 days overdue all money paid in up to that time will be returned and the stock will be sold to another purchaser. Receipts will be issued for each payment and when $50 per share has been paid the stock certificates will become the property of the purchaser or subscriber.

It is intended to pay dividends of $1.75 per share every six months. The stock will be redeemable at $55 per share. Application will be made to list the stock on the New York and Philadelphia exchanges so that a ready market will be available for the issue at all times.

Another Property Passes to Mr. Insull

Samuel Insull, Chicago, and interests represented by him have arranged to purchase the entire system of the Indiana Service Corporation, including both the local city lines in Fort Wayne, Ind., and the three interurban systems operated by the local company. Formal transfer of the company has not yet been completed, but according to an announcement made on Feb. 20, all the details of the transaction were completed some time ago. Robert M. Feustel, president of the company at Fort Wayne, has made this plain.

It was reported in Fort Wayne that the Insull interests paid practically par for the entire preferred and common stock holdings of the local company, but confirmation of the terms of the sale has not been made. Mr. Feustel says the company will continue to function as a local organization, with much the same staff for the present at least.

In addition to the city lines in Fort Wayne, the Indiana Service Corporation operates the city lines in Wabash, Peru and Logansport and the interurban lines to Lafayette, Bluffton, Waterloo and Kendallville. Its properties also include the light and power plants which supply Fort Wayne.

San Francisco Municipal Loss $295,230

For the Year Ended June 30, 1924, the Excess of Income Over Operating Expenses and Reserves Was $8,374, but Taxes and Similar Items Amounted to $303,604

TOTAL revenue of the Municipal Railway, San Francisco, Cal., for the year ended June 30, 1924, was $3,189,533, and interest on securities owned increase this by $46,519 to $3,236,052. Deducting operating expenses of $2,460,282 left a net of $775,770. Against this $196,223 was charged interest on funded debt and $571,173 for depreciation and accidents, leaving a balance of $8,374, compared with $13,830 for the previous year.

For the purpose of securing a comparison between the results of operation of the municipally owned utility and those operated by private capital, the charter of the city and county of San Francisco provides that the operating reports shall include certain comparison charges consisting of items which constitute part of the actual cost of operating private-owned companies, but which the municipally owned utility is not required to pay. For the year these charges amount to $303,604, leaving a net deficit of $295,230. This compares with a similar deficit for the preceding year of $272,045.

There has been a continuing deficit, as shown by the cumulative income account for the period from Dec. 28, 1912, to June 30, 1923, amounting to $1,024,-

COMPARATIVE INCOME ACCOUNT, SAN FRANCISCO MUNICIPAL RAILWAY

	Years Ended June 30 1923	1924	Dec. 28, 1912 to June 30, 1924
Passenger revenue	$2,993,829	$3,173,181	$25,415,189
Miscellaneous revenue	11,372	16,352	110,356
Total revenue	$3,005,201	$3,189,533	$25,525,545
Interest on securities owned	55,297	46,519	316,674
Total income	$3,060,498	$3,236,052	$25,842,219
Operating expenses:			
Way and structures	$109,572	$115,468	$799,920
Equipment	216,605	187,636	1,495,486
Power	424,695	465,889	3,369,704
Conducting transportation	1,371,843	1,523,269	11,000,120
Traffic	16	109	3,836
General and miscellaneous	179,325	167,911	964,369
Loss on road retired			8,187
Total operating expenses	$2,302,055	$2,460,282	$17,641,622
Excess of income over operating expense	$758,443	$775,770	$8,200,597
Less interest on funded debt	205,724	196,223	2,374,963
Excess of income over operating expenses and interest	$552,719	$579,547	$5,825,634
Less reserve for depreciation and accidents (18 per cent of gross passenger revenue)	538,889	571,173	$4,573,836
Excess of income over operating expenses, interest, depreciation and accident reserves	$13,830	$8,374	$1,251,798
Less charter comparison charges	285,876	303,604	2,276,184
Net income	*$272,045*	*$295,230*	*$1,024,386*
Analysis of comparison charges:			
*State franchise tax—4½ per cent of gross earnings	$154,775	$167,442	$1,338,556
†Municipal franchise tax—3 per cent of gross earnings	119,753	126,928	824,158
Municipal car license	2,835	3,135	30,258
Federal income tax	.....	.....	13,270
Salary of clerks	.....	.....	4,872
Law expenses	.....	.....	13,500
Insurance	5,513	6,099	51,570
Total	$285,876	$303,604	$2,276,184

* Franchise tax percentage has varied in different years. † Municipal franchise tax now increased to 4 per cent. Italics indicate loss or deficiency.

STATISTICAL DATA, SAN FRANCISCO MUNICIPAL RAILWAY
FISCAL YEAR ENDED JUNE 30, 1924

	Total Amount	Per Car-Mile (Cents)	Per Car-Hour	Ratio to Passenger Revenue
Total passenger revenue	$3,173,181.33	36.57	$3.5249	
Total operating expenses (taxes and depreciation not included)	2,460,282.85	28.36	2.7330	
Total operating earnings (taxes and depreciation not included)	712,898.48	8.21	0.7919	0.2246
Total taxes and charter charges	303,604.17	3.50	0.3373	0.0957
*Depreciation	571,172.64	6.58	0.6345	0.1800
Operating expenses, depreciation and taxes	3,335,059.66	38.44	3.7048	1.0510
Net deficit from operation	*161,878.33*	*1.87*	*0.1798*	*0.0610*
†Passenger car mileage	8,676,611			
‡Passenger car-hours	900,224			
Platform expense (62½ cents per hour July 1, 1923, to Sept. 15, 1923, inclusive; 67½ cents per hour Sept. 16, 1923, to June 30, 1924, inclusive; bus operators 72½ cents)	1,269,472.65	14.63	1.4102	

	Total Amount
Number of passenger cars owned	209
Number of work cars owned	4
Total number of cars owned	213
Total number of buses owned	10
Total single-track mileage	68.98
Passengers carried—5-cent fares	62,954,052
5-cent fares—Government tickets	46,950
2½-cent fares—school tickets	995,854
2-cent revenue transfers	327,436
Free transfers	12,808,537
Free passengers (employees, etc.)	603,788
Total passengers carried	77,736,617
Number of passengers carried per car-mile	8.96

* The sum of $200,000 expended from depreciation reserve for bond retirement. † Includes mileage of buses. ‡Includes car-hours of buses. Italics indicate loss or deficiency.

386, when the comparison charges are included. Neglecting these, there has been an excess of income over operating charges, interest and reserves of $1,251,798 for the same period.

Particular attention is given in the report to the explanation of the items in the balance sheet, which is reproduced in condensed form herewith. The capital assets consist of cash in bond funds, $17,428, which represents unexpended balance of the bond fund cash now in possession of the treasurer; road and equipment, $7,570,225, and general expenditures, $324,873. These latter accounts represent the total cost of the road and equipment.

The current assets consist of $943,635 cash in various funds, $979,325 for the book value of the securities bought for the account of the depreciation fund; accounts receivable, $14,148; materials and supplies, $237,815.

Deferred assets have not changed during the year.

On the liabilities side, the funded debt item represents the par value of the bonds outstanding in the hands of the public on June 30, 1924. Current liabilities include accounts and vouchers payable, $221,946, and interest due on funded debt, $47,773. The reserves include a reserve for depreciation of $1,467,977 and a reserve for compensation insurance of $100,492.

The municipal railway has no capital stock and the excess of its assets over its liabilities represents surplus. In the preparation of the balance sheet, it is stated, this surplus has been divided into two classes, first, that which was created by donations or contributions, and, second, that which was accumulated from the earnings resulting from the operation of the road. The contributed surplus includes premiums realized from the sale of bonds, $26,000, and contributions from general taxes, $306,552. In surplus from income is included $1,489,000 representing bonds retired from income; $101,000 reserve for bond redemption. These amounts, totaling $1,590,000, represent the income which has been set aside in cash for the redemption of bonds.

An item of considerable interest to railway operators is the charter reserve of $903,802 for insurance and taxes. As explained previously, there are set aside certain sums for comparison with private operation, of which this item is a part. The municipal system not having to pay any of these charges, the receipts from operation were deposited in the operating cash fund without any restrictions as to how they were to be used. As a matter of fact, however, most of the cash in the operating fund represented by such comparison charges actually was expended in new construction and addition and betterment work, so that these reserves, representing obligatory charter comparison charges, have in reality been used as reserves for betterments.

For the purpose of making the balance sheet reflect the actual results of operations, it is stated, the amount expended in addition and betterment work has been reflected in an account entitled "additions and betterments from income," and the charter reserves for insurance and taxes carry a balance equal only to the unused portion of the original income. The amount in the additions and betterments account is $2,199,388.

Operating surplus is made up as follows:

Surplus, June 30, 1923, as per last report		$484,477
Add:		
Reduction of compensation insurance reserve corresponding to dividends declared by the state compensation insurance fund applicable to year ended June 30, 1924	$14 946	
Transfers from depreciation fund to operating fund as follows:		
Deficits in operating fund	60 639	
Insurance refund credited to accident insurance reserve but deposited in operating fund	1 679	77 264
		$407 213
Deduct:		
Amount transferrable from income account	$295 230	
Interest on bonds credited to income but deposited in depreciation fund	46 519	
Adjustment reconstruction of lower Market Street tracks	19 518	361 267
		$768 481

Italics indicate loss or deficiency.

COMPARATIVE CONDENSED GENERAL BALANCE SHEET, SAN FRANCISCO MUNICIPAL RAILWAY, AS OF JUNE 30, 1924

Assets	1924	1923	Increase or *Decrease*
Capital assets	$7,912,526	$7,610,138	$302,387
Current assets	$2,174,925	$2,241,396	*$66,470*
Deferred assets	$132,124	$132,122	.....
Total assets	$10,219,575	$9,983,659	$235,916
Liabilities, Reserves and Surplus			
Funded debt	$3,992,000	$4,192,000	*$200,000*
Current liabilities	$269,720	$343,126	*$73,406*
Reserves	$1,568,469	$1,615,740	*$47,270*
Contributed surplus	$332,552	$332,552	
Surplus from income	$4,056,832	$3,500,238	$556,594
Total surplus	$4,389,385	$3,832,791	$556,594
Total liabilities, reserves and surplus	$10,219,575	$9,983,659	$235,916

Italics indicate loss or deficiency.

STATEMENT OF BUS LINE OPERATIONS, SAN FRANCISCO MUNICIPAL RAILWAY, YEAR ENDED JUNE 30, 1924

Revenues:		
Passenger revenue	$33,323	
Quartermaster tickets	5	
School tickets	639	
Local transfers	11,356	
Total revenues		$45,323
Operating Expenses:		
Repairs to buses	$12,445	
Tire expense	10,350	
Garage expense	13,317	
Conductors and chauffeurs	21,936	
Depreciation (18 per cent of gross passenger revenue)	5,998	
Compensation insurance	1,138	
Total operating expenses		65,184
Net loss for year		$19,861
Average net loss per day		54.26

The statement of bus line operations for the year shows total revenues of $45,323, compared with $39,875 last year, and expenses of $65,184, compared with $61,302 the previous year, giving a net loss for the year of $19,861, compared with $21,427. In 1922 the net loss was $29,086 on a total gross of $38,863. These figures, however, do not include any supervision or other overhead or comparison charges.

Customer Ownership Campaign on in St. Joseph

The St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., started its second customer-ownership campaign on Feb. 16 to be in effect until Feb. 28. The security is preferred stock of the Cities Service Company, which controls the St. Joseph property. The employees are all interested in making the campaign more successful than last year's and are anxious to exceed their sales by a substantial number. The New York office has set the St. Joseph quota at 2,500 shares. An offer of $7,000 in prizes and commissions has been made to employees who sell the greatest number of shares.

Twelve important steps in selling the Cities Service preferred stock were outlined in the February number of "Rylite Employees' News," the company's official publication. The employees were advised to tell the prospect that his purchase would make him part owner of the company's substantial properties and that he would share in the company's earnings.

January a Record Month for Boston "L"

The Boston Elevated Railway, Boston, Mass., reports the largest surplus for any January since the road was turned over to public trustees.

In submitting his report for the month Edward Dana, general manager, says that the savings were accomplished by the most rigid economy and without curtailment or impairment of service. The company carried 33,305,311 passengers, received from all sources $3,130,996 and paid out $2,861,347, which leaves an excess of receipts over cost of service of $269,649. The natural increase in wages from the arbitration award would have been $40,000, but the actual increase was only $1,400 because 400 employees were laid off and the repair shops were put on a 5-day basis.

	1925	1924
Revenue passengers:		
10-cent passengers	26,813,722	25,079,496
5-cent passengers	1,138,715	9,337,482
6-cent passengers	5,352,874	....
Total revenue passengers	36,305,311	34,416,978
Total receipts per revenue passenger	9.401c.	8.855c.
Receipts from fares per revenue passenger	9.186c.	8.643c.
Cost of service per revenue passenger	8.591c.	8.490c.
Total payroll included in operating expenses	$1,453,173.97	$1,451,724.35
Payroll cost per revenue passenger	4.363c.	4.218c.

By increasing the safety factor, operating more safely, reducing accidents and incidentally accident insurance, the company cut its expenses for the law department, injuries and damages and insurance from $141,310 in January, 1924, to only $77,431 last month. Coal was bought at an average figure of $5.37 per ton as against $6.30 per ton a year ago, and the consumption was reduced by the higher efficiency engines, from 27,326 tons in January a year ago to 25,445 tons in January of this year.

Purchases Interurban Tracks

The City Commission of Dallas, Tex., recently gave the Dallas Railway permission to requisition $123,675 to purchase the Forney Avenue line from the Texas Interurban Railway. The company will give a note for the purchase price and pay the interest out of the company's authorized 7 per cent return on property values.

This line was built by the interurban company for the Terrell-Dallas line, but the Dallas Railway rented the trackage for local service. Under the new arrangement the Dallas Railway will have title to the lines and the Texas Interurban Railway will pay an annual rental of $3,000 for the interurban service.

Valuation of New York State Railways Reduced

The city of Rochester has reached an agreement with the New York State Railways in its long-pending suit for a reduction of the base valuation of the Rochester lines of the company, whereby the value under the service-at-cost contract will be cut from $19,216,000 to $18,076,000, a reduction of $1,140,000.

The figure agreed upon represents a compromise on the part of both parties, as the railway some time ago offered to reduce the value by $1,005,000. This proffer was rejected. The matter now is before the Common Council and acceptance is said to be assured.

The amount of the reduction, Corporation Counsel C. M. Platt said, is too small to allow any immediate reduction in the present 7-cent fare. Under the service-at-cost contract the railways must show a surplus of $200,000 in its balancing accounts before a fare cut is possible. The railways for the 4 years of operation under the contract have failed to show such return.

Dividends and Directors in Brooklyn.—The Brooklyn City Railroad, Brooklyn, N. Y., declared a quarterly dividend of 20 cents, payable March 2 to stock of record Feb. 14. Three months ago the company declared a quarterly dividend of 20 cents and 5 cents extra. Thomas I. Parkinson, vice-president of the Equitable Life Assurance Society, and Clinton E. Morgan, vice-president and general manager of the road, were elected directors.

Contract Agreement Reached.—Agreement over the question of valuation has finally been reached between the officials of the Milwaukee Electric Railway & Light Company and the public utilities acquisition committee, which are negotiating the proposed service-at-cost contract. It places a valuation of the company's properties at $56,456,506 as of July, 1925, the date when the contract is to become effective, providing the vote is in favor of the plan. This figure will be replaced by the exact amount determined when the audit of the company's books is completed up to that time. The audit is now completed up to Jan. 1, 1922, which establishes a valuation at that time of $42,382,000.

Receipts Higher in January This Year.—Total passenger revenues of the Indianapolis Street Railway, Indianapolis, Ind., for January were $449,657. This is a decrease of $17,091 compared with the previous month, but contrasted with total receipts for January of last year revealed an increase of $21,683.

Railway Included in Merger.—The Maine Public Utilities Commission recently rendered a decision authorizing the Bangor Railway & Electric Company, Bar Harbor & Union River Power Company, the Bangor Power Company and the Lincoln Light & Power Company to consolidate with the Bangor Hydro Electric Company.

No Intervention for Protection Necessary.—When the time arrives for a settlement under the reorganization of the United Railways of St. Louis all judgment creditors of the company prior to the receivership will have an opportunity to protect their interests. Federal Judge Faris so informed John V. Lee, counsel for judgment creditors holding claims for $129,000 against the company. Judge Faris overruled Counsel Lee's request to intervene in the receivership suit. The court told Mr. Lee there was no necessity for him to intervene as all those interested in the reorganization would receive proper consideration. In overruling a similar motion many weeks ago Judge Faris stated he had been assured the judgment creditors would be paid off in full when the reorganization was accomplished.

Railway at Public Sale.—The Phoenixville Trust Company as trustee for the bondholders will offer at public sale on March 11, 1925, at the Phoenix Hotel, Phoenixville, Pa., all the property of the Phoenixville, Valley Forge & Strafford Electric Railway, a 4½-mile trolley. Included in the sale will

Conspectus of Indexes for February, 1925

Compiled for Publication in this Paper by

Albert S. Richey

Electric Railway Engineer

Worcester, Mass.

	Latest	Month Ago	Year Ago	Since War High	Since War Low
Street Railway Fares* 1913 = 4.84	Feb. 1925 **7.17**	Jan. 1925 **7.17**	Feb. 1924 **6.93**	May 1921 **7.24**	May 1922 **6.88**
Street Railway Materials* 1913 = 100	Feb. 1925 **153.1**	Jan. 1925 **150.3**	Feb. 1924 **163.2**	Sept. 1920 **247.5**	Oct. 1924 **148.5**
Street Railway Wages* 1913 = 100	Feb. 1925 **221.0**	Jan. 1925 **221.0**	Feb. 1924 **217.4**	Sept. 1920 **232**	Mar. 1923 **206.8**
Steel—Unfilled Orders (Million Tons) 1913 = 5.91	Jan. 31 1925 **5.04**	Dec. 31 1924 **4.82**	Jan. 31 1924 **4.80**	July 31 1920 **11.12**	July 31 1924 **3.19**
U.S. Bank Clearings Outside N. Y. City (Billions)	Jan. 1925 **18.53**	Dec. 1924 **18.45**	Jan. 1924 **16.86**	Mar. 1920 **18.54**	Feb. 1922 **10.65**
Business Failures Number	Jan. 1925 **2344**	Dec. 1924 **1911**	Jan. 1924 **2231**	Jan. 1924 **2231**	Sept. 1924 **1277**
Liabilities (Millions)	**64.01**	**57.77**	**122.95**	**122.95**	**27.71**

	Latest	Month Ago	Year Ago	Since War High	Since War Low
Eng. News-Record Construction costs 1913 = 100	Feb. 1925 **209.7**	Jan. 1925 **210.4**	Feb. 1924 **220.3**	June 1920 **273.8**	Mar. 1922 **162.0**
U.S. Bur. Lab. Stat. Wholesale Commodities 1913 = 100	Jan. 1925 **160.0**	Dec. 1924 **157.0**	Jan. 1924 **151.2**	May 1920 **247**	Jan. 1922 **138**
Bradstreet's Wholesale Commodities 1913=9.21	Feb. 1 1925 **13.89**	Jan. 1 1925 **13.93**	Feb. 1 1924 **13.20**	Feb. 1 1920 **20.87**	June 1 1921 **10.62**
Dun's Wholesale Commodities 1913 = 120.9	Feb. 1 1925 **204.6**	Jan 1 1925 **202.6**	Feb. 1 1924 **191.1**	May 1 1920 **263.3**	July 1 1921 **159.8**
U.S. Bur. Lab. Stat. Retail food 1913 = 100	Jan. 1925 **154.3**	Dec. 1924 **151.5**	Jan. 1924 **149**	June 1920 **219**	Mar. 1922 **139**
Nat. Ind. Conf. Bd. Cost of living 1914 = 100	Jan. 1925 **167.1**	Dec. 1924 **166.1**	Jan. 1924 **164.6**	July 1920 **204.5**	Aug. 1922 **154.5**

*The three index numbers marked with an asterisk are computed by Mr. Richey, as follows: Fares index is average street railway fare in all United States cities with a population of 50,000 or over except New York City, and weighted according to population.

Street Railway Materials index is relative average price of materials (including fuel) used in street railway operation and maintenance, weighted according to average use of such materials.

Wages index is relative average maximum hourly wage of motormen, conductors and operators on 100 of the largest street and interurban railways in the United States, weighted according to the number of such men employed.

be Pleasure Park, near Valley Forge, and about 12 acres of land. The road runs from Main and Church Streets, Phoenixville, Pa., to the village of Valley Forge and the Pennsylvania State Park, embracing the encampment grounds of Washington's army. Early last year it was stated that no buyer for the road could be found and the creditors' committee had decided that it would be best for the bondholders to purchase it and sell it for scrap.

Changes in Effect to Improve Business.—Receiver Henshaw of the Oklahoma Railway, Oklahoma City, Okla., has purchased the Katy railway passenger station at Guthrie with four and one-half blocks of yards and 7,000 ft. of railroad track by the Oklahoma Railway for $10,000. The purchase is to enable the electric railway to increase freight business. The receivers have outlined a reorganization plan calling for the expenditure of $50,000 on the Guthrie division, which is expected to reduce annual operating cost of that division by more than $40,000.

January Shows Profit. — January operations of the Community Traction Company, Toledo, Ohio, resulted in a profit of $14,952 for the stabilizing fund. Gross earnings were $334,874 and operating expenses $257,433, leaving a net profit of $77,441. Non-operating income added $3,035. Bond interest was $36,390 and the sinking fund requirement $22,512. This left $21,400 applicable to preferred dividends and stabilizing fund. Dividends on the preferred stock outstanding were $7,153.

Seeks Abandonment Permission.—The Pennsylvania-Ohio Electric Company, Youngstown, Ohio, has asked the Public Service Commission to permit it to abandon its railway between Hubbard, Ohio, and New Castle, Pa.

Dividend Suit Dismissed. — Suit to force distribution of nearly $2,000,000 as dividends to stockholders of the Chicago City Railways, Chicago, Ill., has been thrown out of court by the federal appellate judges who upheld a lower court ruling which involved the validity of the 1907 traction ordinances of Chicago.

City May Retire from Interests Outside City.—The city of Winnipeg, Man., will confine its traction activities to Winnipeg proper and retire from adjacent municipalities under a plan which has been submitted to the City Council and shareholders of the Winnipeg Electric Company, according to a recent report. If the plan is accepted by the city and the shareholders competition between the city and the company in the street railway business will be eliminated. The city would also buy the company's surplus current. Early in the present year it was said that a special committee might be appointed by the new City Council to consider the advisability of taking over the railway from the Winnipeg Electric Company.

Electric Branch Line Under Consideration.—The Philadelphia & Reading Railway is negotiating for the purchase of the Princeton branch of the New Jersey & Pennsylvania Traction Corporation, Trenton, N. J., for a freight line between Trenton and Princeton.

Personal Items

C. A. Brooks Leaves Poughkeepsie

Manager There Joins Fitkin & Company, Bankers and Utility Operators, in Charge of Railway Properties

Charles A. Brooks, general manager of the Poughkeepsie & Wappingers Falls Electric Railway, Poughkeepsie, N. Y., for the J. G. White Management Corporation, will on March 1 become associated with the general engineering and management corporation of A. E. Fitkin & Company, New York City, in charge of its electric railway properties. The Fitkin holdings include both city and interurban lines.

Mr. Brooks went to Poughkeepsie in April, 1913, after having served as a

C. A. Brooks

member of the J. G. White staff in New York. He had been identified with the traction business since 1902, when he entered the employ of the Brooklyn Rapid Transit Company. Later he was with Sanderson & Porter, New York, but left their employ to enter the service of the Third Avenue Railroad, New York City. Then followed a period in which he directed the construction of the South Shore traction lines in Long Island, and in 1912 he joined the staff of the White Corporation as a special engineer.

Since he went to Poughkeepsie Mr. Brooks has been in charge of the railroad there except during the period from May, 1922, to November, 1923, when he was associated with Ward S. Lent in the Lenbrook Motor Corporation. Upon the death of R. J. Morrison, who had succeeded him as manager at Poughkeepsie, Mr. Brooks returned to his old position.

Under his direction the company at Poughkeepsie has purchased and put into operation an entire new equipment of rolling stock and has virtually rebuilt its lines. Ninety-five per cent of its trackage and pavement within the city has been replaced since 1913, under his personal direction.

Mr. Brooks has been president of the local Chamber of Commerce for nearly two years. In addition he is president of the Poughkeepsie Automobile Club, and is affiliated with many other local organizations. He is a member of the Amrita, Poughkeepsie Rotary, and Dutchess Golf and Country Clubs, and of the Transportation Club of New York City. He is a Knight Templar.

The Poughkeepsie *Eagle-News* said:

> Mr. Brooks has demonstrated that he is a man of high capabilities and of outstanding public spirit. As manager of the railway he has filled one of the most difficult positions in the community. He has had to contend with the same conditions which in other cities have made the operation of traction lines an exacting business in the last decade. Mr. Brooks succeeded in increasing the efficiency of service, despite formidable handicaps, and under his supervision the physical property of the company has been almost entirely rebuilt. Any fair review of his management must concede that he has done an extraordinarily fine piece of work. Mr. Brooks's services to the city through the Chamber of Commerce have been likewise notable.
>
> Mr. Brooks takes up his new duties with a background of experience which will serve him in good stead. Poughkeepsians will be glad that he has obtained at least a part of that experience in this city, and will wish for him the success which they are sure will be his.

Chicago Officials Advanced

At the annual meeting of the Chicago Rapid Transit Company, Chicago, Ill., operating the Elevated lines there, the title of B. J. Fallon was changed to vice-president in charge of operations. H. A. Johnson was given the title of general manager.

Mr. Fallon has been general manager since the summer of 1921. His promotion at that time had been the second within a period of a little longer than a year, his other positions being those of assistant general manager and engineer maintenance of way. His record of efficiency and achievement was reviewed in the ELECTRIC RAILWAY JOURNAL, issue of July 9, 1921.

H. A. Johnson, who now assumes the rôle of general manager, has also had a notable career in the railway field. He was formerly assistant to the general manager of the Chicago Rapid Transit and superintendent of shops and equipment of the Chicago, North Shore & Milwaukee Railroad. He was a member of the committee from the American Electric Railway Association sent abroad last year to study foreign practice. Recently, he was appointed director of research of the American Railway Association to take full charge of an extensive investigation of power brakes for both passenger and freight trains. The details of his career were published in the ELECTRIC RAILWAY JOURNAL, issue of Dec. 20, 1924.

S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has been elected president of the Peninsular Power Company, the properties of which were recently acquired by the North American Com-

pany. A. K. Ellis, general superintendent of the Wisconsin Traction, Light, Heat & Power Company, has been named vice-president, and F. J. Boehm, secretary and treasurer.

Wallace Shaw has succeeded Joseph P. Hines as general manager of the Nahant & Lynn Street Railway, Nahant, Mass. Thomas Fee is roadmaster, replacing Arthur Hollis.

J. Sandie has succeeded Alexander McCready, deceased, as master mechanic of the Sault Ste. Marie Traction Company, Sault Ste. Marie, Mich. J. H. Stewart has succeeded J. N. Franz as superintendent.

L. H. McCray, formerly assistant general manager of the East Penn Electric Company of Pottsville, Pa., has been elected vice-president of the New Hampshire Electric Railways. He will be in charge of the operation of the Massachusetts Northeastern Street Railway and the Dover, Somersworth & Rochester Street Railway in addition to light and power properties. Ralph Hood will continue as manager of the Massachusetts Northeastern Street Railway and the Dover, Somersworth & Rochester Street Railway.

J. P. Hudson, auditor of the Niagara, St. Catherines & Toronto Railway, St. Catherines, Ont., has had his jurisdiction extended to include the accounts of the Toronto Suburban Railway. Mr. Hudson will report direct to T. H. Cooper, general auditor, Montreal. H. J. Harris has been appointed assistant auditor with office at Lambton, Toronto, Ont.

Carl C. Jones has been promoted to division ticket and freight agent of the Terre Haute, Indianapolis & Eastern Traction Company, Terre Haute, Ind. This is a newly created office, to supervise all freight, express and baggage business which heretofore has been connected with the railway baggage department. The new arrangement separates the freight service entirely from the transportation department, which will allow M. M. Nash, superintendent of transportation, and his workers an opportunity to devote their entire time to traffic and transportation problems.

O. S. Hanson was elected treasurer of the Grand Forks Street Railway, Grand Forks, N. D., at the recent annual meeting. In this capacity he succeeds A. I. Hunter.

C. F. Crane, assistant to the president of the Harrisburg Railways, Harrisburg, Pa., was recently elected treasurer of the Pennsylvania Street Railway Association. At the same meeting Harold A. Buch was elected secretary. Mr. Buch was an assistant to the late Henry M. Stine, secretary and treasurer of the association.

Capt. W. V. Morland, manager of the Nottinghamshire & Derbyshire Tramways and the Midland General Omnibus Company, Nottinghamshire, England, has been appointed manager of the St. Helens Corporation Tramways.

Clarence Kline, purchasing agent, claim agent and superintendent of the Enid City Railway, Enid, Okla., is now vice-president of the Tulsa Street Railway, Tulsa, Okla. Mr. McGrath succeeded Mr. Kline at Enid.

E. W. Dickinson is retiring from the post of power station engineer of the London County Council Tramways, London, England, and will receive a retiring allowance. He has been on the permanent staff since 1906.

Obituary

F. P. Maize

F. P. Maize, master mechanic of the Portland Electric Power Company, Portland, Ore., since 1911, died recently. Mr. Maize was in the railway field for many years, his first connection being in the shops of the Carlisle Manufacturing Company, locomotive builders, which he served from 1885 to 1893. He then became foreman of the machine shop of the Atlantic Avenue Railroad in Brooklyn and a year later accepted a position with the Scranton traction company.

It was at the time he was connected with the Scranton property that Mr. Maize took up the study of the subject of mechanical and electrical engineering. This equipment enabled him to perform with even greater zeal the duties of foreman of repair shops of the second division of the Union Traction Company, Philadelphia. Each position seemed to fit him for something higher and a year later he became master mechanic of the New York & Queens County Railway, Long Island City, later being promoted to superintendent of power houses and equipment.

From 1903 until the summer of 1908 Mr. Maize was master mechanic of the Rochester Railway, in the latter year resigning to become a mechanical instructor of the Public Service Corporation of New Jersey and in general charge of the repair shops of the company throughout New Jersey. He next moved to Portland, Ore., where he has been employed for the past 14 years.

Job E. Hedges

Job E. Hedges, humorous speaker, political philosopher, lawyer and former receiver of the New York Railways, New York City, died at his rooms in the Chalfonte Hotel at Atlantic City, N. J., on Feb. 22. The death, which was sudden, was caused by heart disease, of which Mr. Hedges has suffered several previous attacks. He was 62 years old.

In 1914 Mr. Hedges was defeated for Governor of New York by William Sulzer, the Democratic candidate. After Mr. Sulzer's impeachment and the succession of the late Martin H. Glynn to the Governorship, Mr. Hedges became a candidate for the nomination again in 1914.

The New York *Times* said that in the opinion of many of his friends, Mr. Hedges' reputation as a humorist was a decided handicap to him politically, and that it was certain his reputation as a wit prevented many epigrams of political philosophy of his being taken with the seriousness that they deserved.

Mr. Hedges always took an active part in Republican State and national conventions. He placed Charles E. Hughes in nomination for Governor in 1906 and supported Mr. Hughes in the campaign.

In a speech at a dinner of the University of Vermont alumni, he said:

> The only difference between the Governor of Vermont and the Mayor of this city is that the Governor says nothing and does a whole lot while the Mayor says a whole lot and does nothing. When the Mayor has more to say than usual he seeks redress in the City Record.

Mr. Hedges' wit continued undimmed by failing health. When criticised by Mayor Hylan for action as a surface railway receiver, Mr. Hedges retorted by referring to the Board of Estimate and Apportionment as "a board that neither estimates nor apportions."

C. M. Murdock

Charles M. Murdock, Lafayette, Ind., vice-president of the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind., died of heart disease Feb. 8 at his home in that city. He had been ill several years. The day prior to his death he visited the First Merchants National Bank, Lafayette, of which he was chairman of the board of directors, but that night appeared restless and at 7 o'clock, when the nurse tried to awaken him, she found he was dead. He was 60 years old.

With his father and brother Mr. Murdock organized the first gas company in Lafayette and later the Lafayette Lighting Company. These utilities are now combined as the Northern Indiana Gas & Electric Company. He and his brother also were pioneers in interurban development. They became interested years ago in the Terre Haute, Indianapolis & Eastern Traction Company, the Fort Wayne & Wabash Valley Traction Company, the Evansville & Southern Traction Company and the Chicago, South Bend & Northern Indiana Railway and the Southern Michigan Railway. Mr. Murdock also was interested in several banks.

William M. Lawyer, connected with the E-Z Car Control Corporation, Turnstile Car Corporation and Haller-Powers Printing Company, Syracuse, N. Y., is dead. Mr. Lawyer was born in Oswego County, New York, on June 19, 1874. After being educated in public schools of his native district he worked for the Buffalo, Rochester & Pittsburgh Railroad and later entered the employ of the New York Central Railroad, continuing with the latter until he had completed 10 years of service. He then went to Cleveland, Ohio, where he was associated with the Whitmore Manufacturing Company, manufacturers of lubricants, as salesman and Eastern representative for 16 years. Next he engaged in manufacture and distribution of railroad supplies in Syracuse and in March, 1922, he helped to organize the Turnstile Car Corporation.

Edward W. Gross, treasurer and general manager of the Berlin Street Railway, Berlin, N. H., died recently in Auburn, Me. In the early '80s in Lewiston and Auburn Mr. Gross organized the American Light & Power Company, becoming treasurer and manager. Twenty-two years ago he secured control of the Berlin Street Railway and as treasurer and general manager devoted all his energy to putting the company on a sound financial basis. Mr. Gross was 87 years old.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

Jacksonville Coal Agreement Stimulates Non-Union Mining

The Jacksonville agreement between bituminous coal operators and the United Mine Workers is not working out in an entirely satisfactory manner, according to the opinion in well-informed quarters in Washington. It is stimulating greatly the production from non-union mines. One effect is the keeping in operation of inefficient mines in non-union territory and closing efficient mines in the union area. Nevertheless, the alternative to the Jacksonville agreement was a strike, and the present situation is preferable to one which would have followed such a course.

The union probably is not ready to concede it, but the trend among the men is to make wage concessions. It is regarded as entirely preferable that this suggestion should come from the men rather than from their employers. The coal industry, however, still is reaping the harvest, it is declared, of war distortions, of transportation inefficiencies and of the mismanagement which characterized the decade preceding the Jacksonville agreement.

Buses to Be Exhibited at Boston Show

Buses will constitute a substantial and special feature of the annual Boston Automobile Show in Mechanics Building on March 7 to 17. Many different sizes and types will be displayed. Some exceptionally fine buses are being built for service in New England this spring, and some of them will be on display at the Boston show before they are placed in service.

Gould Coupler Taken by Symington Interests

The Gould Coupler Company, New York, has been purchased from Charles J. Graham of the Graham Bolt & Nut Company by a banking group acting in behalf of interests connected with one of the largest railway supply companies. Announcement to this effect was made on Feb. 6. On Feb. 10 it was made public that the purchase of the Gould Coupler Company and the Gould Storage Battery Company was for the Symington interests.

Confirmation of these changes and of other details of the proposed new financing was obtained through Blair & Company, New York, on Feb. 26. At that time public offering was made of 175,000 shares of participating Class A shares of the Gould Coupler Company of Maryland. This company has acquired the plants, equipment, patents, trade names, etc., of Gould Coupler Company, a New York corporation, as a going concern. The business of the company was started 43 years ago under the title of Gould & Stimson. In 1890, the Gould Coupler Company was incorporated in West Virginia, and was succeeded in 1903 by a corporation of the same name chartered in the State of New York.

Simultaneously with this move, Charles A. Gould, who has been president of the company since its inception, is retiring from business at the age of 76 years and has been succeeded as president by his son, William S. Gould, who has been identified with the business for many years as vice-president. The executive and operating personnel will continue as heretofore with no other material change.

The Symington Company is acquiring a majority of the common shares of the new Gould company.

Electric Locomotive Shipments $3,500,000

Shipments of electric locomotives for the quarter ended Dec. 31, 1924, totaled 167, valued at $901,342, against 148, with a value of $738,540, for the quarter ended Sept. 30. Shipments for the year 1924 were 655, valued at $3,483,150, against 1,334, worth $6,221,170, in 1923. These figures are in accordance with the findings of the Department of Commerce.

Upward Trend of Gasoline Prices Quite Natural

A table of tank-wagon prices compiled by Dow, Jones & Company, New York, for 30 principal cities of the United States, shows an average price for gasoline was 15.6 cents a gallon on July 29, 15.21 cents on Aug. 29, 14.44 cents on Sept. 17, 14.64 cents on Sept. 20 and 13.59 cents a gallon on Oct. 3. It is explained that this steady decline was brought about by cheapness of crude, which, in turn, was attributable to overproduction that during the year added 19,843,000 bbl. to the 333,053,000 already held in storage at the end of

With the recent falling off in production and the improvement in crude oil prices gasoline has advanced 3.67 cents a gallon from the average low point of early October, the present average price being 17.26. Since Jan. 1, 1925, crude has advanced from $1.10 to $1.80 a barrel, net of 70 cents.

The yield of gasoline per barrel of crude varies with refining methods and the grade of crude oil, but averages about 30 per cent. In other words, a 42-gal. barrel of crude yields about 13 gal. of gasoline on the average, and other products and refining losses account for the remainder.

In commenting on these facts the *Wall Street Journal* admonishes its readers to remember that refiners were selling gasoline throughout the summer of 1924 at prices that would hardly yield a fair return on the investment, and that in all fairness present prices should allow them to recoup such losses as they sustained.

Oil men themselves explain that the recent upward change in prices is merely a manifestation of a natural economic sequence.

ELECTRIC RAILWAY MATERIAL PRICES—FEB. 26, 1925

Metals—New York

Copper, electrolytic, cents per lb.	14.687
Lead, cents per lb.	9.175
Nickel, cents per lb.	31.00
Zinc, cents per lb.	7.87
Tin, Straits, cents per lb.	57.00
Aluminum, 98 to 99 per cent, cents per lb.	27.00
Babbitt metal, warehouse, cents per lb.:	
Fair grade	60.00
Commercial	28.00

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	$4.45
Somerset mine run, Boston	2.125
Pittsburgh mine run, Pittsburgh	1.95
Franklin, Ill., screenings, Chicago	1.875
Central, Ill., screenings, Chicago	1.875
Kansas screenings, Kansas City	2.50

Track Materials—Pittsburgh

Standard Bessemer steel rails, gross ton	$43.00
Standard open hearth rails, gross ton	43.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	3.05
Tie plates (flat type), cents per lb.	2.425
Angle bars cents per lb.	2.75
Rail bolts and nuts, Pittsburgh base, cents, lb.	4.075
Steel bars, cents per lb.	2.10
Ties, white oak, Chicago, 6 in. x 8 in. x 8½ ft.	$1.60

Hardware—Pittsburgh

Wire nails, base per keg	2.85
Sheet iron (28 gage), cents per lb.	5.50
Sheet iron, galvanized (28 gage), cents per lb.	4.75
Galvanized barbed wire, cents per lb.	3.55
Galvanized wire, ordinary, cents per lb.	2.60

Waste—New York

Waste, wool, cents per lb.	16
Waste, cotton (100 lb. bale), cents per lb.:	
White	13–19
Colored	10–15

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), per gal.	$1.20
White lead (100 lb. keg), cents per lb.	0.1625
Turpentine (bbl. lots), per gal.	0.94
Car window glass, (single strength), first three brackets, A quality, discount*	84.0%
Car window glass, (single strength), first three brackets, B quality, discount*	86.0%
Car window glass, (double strength) all sizes, A quality, discount*	85.0%
Putty, 100 lb. tins, cents per lb.	4–6

* Prices f.o.b. works, boxing charges extra.

Wire—New York

Copper wire base, cents per lb.	17.00
Rubber-covered wire, No. 14, per 1,000 ft.	$7.00
Weatherproof wire base, cents per lb.	19.50

Paving Materials

Paving stone, granite, 4 x 8 x 4, f.o.b. Chicago, dressed, per sq.yd.	....
Common, per sq.yd.	....
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd.	$2.82
Paving brick 3½ x 8½ x 4, N. Y., per 1,000 in carload lots	51.00
Paving brick 3½ x 8½ x 3 N.Y., per 1000 in carload lots	45.00
Crushed stone, ½-in., carload lots, N. Y., per cu.yd.	1.85
Cement, Chicago consumers' net prices, without bags	2.20
Gravel, ½-in., cu.yd., f.o.b. N. Y.	1.75
Sand, cu.yd., N. Y.	1.25

Old Metals—New York and Chicago

Heavy copper, cents per lb.	11.75
Light copper, cents per lb.	10.00
Heavy brass, cents per lb.	7.50
Zinc, old scrap, cents per lb.	4.25
Lead, cents per lb. (heavy)	7.50
Steel car axles, Chicago, net ton	$19.25
Cast iron car wheels, Chicago, gross ton	19.25
Rails (short), Chicago, gross ton	20.25
Rails, (relaying), Chicago, gross ton	25.50
Machine turnings, Chicago, gross ton	12.25

Extensive Improvements Planned in New Orleans

Improvements planned by the New Orleans Public Service, Inc., New Orleans, La., during 1925 will cost approximately $6,641,203. With the completion of the program planned for this year, the Public Service will have spent $21,022,253 in 3 years. Among other things the improvements will include new machinery for the power houses and substations, changes in overhead and underground systems of distribution and machinery to increase the capacity of the gas department to 21,250,009 cu.ft.

Changes in American Car & Foundry Personnel

H. W. Wolff, vice-president of the American Car & Foundry Company, and G. R. Scanland, formerly auditor, have been elected to the board of directors of the company. Mr. Scanland has also been elected vice-president in charge of finance and accounts. Others elected were S. A. Maleppe, assistant treasurer, in place of S. S. De Lano, deceased; E. S. Block, assistant auditor, and A. E. Jackson, assistant treasurer.

Rolling Stock

Madison Railways, Madison, Wis., expects to purchase from the Yellow Coach Manufacturing Company, Chicago, three buses of the street-car type seating 29 passengers.

Municipal Railway of San Francisco, San Francisco, Cal., will purchase 10 all steel cars at a cost of $16,000 each.

Minneapolis Street Railway, Minneapolis, Minn., expects to spend $500,000 for some 50 buses and $100,000 additional for a garage as soon as the bus ordinance is passed.

Track and Line

Grand Rapids Railway, Grand Rapids, Mich., expects to spend $746,714 on relaying and building new track, making a total of $2,081,737 spent for construction since 1919.

Denver Tramway, Denver, Col., plans to construct a new car line, a cross-town branch extending from Broadway to University Avenue and possibly beyond Colorado Boulevard when plans for reorganization and removal of receivership are completed. The line will be from 23 to 40 blocks long. This construction is part of the South Denver improvement program, providing for construction of a consolidated freight and passenger railroad station.

Key System Transit Company, Oakland, Cal., has been granted an extension of time by the Railroad Commission in which to construct double tracks across 41st Street and Piedmont Avenue in the city of Oakland, double tracks across Arroyo Avenue between York Drive and Ricardo Avenue at grade and a single track across Cambridge Way between York Drive and Ricardo Avenue at grade in the city of Piedmont.

Shops and Buildings

Public Service Railway, Newark, N. J., plans to erect a combination car-house and garage at New Brunswick, N. J., to be about 400 ft. long on Sanford and Delevan Streets and 200 ft. on Commercial Avenue. Six tracks would lead into the building. The garage would be 120 by 190 ft., with a 115-ft. pit. In addition there would be a bus repair shop, oil house and store room.

Wisconsin Power & Light Company, Fond du Lac, Wis., plans to build a modern interurban-bus terminal at Fond du Lac. Administrative and sales departments will also be located in this building. A train shed will be added to the building of sufficient size to provide ample space for the increasing number of buses in operation.

Trade Notes

Combustion Engineering Corporation, New York, N. Y., has announced the appointment of W. R. Quinn, former manager of the fuel oil department, as Pacific Coast agent, with headquarters in San Francisco. Mr. Quinn's territory will include the states of Washington, Oregon and California.

Economy Electric Devices Company, Chicago, Ill., announces the installation of 10 additional meters with inspection dials on the Denver Tramway's equipment. This installation completely equips all of the rolling stock on this property.

Allen D. Turner, formerly in charge of convention publicity for the Westinghouse Electric & Manufacturing Company, with headquarters at Pittsburgh, and more recently in charge of automotive equipment advertising at the Springfield, Mass., office, has been appointed publicity manager of the New England district office of the company with headquarters at 10 High Street, Boston.

Charles Piez, chairman of the board of the Link-Belt Company, Chicago, tells in the January number of *System* what he means by the "Exception Plan." "The man who has continually to work overtime is a poor executive," is the opinion of Mr. Piez. He says the executive cannot immerse himself in routine matters, but must hold himself free to take care of the exceptions. He is in effect an emergency man, and added that it would mean death to his usefulness if he made himself the slave of a time-table.

Okonite Company, Passaic, N. J., opened an office at 310 South Michigan Avenue, Chicago, on Feb. 1 and took over the sale of Okonite products in the Western territory. Charles E. Brown, formerly vice-president of the Central Electric Company, was appointed vice-president in charge of the territory west of Pittsburgh and east of the Rocky Mountains of the Okonite Company, with headquarters in Chicago. A. L. McNeill, formerly manager of the railroad department of the Central Electric Company, has been appointed manager of the railroad department. E. H. McNeill, formerly railroad sales representative of the Central Electric Company, has been appointed sales engineer. Ray N. Baker, formerly railroad sales representative of the Central Electric Company, has been appointed sales engineer. L. R. Mann, formerly sales representative of the Central Electric Company, with headquarters at St. Louis, has been appointed manager of the St. Louis office. Joseph O'Brien, formerly railroad sales representative of the Central Electric Company, has been appointed sales representative, with headquarters in Chicago. C. E. Brown, Jr., formerly country sales manager of the Central Electric Company, has been appointed manager of the light and power department.

Lynn W. Nones has been appointed Eastern sales manager for the Diamond Power Specialty Corporation, in charge of the Atlantic Coast offices from Boston to Charlotte inclusive. His office is at 90 West Street, New York.

New Advertising Literature

Texas Company, New York, N. Y., in the January issue of *Lubrication* has given much information regarding lubrication practice for electric railways. Articles on methods of reclaiming, handling and storing lubricants are given, together with specific recommendations to eliminate waste and increase efficiency.

Portland Cement Association, Chicao, Ill., has issued a publication entitled "Design and Control of Concrete Mixtures." This booklet describes a method to produce concrete of predetermined strength.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has reprinted the paper "The Development of the Electric Locomotive," originally presented before the meeting of the American Railway Association in Atlantic City in June, 1924. The paper points out the salient facts incident to electric locomotive progress.

General Electric Company, Schenectady, N. Y., has issued bulletin No. 47640.2, devoted to induction, time, over-current relays, types IA-201, IA-202 and IA-206. It describes the four forms of over-current relays, together with the applications of each. Details of construction, lists of available ratings and principles of operation are covered, together with other general information. The bulletin is illustrated by photographs, charts and diagrams.

Crouse-Hinds Company, Syracuse, N. Y., has issued folder No. 21, on junction box condulets with removable hub plates.

Federal Porcelain Company, Carey, Ohio, has issued its condensed catalog of standard electrical porcelain in response to a demand from some of its jobber customers for a small catalog, but one that would at the same time contain complete information on all the types most in demand. The condensed catalog contains list prices, weights, barrel quantities, dimensions and wire carrying capacities on all the items of standard porcelain which are most commonly in demand. The folder is properly punched to fit standard E. S. J. A. salesmen's binders.

Bankers and Engineers

The Best Thing Niagara Falls Ever Fell For!

Niagara Falls, N. Y., is but one of many progressive cities that have profited by installing ELRECO Combination Railway and Lighting Poles. The first noticeable advantage is the marked improvement in the appearance of their streets. The next is the very substantial economy for the street railway company and the illuminating company by their common use of one set of poles. ELRECO Poles support the trolley span-wires as well as the ornamental lighting system. The lighting fixtures can be placed on these poles at just the right height for maximum lighting efficiency. This is another big advantage for the city. Lighting standards are usually too low for the best lighting results.

For the street railway, ELRECO Tubular Steel Poles mean lowest first cost, lightest weight, least maintenance, easiest possible painting, longest life, greatest possible ability to withstand strains in ALL directions, absolute safety and many other advantages.

We have facts that will knock every objection you can think of COLD. Write for them.

Electric Railway Equipment Co.
Cincinnati, Ohio
New York City, 30 Church Street

ELRECO POLES

These figures tell their own story of MILLER TROLLEY SHOE economy

COMPARISON OF REPLACEMENT COSTS FOR COLLECTION EQUIPMENT FOR THE YEARS 1920 AND 1922

Year 1920	Used	Cost
Trolley poles 10 ft. 8 in.	128	$363.52
Trolley poles 12 ft. 6 in.	95	351.50
Fixtures:		
Bearings	738	287.82
Renewable washers	1,561	93.66
Contact rings	1,476	291.88
Contact springs	1,669	216.97
Trolley harps, type "C"	200	480.00
Trolley rope	1,850	1,377.60
Trolley wheels	1,932	3,272.32
Total replacement costs for year 1920		$6,735.27
Year 1922		
Trolley poles 10 ft. 6 in.	44	$161.04
Trolley poles 12 ft. 6 in.	63	285.39
Fixtures:		
Bearings	60	23.40
Renewable washers	128	3.34
Contact rings	96	13.24
Contact springs	110	14.30
Trolley harps type "C"	0	....
Trolley rope	1,399	798.16
Trolley wheels, 6 in.	621	838.35
Miller trolley shoes	159	802.95
Miller contacts	1,343	2,377.11
Miller shunts	86	57.68
Miller lockwashers	6	.29
Miller bolts and nuts	469	15.01
Miller center pins	32	18.24
Total replacement costs for year 1922		$5,408.50
Difference in total costs for the two years in favor of the year 1922		$1,326.77
Cost per M.C.M. for collection equipment, 1920, cent		0.751
Cost per M.C.M. for collection equipment, 1922, cent		0.642

Note:—All cars were equipped with 6-in trolley wheels during 1922, while during 1922 a large per cent of the cars were equipped with Miller trolley shoes.

Note:—In the above comparative costs the cost of trolley bases and repairs are not considered.

—Note these other advantages too!

The Northern Texas Traction Company, (Winners of last year's Coffin Medal), from whose report the above is an excerpt, is but one of many progressive roads which have found specific and substantial economies in the use of Miller Trolley Shoes.

And their experience has but served to confirm the other important Miller advantages:—

1. Less wire wear.
2. More Mileage.
3. No Dewirements.
4. Silent Operation.
5. Steady Current Delivery.

And there's no backing up problem to face. The shape and construction of Miller Trolley Shoes make backing up as simple as going forward.

Miller-ize one route and check up. You'll be convinced.

Miller Trolley Shoe Company

Boston 21, Mass.

Rolling Stock the Beginning

The Dayton Resilient Tie meets all the requirements that the Way Committee of the A. E. R. A. asks for a substitute tie: Resiliency, holding rail to gage, sufficient bearing area, provision for rail renewal, ease of installing, low cost.

Resilient TIE

Puss may or may not have nine lives—

BUT—

—it becomes a matter of real importance to you as a practical railway man when month after month evidence piles up that BOYERIZED Parts are outliving ordinary hardened steel not once or twice, *but three to four times.*

Boyerizing does it, gives the tough steel from which these parts are made a glossy, glass-hard, armorplate surface that literally offers no foothold for wear. Get a few of these tough little fellows on the job right now. Let 'em prove their mettle on your own cars.

Buy from this list—
They're BOYERIZED

Brake Pins
Brake Hangers
Brake Levers
Pedestal Gibs
Brake Fulcrums
McArthur Turnbuckles
Manganese Brake Heads
Manganese Truck Parts
Center Bearings
Side Bearings
Spring Post Bushings
Spring Posts
Bolster and Transom Chafing Plates
Bushings
Bronze Bearings

Bemis Car Truck Company
Electric Railway Supplies
Springfield, Mass.

Representatives:
Economy Electric Devices Co., Old Colony Bldg., Chicago, Ill.
F. F. Bodler, 903 Monadnock Bldg., San Francisco, Cal.
W. F. McKenney, 54 First Street, Portland, Ore.
J. H. Denton, 1328 Broadway, New York City, N. Y.
A. W. Arlin, 772 Pacific Electric Bldg., Los Angeles, Cal.

St. Louis Built-
Ever-Wear STEEL BODIES
for Street Railways-

It Reflects the Standard of Its Builders

THIRTY-FIVE years of a consistent "Quality" policy has definitely established the reputation of St. Louis Cars and Equipment.

In back of every St. Louis "Ever-Wear Steel Body" is not only the vast experience in railway body building but a reputation for quality products that is universally recognized.

The illustration shows a 29-passenger Ever-Wear steel body built for the Houston Electric Company. This body will survive the chassis in normal service.

"Ever-Wear" steel bodies are built for railways only, and to conform to the most exacting requirements.

Write us today for further details.

St. Louis Car Company
St. Louis, Mo.

Standard Varnishes and Colors—

for transportation service—

For many years the name *Beckwith-Chandler* has stood for the highest quality finishes for steam and electric railway cars. The durability of these products under severe operating and climatic conditions has been proved by the experience of many of the leading railroads of the country.

There are specific Beckwith-Chandler products for every part of the car—exterior, interior, roof, headlining, cane seats, floor and trucks.

We can supply finishes in the flat color and varnish systems, enamel systems or color varnish systems.

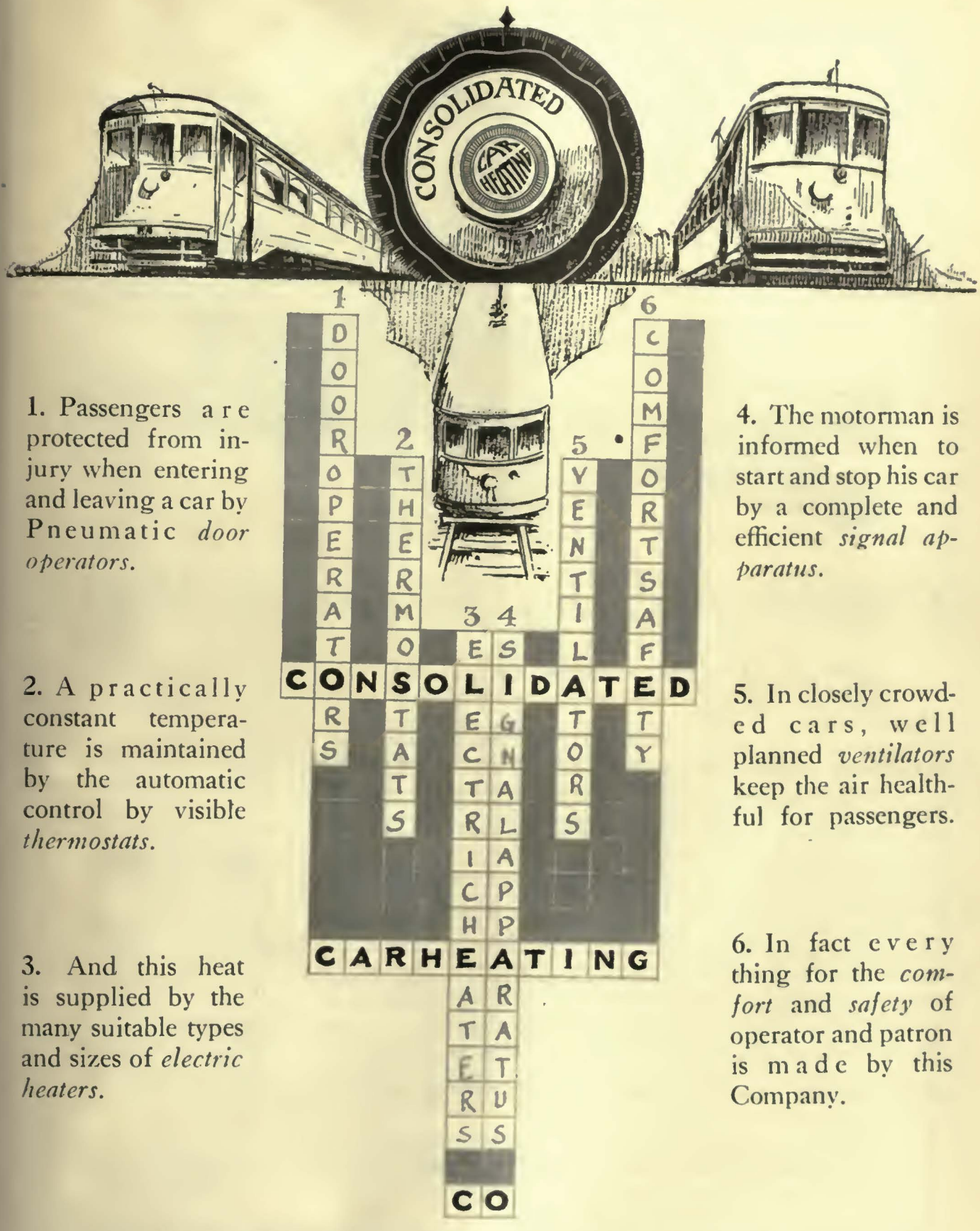
NEOLITE—the new Pyroxylin finish is another Beckwith-Chandler development.

Make Beckwith-Chandler products your paint shop standard.

BECKWITH-CHANDLER COMPANY

Manufacturers of Highest Grade Varnishes

320 Fifth Avenue, New York, N. Y. **203 Emmett St., Newark, N. J.**



1. Passengers are protected from injury when entering and leaving a car by Pneumatic *door operators.*

2. A practically constant temperature is maintained by the automatic control by visible *thermostats.*

3. And this heat is supplied by the many suitable types and sizes of *electric heaters.*

4. The motorman is informed when to start and stop his car by a complete and efficient *signal apparatus.*

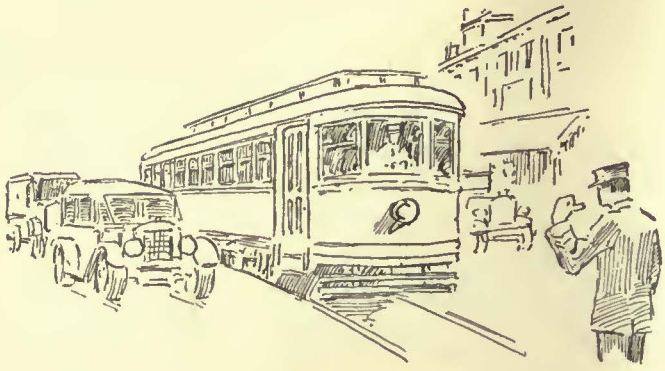
5. In closely crowded cars, well planned *ventilators* keep the air healthful for passengers.

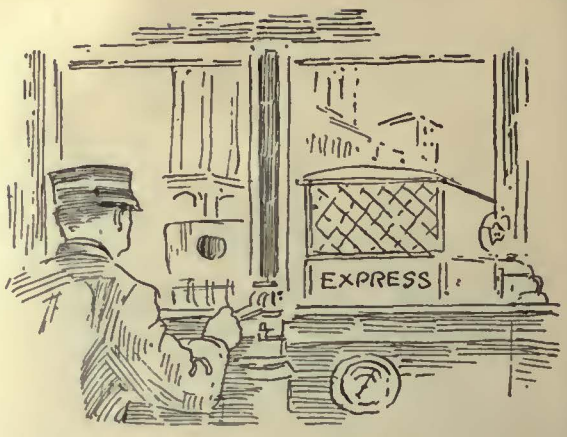
6. In fact every thing for the *comfort* and *safety* of operator and patron is made by this Company.

CONSOLIDATED CAR HEATING COMPANY

ALBANY, N. Y.

NEW YORK CHICAGO





Save the motors with Nuttall Standard Helical Gears

First, second—fifth notch on the controller, and a shock goes through the car as the motors gather speed!

That's where the trouble begins, that shock of acceleration that is inevitable with spur gearing. It springs Bolts, strains bearings, loosens insulation, cuts gear life and motor life, and piles up maintenance.

Not only the motors suffer; body work suffers too, and soon begins to creak, soon need "touching up."

Nuttall BP Helical Gears will stop this profit leak. The meshing of the teeth is like the turning of a screw—smooth, vibrationless, noiseless, shockless. There is no grinding and no chattering.

The secret lies in the 7½ deg. Heliz Angle; the long and short Addendum tooth; and the famous Nuttall BP Heat Treating Process.

The West Penn Railways have one set of Nuttall Helicals among the many they use with a 500,000 mile record to its credit. Practically every traction property in the country is using helical gears.

We'll be glad to co-operate in *proving* their economy on your cars. Consult us.

Write for our Helical Gear Book

R.D. NUTTALL COMPANY
PITTSBURGH PENNSYLVANIA

All Westinghouse Electric & Mfg. Co. District Offices are Sales Representatives in the United States for the Nuttall Electric Railway and Mine Haulage Products. In Canada: Lyman Tube & Supply Co., Ltd., Montreal and Toronto.

Steel Wheels Without Maintenance

Wheel-turning is a fast growing maintenance item.

Every addition of "multiple-wear" steel wheels increases the shop burden.

If steel wheels other than Davis Wheels go under your cars today you are faced with the necessity of conditioning their contours. Shop equipment must be bought and skilled mechanics detailed to the work. This cuts into funds for improvements and increases maintenance costs.

Davis "One-Wear" Steel Wheels eliminate this expense. They make a big mileage without repeated re-turnings.

The Davis "One-Wear" Steel Wheel is made of special steel compressed by centrifugal action while the metal is molten. It is subjected to scientific heat treatment, resulting in great strength and resistance to wear.

Ask about the properties who are using Davis Steel Wheels

AMERICAN STEEL FOUNDRIES

NEW YORK CHICAGO ST. LOUIS

WHAT size of conduit? What about elbows? Questions instantly and authoritatively settled for any job where rigid conduit is to be installed.

This Chart hangs on the wall as handy as a calendar—and as necessary when wiring must be figured.

It is a quiet reminder of *Sherarduct*—the Rigid Conduit. The Chart is free, and so intensely practical you will regularly use it.

National Metal Molding Company

WORLD'S LARGEST PRODUCERS OF ELECTRICAL CONDUITS AND FITTINGS

1559 Fulton Building, Pittsburgh, Pa.

Represented in All Principal Cities

10

Sherarduct

The Rigid Conduit That Bends

Make certain on every wiring job with this free Chart. Just slip this coupon in the mail now; that's all you need to do.

MAIL TODAY

National Metal Molding Company

Pittsburgh, Pa.

Please send free Chart of Standard Sizes of Conduits.

Name

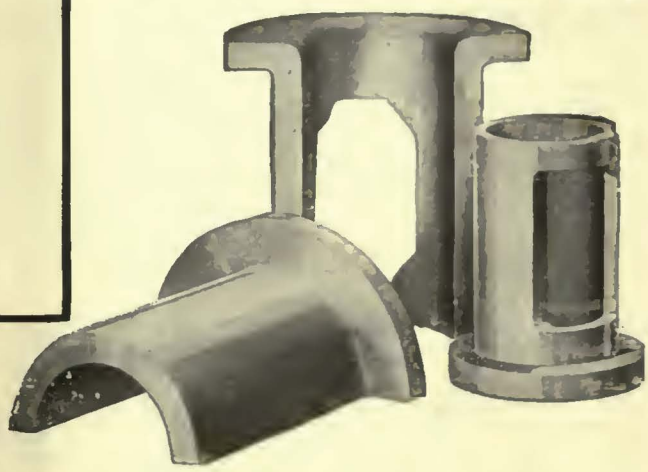
Firm

Address

SIGN—TEAR OFF

1559

Quality Service Economy Security



M-J Armature Babbitt Metal

compounded of new tin, copper, antimony and metallic nickel—no lead used. Insures lowest net cost per mile of operation.

"Tiger" Bronze Axles and Armature Bearings

The exceptional toughness and anti-frictional qualities of "Tiger" Bronze insures great strength and a very slow and even rate of wear. The result is perfect bearing alignment and greater mileage. "Tiger" Bronze will save its cost many times over every year.

M-J Lubricated and V. K. Oilless Trolley Wheels and Non-Arcing Harps

The metal used is exceedingly tough, yet does not grind away the metal of the wire. Perfect lubrication is accomplished automatically. Properly balanced and mechanically perfect in finish. Greater mileage assured. Lowest in ultimate cost and highest in net efficiency.

Those responsible for the purchasing of street car equipment can come to More-Jones for certain of their requirements with a full knowledge that here is equipment that represents the utmost in service value. Economy is a very definite result and is realized over a period of years. Start securing it by letting More-Jones furnish your next requirements.

MORE-JONES BRASS & METAL CO.
ST. LOUIS, MISSOURI

MORE-JONES QUALITY PRODUCTS

Of the 19 railway Co.s

in the U.S.A.

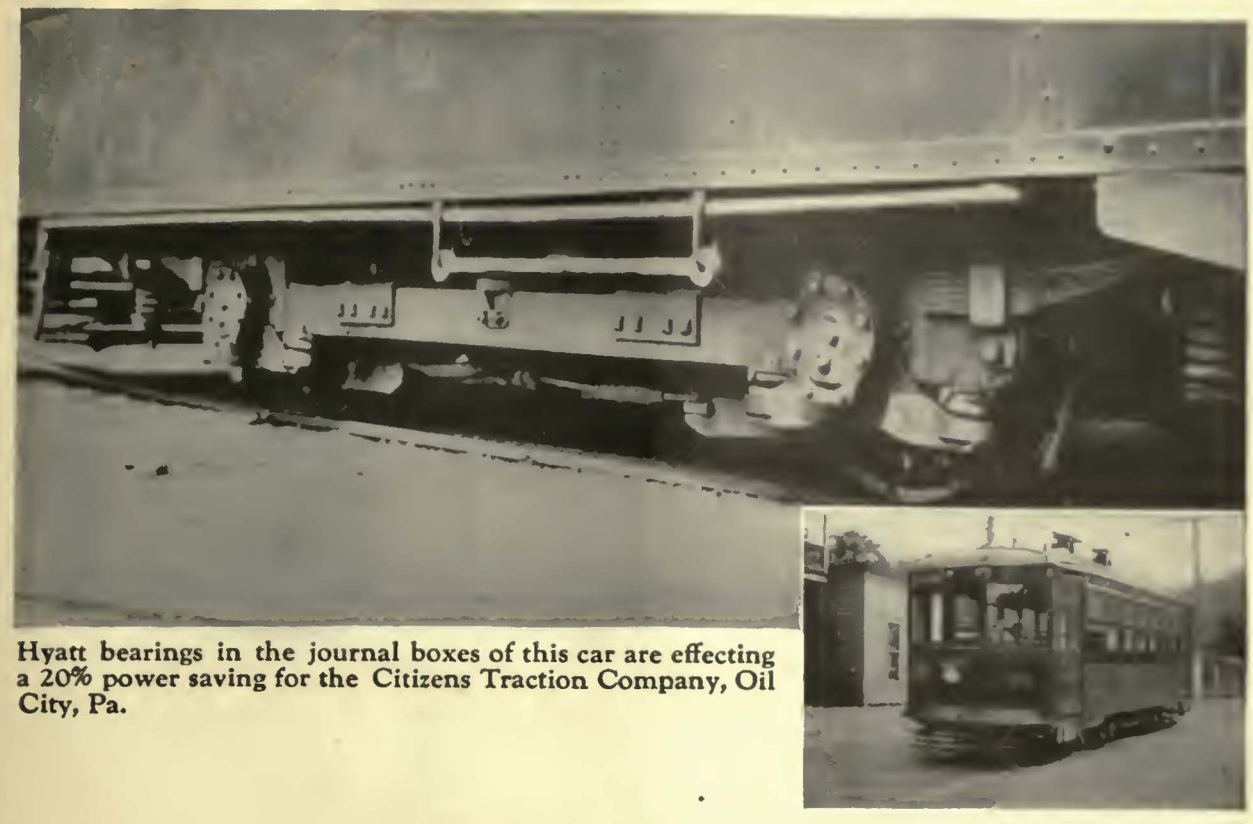
operating 1000 or more cars,

13

regularly use "Tool Steel" gears + pinions.

68 %

"Tool Steel" Quality T. S. Q. "Tool Steel" Quality



Hyatt bearings in the journal boxes of this car are effecting a 20% power saving for the Citizens Traction Company, Oil City, Pa.

20% Saved Is 20% Earned

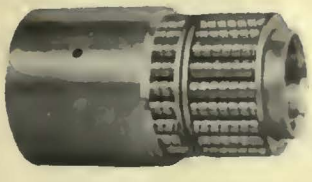
LEADING engineers in the electric railway field recognize that Hyatt equipped journal boxes on electric cars effect a power saving of at least 20% when compared with plain bearing equipment.

Mr. John A. Dewhurst, of Day & Zimmerman, Inc., in referring to the first completely Hyatt equipped car of the Citizens Traction Company, says:

"We made this installation principally to determine what saving in power would result, and the earliest tests indicate a 20 per cent saving. It is further reported that the Hyatt roller bearings have apparently brought about an elimination of noise."

Not only is a 20% power saving possible through the use of Hyatt bearings but the elimination of plain bearing friction means lighter loads on the motors and less wear and tear on the other parts of the running gear. Easier and quicker acceleration shortens the schedule time over the complete run without increasing maximum speeds.

A power saving of 20% and substantial savings in lubrication and maintenance costs are worth looking into. May one of our electric railway specialists give you complete information?



HYATT ROLLER BEARING COMPANY
NEWARK, NEW JERSEY

HYATT ROLLER BEARINGS FOR ELECTRIC RAILWAY CARS

SEARCHLIGHT SECTION

USED EQUIPMENT & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD.

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals)

DISPLAYED—RATE PER INCH

1 to 3 inches . . $4.50 an inch
4 to 7 inches . . 4.00 an inch
8 to 14 inches . . 3.50 an inch

Rates for larger space, or yearly rates on request. An advertising inch is measured vertically on one column, 3 columns—10 inches—to a page.

E.F.J.

POSITIONS VACANT

SPECIAL track work draftsmen wanted preference given men having had experience with special track work manufacturer, but will consider one or two junior draftsmen familiar with trigonometry. State age, experience and salary in first letter. P-774, Electric Railway Journal, Old Colony Bldg., Chicago, Ill.

YOUNG engineer wanted with experience on street railway track maintenance and construction; college man preferred, for position in sales department of rapidly growing industry. Give full particulars as to education, experience and salary expected. P-792, Elec. Ry. Journal, 10th Ave. at 36th St., New York.

POSITIONS WANTED

ACCOUNTING executive, railway, electric and gas utilities, now employed, seeks change; can produce results. PW-780, Electric Railway Journal, Old Colony Bldg., Chicago, Ill.

CAR painter wants position; letterer, striper and varnisher. Can do anything to be done on a car in the line of painting; an all around man. PW-791, Elec. Ry. Journal, 10th Ave. at 36th St., New York.

GENERAL repairman, 12 years' experience on armature winding, and electric equipment, on city and interurban equipment. PW-779, Elec. Ry. Journal, Old Colony Bldg., Chicago, Ill.

TRAFFIC manager, competent to handle traffic promotion and public relations work, including advertising for railway company operating city and interurban rail and bus service. At present assistant with such company. Particularly valuable to company modernizing or expanding its service. Good business sense and practical knowledge of rail and bus operation. PW-790, Elec. Ry. Journal, 10th Ave. at 36th St., New York.

SALESMAN WANTED

Side Line

Salesman who is already calling on, or in touch with street railways in the eastern part of the United States to take on a new article for sale, paying a good commission for which there is a great demand, and very little competition. SW-784, Electric Railway Journal, Leader-News Bldg., Cleveland, Ohio.

Keep your Eye
on the
Searchlight
and your
Advertisements in it

BARGAIN
68—WH-93-A
MOTORS
Splendid Condition
Complete $150 Each
Transit Equipment Company
Cars—Motors
501 Fifth Avenue, New York

WANTED
Orders for Oak, Car Stock, Cross Ties, Switch Ties, Timber
Have four mills in operation. A good stand of timber. Grades guaranteed. Prices right. Let's get acquainted.
ENARC LUMBER MFG. CO.
411 A. O. U. W. Bldg., Little Rock, Ark.

FOR SALE
30—GE-1000 Motors
50—GE-80 Motors
J. W. GERKE, 303 Fifth Avenue, N. Y. C.

SEARCHLIGHT SERVICE SECURES SATISFACTORY SITUATIONS
2003

FOR SALE
20—Birney Safety Cars. Brill built. Seating 32.
8—Steel Interurbans, 48 ft. long. Seating 52.
ELECTRIC EQUIPMENT CO.
Commonwealth Bldg., Philadelphia, Pa.

SOME ONE WANTS TO BUY

the equipment or machinery that you are not using.

This may be occupying valuable space, collecting dust, rust and hard knocks, in your shops and yards.

SELL IT BEFORE DEPRECIATION SCRAPS IT

THE SEARCHLIGHT SECTION
IS HELPING OTHERS

—LET IT HELP YOU ALSO

0128

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G.

Anchors, Guy
Elec. Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Armature Shop Tools
Elec. Service Supplies Co.

Automatic Return Switch Stands
Ramapo Ajax Corp.

Automatic Safety Switch Stands
Ramapo Ajax Corp.

Axles
Bemis Car Truck Co.
Bethlehem Steel Co.
Brill Co., The J. G.
Carnegie Steel Co.
Johnson & Co., J. R.
St. Louis Car Co.
Westinghouse E. & M. Co.

Axles (Front and Rear) Motor Truck & Passenger Car
Timken-Detroit Axle Co.

Axles, Trailer & Motor Bus
Timken-Detroit Axle Co.

Babbitt Metal
Ajax Metal Co.

Babbitting Devices
Columbia Machine Wks.

Badges and Buttons
Elec. Service Supplies Co.
International Register Co., The

Bearings and Bearing Metals
Ajax Metal Co.
Bemis Car Truck Co.
Brill Co., J. G., The
Columbia Machine Wks.
General Electric Co.
More-Jones Brass & Metal Co.
Westinghouse E. & M. Co.

Bearings, Center and Roller Side
Stucki Co., A.

Bells and Gongs
Brill Co., The J. G.
Columbia Machine Wks.
Consolidated Car Heat. Co.
Elec. Service Supplies Co.

Boilers
Babcock & Wilcox Co.

Bonding Apparatus
Amer. Steel & Wire Co.
Electric Railway Improvement Co.
Elec. Service Supplies Co.
Ohio Brass Co.
Rail Welding & Bonding Co.

Bonds, Rail
Amer. Steel & Wire Co.
Electric Railway Improvement Co.
Elec. Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Rail Welding & Bonding Co.
Westinghouse E. & M. Co.

Book Publishers
McGraw-Hill Book Co.

Boxes, Junction and Outlet
National Metal Molding Co.

Brackets and Cross Arms (See also Poles, Ties, Posts, Etc.)
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
Hubbard & Co.
Ohio Brass Co.

Brake Adjusters
Brill Co., The J. G.
National Ry. Appliance Co.
Westinghouse Tr. Br. Co.

Brake Shoes
Amer. Br. Shoe & Fdy. Co.
Bemis Car Truck Co.
Brill Co., The J. G.

Brakes, Brake Systems and Brake Parts
Allis-Chalmers Mfg. Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia Machine Wks.
General Electric Co.
National Brake Co.
Westinghouse Tr. Br. Co.

Brooms Wire & Rattan
Paxson Co., J. W.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Le Carbone Co.
Westinghouse E. & M. Co.

Bus Seats
Heywood-Wakefield Co.

Buses, Motor
Brill Co., The J. G.
International Motor Co.
N. Y. Transportation Co.
St. Louis Car Co.

Bushings
National Metal Molding Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.
Brill Co., The J. G.

Cables. (See Wires and Cables)

Cambric Tapes, Yellow and Black Varnish
Irvington Varnish & Ins. Co.

Carbon Brushes (See Brushes, Carbon)

Cars, Dump
Brill Co., J. G., The
Differential Steel Car Co.
St. Louis Car Co.

Car Lighting Fixtures
Elec. Service Supplies Co.

Car Panel Safety Switches
Consolidated Car Heat. Co.
Westinghouse E. & M. Co.

Cars, Passenger, Freight, Express, etc.
Amer. Car Co.
Brill Co., The J. G.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Gas, Rail
Brill Co., J. G., The
St. Louis Car Co.

Cars, Second Hand
Electric Equipment Co.
Transit Equipment Co.

Cars, Self-Propelled
Brill Co., J. G., The
General Electric Co.

Castings, Brass, Composition or Copper
Ajax Metal Co.
Anderson Mfg. Co., A. & J. M.
Columbia Machine Wks.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries
Bemis Car Truck Co.
Columbia Machine Wks.

Castings, Malleable and Brass
Amer. Br. Shoe & Fdy. Co.
Bemis Car Truck Co.
Columbia Machine Wks.
Horne & Ebling Corp.

Catchers and Retrievers, Trolley
Elec. Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Catenary Construction
Archbold-Brady Co.

Ceilings, Plywood, Panels
Haskelite Mfg. Co.

Chairs, Parlor Car
Heywood-Wakefield Co.

Change Carriers
Cleveland Fare Box Co.

Circuit-Breakers
Anderson, A. & J. M. Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Clamps and Connectors for Wires and Cables
Dossert & Co.
Elec. Ry. Equipment Co.
Elec. Ry. Improvement Co.
Elec. Service Supplies Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Cleaners and Scrapers Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.

Cleats
Natl. Metal Molding Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia Machine Wks.
Elec. Service Supplies Co.

Coils, Armature and Field
Columbia Machine Wks.
General Electric Co.
Westinghouse E. & M. Co.

Coils, Choke and Kicking
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Coin Counting Machines
Cleveland Fare Box Co.
Intern'l Register Co.
Johnson Fare Box Co.

Coin Sorting Machines
Cleveland Fare Box Co.

Coin Wrappers
Cleveland Fare Box Co.

Commutator Slotters
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Commutator Truing Devices
General Electric Co.

Commutators or Parts
Cameron Elec'l Mfg. Co.
Columbia Machine Wks.
General Electric Co.
Westinghouse E. & M. Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
General Electric Co.
Sullivan Machinery Co.
Westinghouse Tr. Br. Co.

Compressors, Gas
Sullivan Machinery Co.

Compressors, Portable
Sullivan Machinery Co.

Condensor Papers
Irvington Varnish & Ins. Co.

Condensers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Conduits, Interior
Natl. Metal Molding Co.

Connectors, Solderless
Dossert & Co.
Westinghouse E. & M. Co.

Connectors, Trailer Car
Consolidated Car Heat. Co.
Elec. Service Supplies Co.
Ohio Brass Co

Controllers or Parts
Allis-Chalmers Mfg. Co.
Columbia Machine Wks.
General Electric Co.
Westinghouse E. & M. Co.

Controller Regulators
Elec. Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse E. & M. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register
Brill Co., The J. G.
Elec. Service Supplies Co.
Internat'l Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works
Silver Lake Co.

Cord Connectors and Couplers
Elec. Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
American Steel Foundries
Brill Co., The J. G.
Ohio Brass Co.
Westinghouse Tr. Br. Co.

Cross Arms (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing, Frog & Switch
Ramapo Ajax Corp.

Crossing, Manganese
Ramapo Ajax Corp.

Crossings
Ramapo Ajax Corp.

Crossing, Track (See Track, Special Work)

Crossings, Trolley
Ohio Brass Co.

Curtains & Curtain Fixtures
Brill Co., The J. G.
Elec. Service Supplies Co.
Morton Mfg. Co.

Dealer's Machinery
Elec. Equipment Co.
Hyman-Michaels Co.
Transit Equipment Co.

Derailing Devices (See also Track Work)

Derailing Switches
Ramapo Ajax Corp.

Destination Signs
Columbia Machine Wks.
Elec. Service Supplies Co.

Detective Service
Wish-Service, P. Edward

Door Operating Devices
Brill Co., The J. G.
Consolidated Car Heat Co.
General Electric Co.
Nat'l Pneumatic Co., Inc.
St. Louis Car Co.

Doors & Door Fixtures
Brill Co., The J. G.
Consolidated Car Heat. Co.
General Electric Co.
Morton Mfg. Co.
St. Louis Car Co.

Doors, Folding Vestibule
Nat'l Pneumatic Co., Inc.
Safety Car Devices Co.

Drills, Rock
Sullivan Machinery Co.

Drills, Track
Amer. Steel & Wire Co.
Elec. Service Supplies Co.
Ohio Brass Co.

Dryers, Sand
Elec. Service Supplies Co.

Ears
Ohio Brass Co.

Economizers
Power Specialty Co.

Electrical Wires and Cables
Amer. Electrical Works
Amer. Steel & Wire Co.
Roebling's Sons & Co., J. A.

Electric Grinders
Western Electric Co.

Electrodes, Carbon
Rail Welding & Bonding Co.

Electrodes, Steel
Rail Welding & Bonding Co.

Enamels
Beckwith Chandler Co.

Engineers, Consulting, Contracting and Operating
Allison & Co., J. S.
Archbold-Brady Co.
Beeler, John A.
Bibbins, J. Rowland
Buchanan & Layng Corp.
Bureau of Commercial Economics, Inc.
Day & Zimmermann, Inc.
Drum & Co., A. L.
Ford, Bacon & Davis
Hemphill & Wells
Holst, Engelhardt W.
Jackson, Walter
Kelly Cooke & Co.
Ong, Joe R.
Railway Audit & Inspection Co.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Stevens & Wood
Stone & Webster
White Eng. Corp., The J. G.

Engines, Gas, Oil or Steam
Allis-Chalmers Mfg. Co.
Westinghouse E. & M. Co.

Fare Boxes
Cleveland Fare Box Co.
Johnson Fare Box Co.
Nat'l Ry. Appliance Co.

Fare Registers
Ohmer Fare Register Co.

Fences, Woven Wire and Fence Posts
Acme Wire Co.
Amer. Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Consolidated Car Fender Co.
Elec. Service Supplies Co.

Fibre and Fibre Tubing
Westinghouse E. & M. Co.

Field Coils (See Coils)

Flangeway Guards, Steel
W. S. Godwin Co., Inc.

Floodlights
Elec. Service Supplies Co.

Forgings
Brill Co., J. G., The

Frogs & Crossings, Tee Rail
Ramapo Ajax Corp.

Frogs, Track (See Track Work)

Frogs, Trolley
Ohio Brass Co.

Fuses and Fuse Boxes
Columbia Machine Wks.
Consolidated Car Heat. Co.
General Electric Co.
Westinghouse E. & M. Co

Fuses, Refillable
General Electric Co.
Johns-Manville, Inc.

Gaskets
Westinghouse Tr. Br. Co.

Gas Producers
Westinghouse E. & M. Co.

Gas-Electric Cars
General Elec. Co.
Westinghouse E. & M. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Brill Co., J. G., The

Gear Cases
Chillingworth Mfg. Co.
Columbia Machine Wks.
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Gears and Pinions
Bemis Car Truck Co.
Columbia Machine Wks.
Elec. Service Supplies Co.
General Electric Co.
Nat'l Ry. Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Girder Rails
Lorain Steel Co.

Gong (See Bells and Gongs)

Greases (See Lubricants)

Grinders & Grinding Supplies
Metal & Thermit Corp.

Guard Rail Clamps
Ramapo Ajax Corp.

Guard Rails, Tee Rail & Manganese
Ramapo Ajax Corp.

Guards, Trolley
Elec. Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Elec. Service Supplies Co.
More-Jones Brass Metal Co.
Nuttall Co., R. D.
Star Brass Works
Thornton Trolley Wheel Co.

Headlights
Elec. Service Supplies Co.
General Electric Co.
Ohio Brass Co.

Headlining
Haskelite Mfg. Co.
Panelyte Co.

Heaters for Special Purposes
Power Specialty Co.

Heaters, Car (Electric)
Consolidated Car Heat. Co.
Gold Car Heat. & Ltg. Co.
Nat'l Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Elec. Service Supplies Co.
Smith Heater Co., Peter

Helmets, Welding
Rail Welding & Bonding Co.

Hoists & Lifts
Columbia Machine Wks.

Hoists, Portable
Sullivan Machinery Co.

Hydraulic Machinery
Allis-Chalmers Mfg. Co.

Instruments Measuring, Testing and Recording
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Insulating Cloth, Paper and Tape
General Electric Co.
Irvington Varnish & Ins. Co.
Okonite Co.
Stand. Underground Cable Co.
Westinghouse E. & M. Co.

Insulating, Silk & Varnish
Irvington Varnish & Ins. Co.

Insulation (See also Paints)
Electric Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Okonite Co.
Westinghouse E. & M. Co.

Insulation Slots
Irvington Varnish & Ins. Co.

Insulators (See also Line Materials)
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse E. & M. Co.

Insulator Pins
Elec. Service Supplies Co.
Hubbard & Co.

Jacks (See also Cranes, Hoists and Lifts)
Buda Company
Columbia Machine Wks.
Elec. Service Supplies Co.

Joints, Rail
(See Rail Joints)

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.

Junction Boxes
Horne & Ebling Corp.
Std. Underground Cable Co.

Lamps, Guards and Fixtures
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Lamps, Arc & Incandescent (See also Headlights)
General Electric Co.
Westinghouse E. & M. Co.

Lamps, Signal and Marker
Nichols-Lintern Co.
Ohio Brass Co.

Lanterns, Classification
Nichols-Lintern Co.

Lightning Protection
Elec. Service Sup. Co.
General Electric Co.
Ohio Brass Co.
Shaw, Henry M.
Westinghouse E. & M. Co.

Line Material (See also Brackets, Insulators, Wires, etc.)
Archbold-Brady Co.
Dossert & Co.
Electric Ry. Equipment Co.
Elec. Service Sup. Co.
General Electric Co.
Hubbard & Co.
More-Jones Brass & Metal Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Locomotives, Electric
General Electric Co.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.
Westinghouse E. & M. Co.

Lubricating Engineers
Galena Signal Oil Co.
Standard Oil Co.
Texas Co.
Universal Lubricating Co.

Lubricants, Oil and Grease
Galena Signal Oil Co.
Standard Oil Co
Texas Co.
Universal Lubricating Co.

Manganese Parts
Bemis Car Truck Co.

Manganese Steel Guard Rails
Ramapo Ajax Corp.

Manganese Steel Switches, Frogs & Crossings
Ramapo Ajax Corp.

Meters (See Instruments)

Molding, Metal
Allis-Chalmers Mfg. Co.
Natl. Metal Molding Co.

Motor Buses (See Buses, Motor)

Motor Leads
Dossert & Co.

Motors, Electric
Allis-Chalmers Mfg. Co.
Westinghouse E. & M. Co.

Motors and Generators, Sets
Allis-Chalmers Mfg. Co.
General Electric Co.

Motormen's Seats
Brill Co., J. G.
Elec. Service Sup. Co.
Heywood-Wakefield Co.
St. Louis Car Co.
Wood Co., Chas. N.

Nuts and Bolts
Bemis Car Truck Co.
Hubbard & Co.

Oil Heaters
Power Specialty Co.

Oils (See Lubricants)

Omnibuses (See Buses, Motor)

Oxy-Acetylene (See Cutting Apparatus, Oxy-Acetylene)

Packing
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Paints and Varnishes (Insulating)
Beckwith-Chandler Co.
Irvington Varnish & Ins. Co.

Paints and Varnishes for Woodwork
Beckwith-Chandler Co.
National Ry. Appliance Co.

Pavement Breakers
Ingersoll-Rand Co.
Sullivan Machinery Co.

Paving Guards, Steel
W. S. Godwin Co., Inc.

Paving Material
Amer. Br. Shoe & Fdy. Co.

Pickup, Trolley Wire
Elec. Service Supplies Co.
Ohio Brass Co.

Pinion Pullers
Elec. Service Supplies Co.
General Electric Co.
Wood Co., Chas. N.

Pinions (See Gears)

Pins, Case Hardened, Wood and Iron
Bemis Car Truck Co.
Elec. Service Sup. Co.
Ohio Brass Co.
Westinghouse Tr. Brake Co.

Pins Wood & Iron
Sharp, E. P.

Pipe Fittings
Westinghouse Tr. Brake Co.

Planers (See Machine Tools)

Plates for Tee Rail Switches
Ramapo Ajax Corp.

Pliers, Rubber Insulated
Elec. Service Sup. Co.

Plugs
Natl. Metal Molding Co.

Pole Line Hardware
Ohio Brass Co.

Poles, Metal Street
Elec. Ry. Equipmeot Co.
Hubbard & Co.
Truscon Steel Co.

Pole Reinforcing
Hubbard & Co.

Poles & Ties Treated
Bell Lumber Co.
International Creosoting & Construction Co.

Poles, Ties, Posts, Piling & Lumber
Bell Lumber Co.
International Creosoting & Construction Co.

Poles, Trolley
Bell Lumber Co.
Elec. Service Supplies Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Elec. Ry. Equipment Co.
Elec. Service Sup. Co.

Portable Grinders
Buda Company

Potheads
Okonite Co.

Power Saving Devices
National Ry. Appliance Co.

Pressure Regulators
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Pumps
Allis-Chalmers Mfg. Co.

Pumps, Air Lift
Sullivan Machinery Co.

Pumps Vacuum
Ingersoll-Rand Co.
Sullivan Machinery Co.

Punches, Ticket
Intern'l Register Co., The
Wood Co., Chas. N.

Rail Braces & Fastenings
Ramapo Ajax Corp.

Rail Filler
Philip Carey Co.

Rail Grinders (See Grinders)

Rail Joints
Carnegie Steel Co.
Rail Joint Co.

Rail Joints—Welded
Lorain Steel Co.
Metal & Thermit Corp.

Rails, Relaying
Foster Co., L. B.
Hyman-Michaels Co.

Rails, Steel
Carnegie Steel Co.
Foster Co., L. B.

Rail Welding
Metal & Thermit Corp.
Rail Welding & Bonding Co.

Railway Paving Guards, Steel
Godwin Co., Inc., W. S.

Railway Safety Switches
Consolidated Car Heat. Co.
Westinghouse E. & M. Co.

Rattan
Brill Co., The J. G.
Elec. Service Supplies Co.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.

Rattan Car Seat Webbing
Heywood Wakefield Co.

Reclaimers, Waste & Oil
Oil & Waste Saving Machine Co.

Registers and Fittings
Brill Co., The J. G.
Elec. Service Supplies Co.
Intern'l Register Co., The
Ohmer Fare Register Co.
Rooke Automatic Register Co.

Reinforcement, Concrete
Amer. Steel & Wire Co.

Repair Shop Appliances (See also Coil Banding and Winding Machines)
Elec. Service Supplies Co.

Repair Work (See also Coils)
General Electric Co.
Westinghouse E. & M. Co.

Replacers, Car
Elec. Service Sup. Co.

Resistances
Consolidated Car Heat. Co.

Resistance, Wire and Tube
General Electric Co.
Westinghouse E. & M. Co.

Retrievers, Trolley (See Catchers and Retrievers, Trolley)

Rheostats
General Electric Co.
Westinghouse E. & M. Co.

Roller Bearings
Hyatt Roller Bearing Co.

Roofs
Haskelite Mfg. Co.

Rosettes
Nat'l Metal Molding

Sanders, Track
Brill Co., The J. G.
Elec. Service Sup. Co.
Nichols-Lintern Co.
Ohio Brass Co.

Sash Fixtures, Car
Brill Co., The J. G.
Horne & Ebling Corp.

Scrapers, Track (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Elec. Service Sup. Co.

Seats, Bus
Brill Co., The J. G.
Heywood-Wakefield Co.
St. Louis Car Co.

Seats, Car (See also Rattan)
Brill Co. The J. G.
Heywood-Wakefield Co.
St. Louis Car Co.

Seating Materials
Brill Co., J. G.
Heywood-Wakefield Co.

Second Hand Equipment
Electric Equipment Co.
Hyman-Michaels Co.
Transit Equipment Co.

Shades, Vestibule
Brill Co., The J. G.

Shovels
Brill Co., The J. G.
Hubbard & Co.

Side Bearings (See Bearings, Center and Side)

Signals, Car Starting
Consolidated Car. Heat Co.
Elec. Service Sup. Co.
Nat'l Pneumatic Co., Inc.

Signals, Indicating
Nichols-Lintern Co.

Signal Systems, Highway Crossing
Nachod Signal Co., Inc.
Wood Co., Chas. N.

Signal Systems, Block
Elec. Service Sup. Co.
Nachod Signal Co., Inc.

Slack Adjusters (See Brake Adjusters)

Sleet Wheels and Cutters
Anderson Mfg. Co., A. & J. M.
Columbia Machine Wks.
Elec. Ry. Equipment Co.
Elec. Ry. Improvement Co.
Elec. Service Supplies Co.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.

Smokestacks, Car
Nichols-Lintern Co.

Snow-Plows, Sweepers and Brooms
Brill Co., The J. G.
Columbia Machine Wks.
Consolidated Car Fender Co.
Heywood-Wakefield Co.
McGuire-Cummings Mfg. Co.

Sockets & Receptacles
National Metal Molding Co.

Soldering and Brazing Apparatus (See Welding Processes and Apparatus)
Irvington Varnish & Ins. Co.

Special Adhesive Papers
Irvington Varnish & Ins. Co.

Special Trackwork
Lorain Steel Co.

Spikes
Amer. Steel & Wire Co.

Splicing Compounds
Westinghouse E. & M. Co.

Splicing Sleeves (See Clamps and Connectors)

Springs, Car and Truck
American Steel Foundries
Amer. Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Fort Pitt Spring & Mfg. Co.
St. Louis Car Co.

Sprinklers, Track and Road
Brill Co., The J. G.
McGuire-Cummings Mfg. Co.

Steel and Steel Products
Carnegie Steel Co.

Steps, Car
Brill Co., The J. G.
Morton Mfg. Co.

Stokers, Mechanical
Babcock & Wilcox Co.
Westinghouse E. & M. Co.

Stop Signals
Nichols-Lintern Co.

Storage Batteries (See Batteries, Storage)

Strain, Insulators
Anderson, A. & J. M. Mfg. Co.
Ohio Brass Co.

Strand
Roebling's Sons Co., J. A.

Superheaters
Babcock & Wilcox Co.
Power Specialty Co.

Sweepers, Snow (See Snow Plows, Sweepers and Brooms)

Switches, Safety
Johns-Pratt Co.

Switches, Selector
Nichols-Lintern Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track (See Track Special Work)

Switches and Switchboards
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Tapes and Cloths (See Insulating Cloth, Paper and Tape)

Tee Rail Special Track Work
Ramapo Ajax Corp.

Telephones and Parts
Elec. Service Supplies Co.

Terminals, Cable
Std. Underground Cable Co.

Testing Instruments (See Instruments, Electrical Measuring, Testing, etc.)

Thermostats
Consolidated Car Heat. Co.
Gold Car Heat. & Ltg. Co.
Railway Utility Co.
Smith Heater Co., Peter

Ticket Choppers & Destroyers
Elec. Service Supplies Co.

Ties, Mechanical
Dayton Mechanical Tie Co.

Ties and Tie Rods, Steel
Carnegie Steel Co.
Godwin Co., Inc., W. S.
International Steel Tie Co.

Ties, Wood Cross (See Poles, Ties, Posts, etc.)

Tools, Track & Miscellaneous
Amer. Steel & Wire Co.
Columbia Machine Works
Elec. Service Supplies Co.
Hubbard & Co.

Torches, Acetylene (See Cutting Apparatus)

Towers and Transmission Structures
Archbold-Brady Co.
Westinghouse E. & M. Co.

Trackless Trolley Cars
Brill Co., The J. G.
St. Louis Car Co.

Track Grinders
Metal & Thermit Corp.

Track, Special Work
Buda Company
Columbia Machine Wks.
N. Y. Switch & Crossing Co.
Ramapo Ajax Corp.

Transfer (See Tickets)

Transfer Issuing Machines
Ohmer Fare Register Co.

Transfer Tables
American Bridge Co.

Transformers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Treads, Safety, Stair, Car Step
Morton Mfg. Co.

Trolley Bases
Elec. Service Supplies Co.
General Electric Co.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
Elec. Service Supplies Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Buses
Brill Co., The J. G.
General Electric Co.
Westinghouse E. & M. Co.

Trolley Material, Overhead
Anderson, A. & J. M. Mfg. Co.
Elec. Service Supplies Co.
More-Jones Brass & Metal Co.
Ohio Brass Co.

Trolley Shoe
Miller Trolley Shoe Co.

Trolley Wheel Bushings
More-Jones Brass & Metal Co.

Trolley Wheels & Harps
More-Jones Brass & Metal Co.
Thornton Trolley Wheel Co.

Trolley Wheels (See Wheels, Trolley)

Trolley Wire
Amer. Electrical Works
Amer. Steel & Wire Co.
Anaconda Copper Min. Co.
Bridgeport Brass Co.
Roebling's Sons Co., J. A.

Trucks, Car
Bemis Car Truck Co.
Brill Co., The J. G.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.
Taylor Elec. Truck Co.

Tubing, Yellow & Black Flexible Varnish
Irvington Varnish & Ins. Co.

Turbines, Steam
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Turbines, Water
Allis-Chalmers Mfg. Co.

Turnstiles
Elec. Service Supplies Co.
Perey Mfg. Co., Inc.

Valves
Ohio Brass Co.
Westinghouse Tr. Br. Co.

Varnished Papers & Silks
Irvington Varnish & Ins. Co.

Ventilators, Car
Brill Co., The J. G.
Nat'l Ry. Appliance Co.
Nichols-Lintern Co.
Railway Utility Co.
St. Louis Car Co.

Welded Rail Joints
Alumino-Thermic Corp.
Electric Railway Improvement Co.
Metal & Thermit Corp.
Ohio Brass Co.
Rail Welding & Bonding Co.

Welders, Portable Electric
Electric Railway Improvement Co.
Ohio Brass Co.
Rail Welding & Bonding Co.

Welding Processes and Apparatus
Alumino-Thermic Corp.
Electric Railway Improvement Co.
General Electric Co.
Metal & Thermit Corp.
Ohio Brass Co.
Rail Welding & Bonding Co.
Westinghouse E. & M. Co.

Welding Steel
Electric Railway Improvement Co.
Rail Welding & Bonding Co.

Wheel Guards (See Fenders and Wheel Guards)

Wheel Presses (See Machine Tools)

Wheels, Car, Cast Iron
Bemis Car Truck Co.
Carnegie Steel Co.
Griffin Wheel Co.

Wheels, Car, Steel & Steel Tire
American Steel Foundries

Wheels, Wrought Steel
Carnegie Steel Co.

Wheels, Trolley
Columbia Machine Wks.
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.
Sharp, E. P.
Star Brass Works

Whistles, Air
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Wire Rope
Roebling's Sons Co., J. A.

Wires and Cables
Acme Wire Co.
Amer. Electrical Works
Amer. Steel & Wire Co.
Anaconda Copper Min. Co.
Bridgeport Brass Co.
General Electric Co.
Okonite Co.
Roebling's Sons Co., J. A.
Westinghouse E. & M. Co.
Std. Underground Cable Co.

Fifty-one cities will use the Carey Elastite System of Track Insulation in their track work this spring.

"Sho am a easy job, boss!"

Installation of Carey Elastite track insulation is easy, and does not interfere with other work in track construction. Two or three laborers can set the rail filler in the time between welding and spiking of track and the concrete pouring.

The Carey Elastite System of Track Insulation protects both track and pavement from destructive rail vibration, traffic-impact, and frost-action. It pays a profit over and above by greatly reducing maintenance cost on tracks and rolling stock, at the same time insuring much quieter operation.

THE PHILIP CAREY COMPANY
53 Wayne Ave., Lockland, Cincinnati, O.

Send for Complete Data

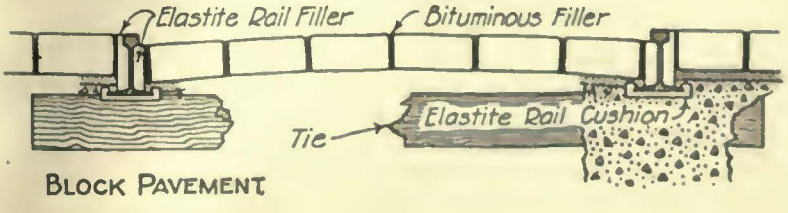
Elastite Rail Filler Is Easy to Install

a tap of a mallet holds it in the web of the rail

Carey Elastite Rail Filler is a composition of specially-tempered asphalt and fibre which is used as a resilient cushion between the rail and the pavement absorbing traffic-impact, rail vibration and traffic-noise. It is preformed to fit any rail-section and is readily shaped on the job to fit any track-curve. It is unaffected by moisture or temperature changes and is enduring under all service conditions.

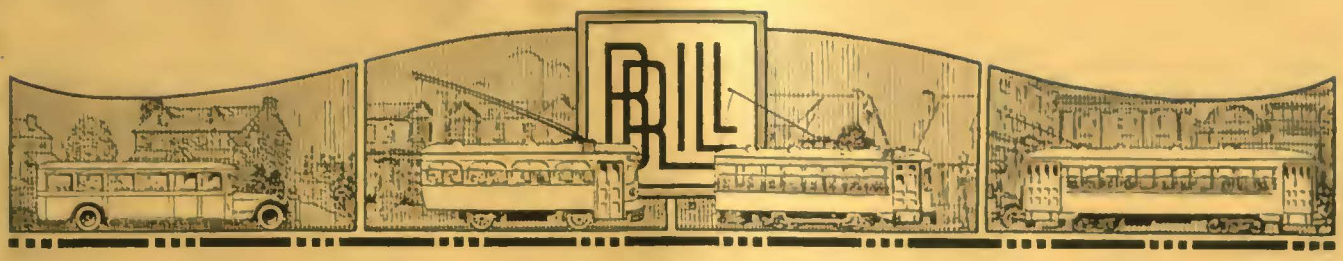
Carey Elastite

SYSTEM OF TRACK INSULATION



BLOCK PAVEMENT

ALPHABETICAL INDEX TO ADVERTISEMENTS



Light-Weight Interurban Type Car—Brill 77-E Trucks with Twin Links

This single-end combination passenger and baggage type car, recently built by The G. C. Kuhlman Car Company for The Ohio Public Service Company's lines between Mansfield and Shelby, Ohio, has many distinctive features.

In addition to its light weight of 31,460 lb. complete with quadruple 25-Hp. motors, its Brill 77-E trucks are equipped with Twin Swing Links, which retain the superior riding action under the higher rates of speed and on uneven track. Also, with the main passenger compartment in front and the absence of any forward bulkhead, an excellent view is obtained from this compartment.

This type car measures 38 ft. 1¼ in. over platforms, 8 ft. 6 in. wide over posts, 32-in. post centers, and seats 44 passengers, 16 of which are in the combined smoking and baggage compartment at rear.

A year of repeat orders

82%
of CP Compressors go to CP users

And the other 18% of 1924 purchases were for companies who more recently decided to take advantage of CP supremacy.

For reliability and low cost of operation the CP Compressor has no superior. Many railways are maintaining their CP Compressors at a cost of only $3 per compressor per year

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