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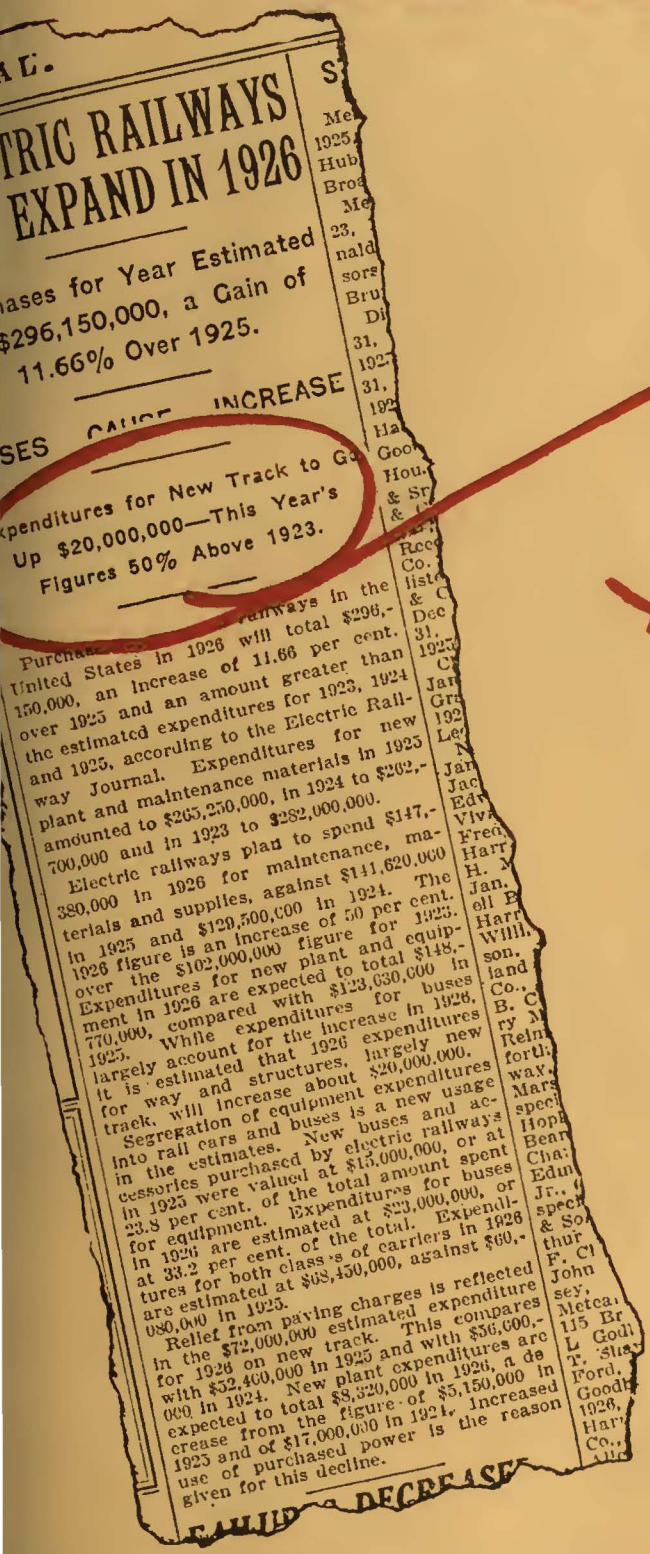
ELECTRIC RAILWAY JOURNAL



...AL.

TRIC RAILWAYS EXPAND IN 1926

...ases for Year Estimated $296,150,000, a Gain of 11.66% Over 1925.

...SES ...INCREASE

...xpenditures for New Track to G... Up $20,000,000—This Year's Figures 50% Above 1923.

...Railways in the United States in 1926 will total $296,150,000, an increase of 11.66 per cent. over 1925 and an amount greater than the estimated expenditures for 1923, 1924 and 1925, according to the Electric Railway Journal. Expenditures for new plant and maintenance materials in 1925 amounted to $265,250,000, in 1924 to $262,700,000 and in 1923 to $282,000,000.

Electric railways plan to spend $147,389,000 in 1926 for maintenance, materials and supplies, against $141,620,000 in 1925 and $129,500,000 in 1924. The 1926 figure is an increase of 50 per cent. over the $102,000,000 figure for 1923. Expenditures for new plant and equipment in 1926 are expected to total $148,770,000, compared with $123,630,000 in 1925. While expenditures for buses largely account for the increase in 1926, it is estimated that 1926 expenditures for way and structures, largely new track, will increase about $20,000,000. Segregation of equipment expenditures into rail cars and buses is a new usage in the estimates. New buses and accessories purchased by electric railways in 1925 were valued at $15,000,000, or at 23.8 per cent. of the total amount spent for equipment. Expenditures for buses in 1926 are estimated at $23,000,000, or at 33.2 per cent. of the total. Expenditures for both classes of carriers in 1926 are estimated at $68,450,000, against $60,080,000 in 1925.

Relief from paving charges is reflected in the $72,000,000 estimated expenditure for 1926 on new track. This compares with $52,400,000 in 1925 and with $56,600,000 in 1924. New plant expenditures are expected to total $8,320,000 in 1926, a decrease from the figure of $5,150,000 in 1925 and of $17,000,000 in 1924. Increased use of purchased power is the reason given for this decline.

...DECREASE

But how?

Progressive and courageous financial and managerial leadership is looking to its engineering staffs, both in the manufacturing and operating fields, for those same qualities in order to make good the implied promise of this *Times* headline.

That its faith is justified is evidenced by the enthusiasm of the special A.E.R.A. committees on car design and development, by power savings both in production and operation and by better transportation methods and better selling of transportation.

In the track field this justification is found in our 1925 collection of track costs which indicate that much renewable base, twin tie construction built with high-class rail, joints and paving was installed at a lower cost than wood tie, stone ballasted construction.

May we send you these figures as a barometer to check your efforts to help your "Electric Railway to Expand in 1926?"

THE INTERNATIONAL STEEL TIE COMPANY
CLEVELAND, OHIO

Financial Section,
York Times,
ry 3, 1926

Steel Twin Tie Track

Renewable Track Permanent Foundation

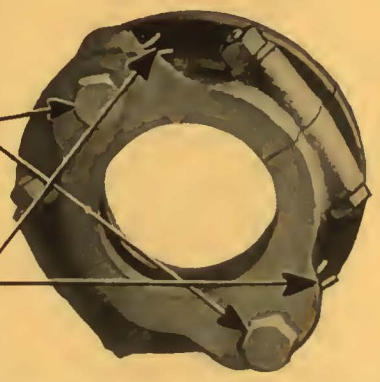
HOW MANY—

of your motors are held in the correct position on the axle?

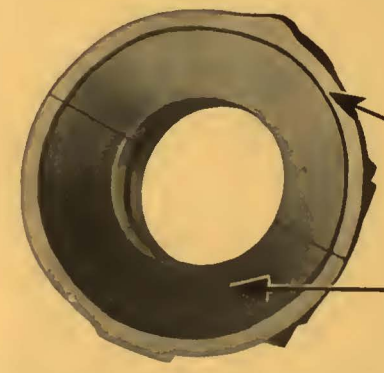
Consider the armature end-play and the lateral movement of the motor on the axle, as commonly experienced, which result in a short life of pinions, bearings, gear cases, etc. Why not give your motors a "sporting chance" with a *Quality Axle Collar?*

Adjustable Screws Sherardized Permit taking up end-play of motor on axle.

Adjusting Bolts locked by cotter pins to prevent change in position.



Complete Axle Collar, Front View

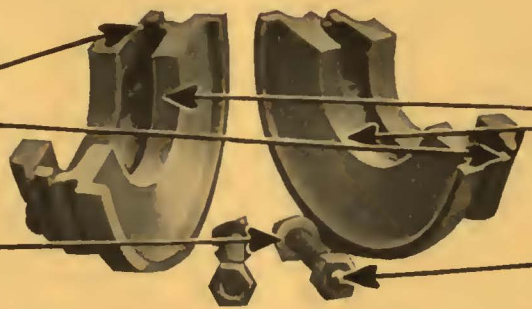


Complete Axle Collar, Rear View

Lip, overhanging axle bearing flange, provides dust-proof protection at the rubbing surfaces.

The material of the collar is semi-steel, strong and durable.

Tongue and Groove are provided at the parting.



Upper Half of Axle Collar

Lower Half of Axle Collar

Careful machining assures a tight clamp action of the collar on the axle seat.

Lock Washer

Clamping Screw

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries

MEMBER AERA 1926

WESTINGHOUSE ELECTRIC

Westinghouse

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Vol. 67
No. 3

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January 16, 1926

It Pays to Bind

TWO railway men, one the newly appointed general manager of a city property, were talking of the difficulties so often encountered in negotiating with municipal authorities.

"Our City Council does not realize the essential character of the service rendered by the street railway," the new g. m. remarked. "I have told them in a general way about the experience of cities that have tried to get along without the railways — Bridgeport, Des Moines, Toledo, Newark, and Akron —but I wish I had more data on this subject."

"Why don't you look it up in the back numbers of ELECTRIC RAILWAY JOURNAL?" asked the other.

"I would if I could, but the old management here never kept back numbers of the JOURNAL. Beginning with the first of this year, however, we're going to keep them all and have them bound regularly."

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(Published in San Francisco)
Industrial Engineer
(Published in Chicago)
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(Published in London)

1926

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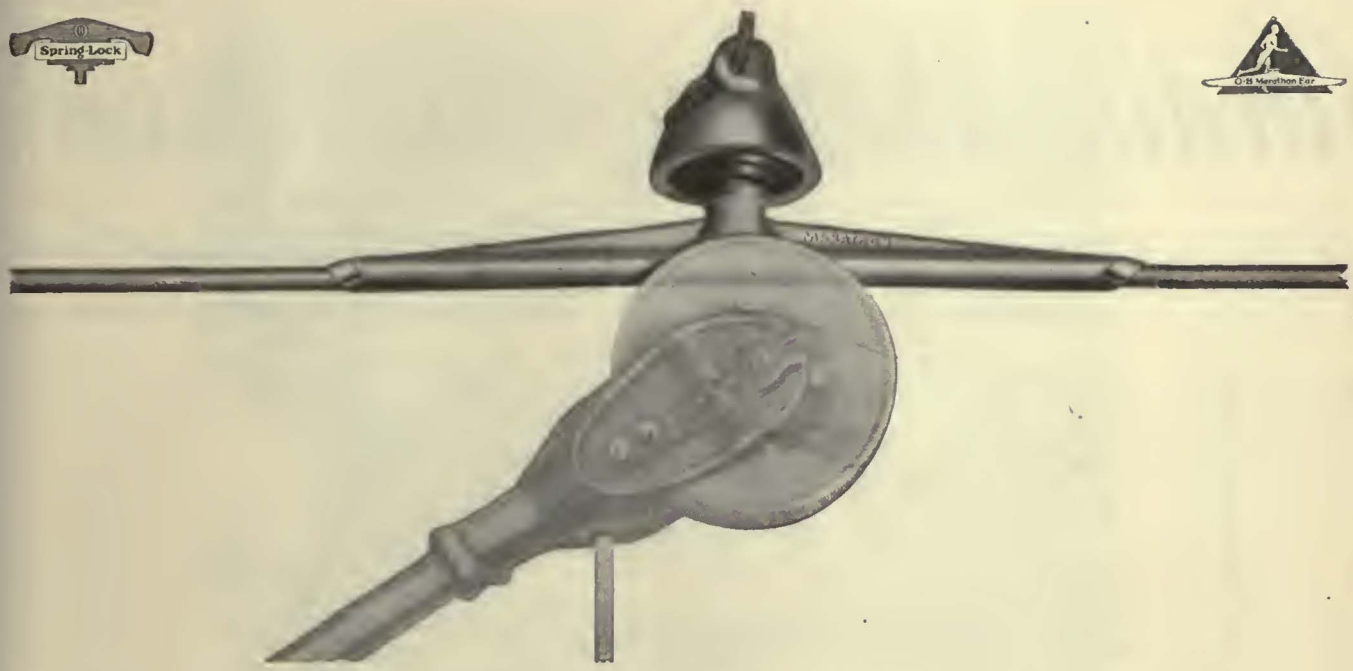
Change of Address—When change of address is ordered the new and the old address must be given, notice to be received at least ten days before the change takes place.

Published weekly. Entered as second-class matter, June 23, 1908, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Number of Copies Printed, 7,180

Advertising Index—Alphabetical, 64; Classified, 60, 62, 64; Searchlight Section, 59



350,000 Wheel Passes per Ear

The BC Frog can be located close up to the switch points. The runners are formed up to the center of the pan, with tips overlapping. Wheel passage on and off the frog is unfailing.

Trolley wire is gripped in the C Splicer without bending. Three hardened steel set screws hold each end securely.

The XH—a rugged insulator for guy wires. High tension porcelain and long leakage path assure maximum insulation.

Two years old and what a recognition! Two years have put the Marathon Ear to the front as an outstanding development in line material.

Repeated endurance tests have shown wearing qualities never even hoped for before in trolley ears. Wheel passes numbering 350,000 as compared with 180,000 with usual types have been recorded. Similarly, 310,000 car movements on a 6% grade. On steep grade track 320 days as compared to 120 days with other ears. These are representative of the performance being derived by electrical railways the country over.

Marathon Ears with Spring-Lock Hangers

Put up Marathon Ears with Spring Lock Hangers (a spring cushion hanger) and you have an unbeatable shock absorbing and wear resisting combination.

Write for details.

OHIO BRASS COMPANY
Mansfield, Ohio
Dominion Insulator & Mfg. Co. Limited,
Niagara Falls, Canada

Ohio Brass Co.

PORCELAIN INSULATORS LINE MATERIALS RAIL BONDS CAR EQUIPMENT MINING MATERIALS VALVES

Easy to "get at"

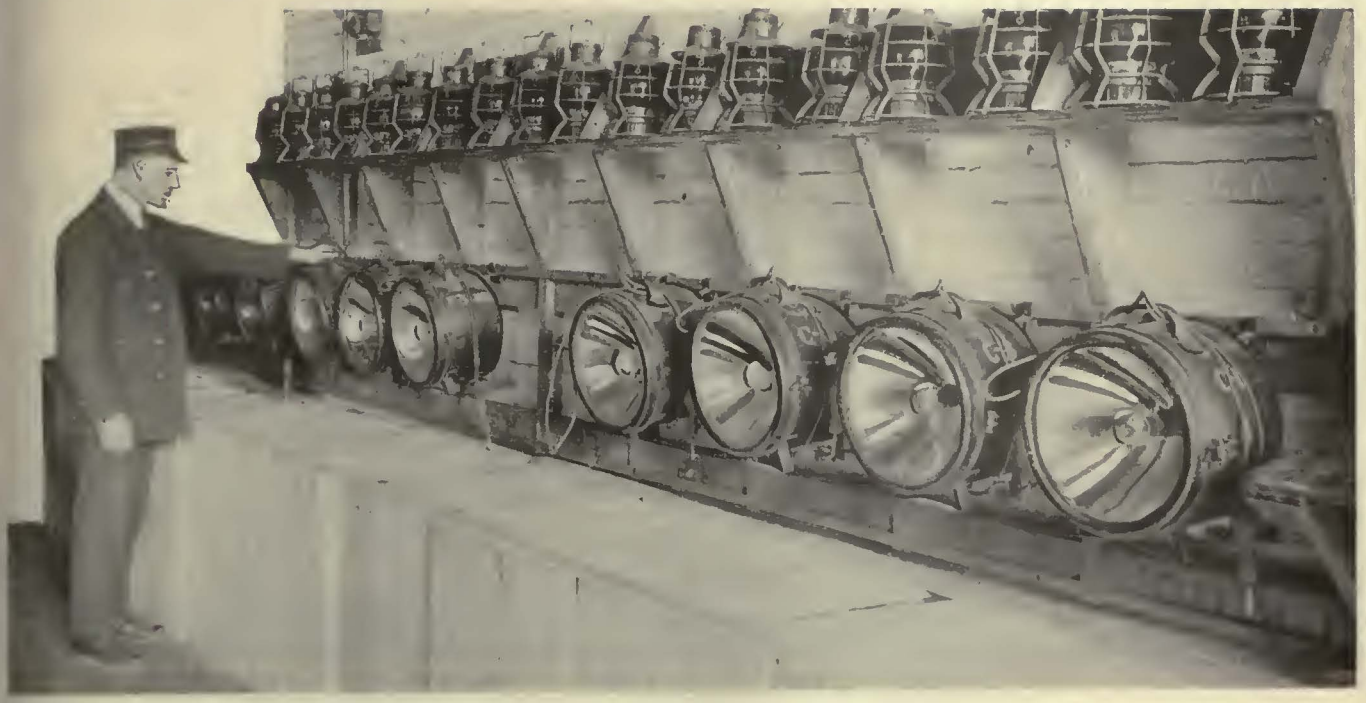
The ready accessibility to all parts is one of the most marked advantages of Westinghouse DH "Bungalow" Compressors.

Your inspectors find DH Compressors so easy to "get at" that a high state of efficiency, with minimum effort and expense, is always assured.

The "Bungalow" Compressor is built in sizes suitable for all classes of traction service — of the same general design and properly constructed to promote maximum accessibility. This feature encourages regular and careful inspection.

Westinghouse Traction Brake Company
General Office and Works: Wilmerding, Pa.

WESTINGHOUSE TRACTION BRAKES



Headlights—

from the viewpoint of the men behind them!

Darkness, rain, fog and dust—these hold fewer terrors for the motorman when he's behind a Golden Glow Headlight. Its sharply defined beam of light cuts its way through the thickest kind of weather—yet the approaching autoist or pedestrian is not blinded.

The characteristic intense, yet soft yellow beam of the Golden Glow Headlight makes your service more popular with the public—it's an advertisement of quality equipment.

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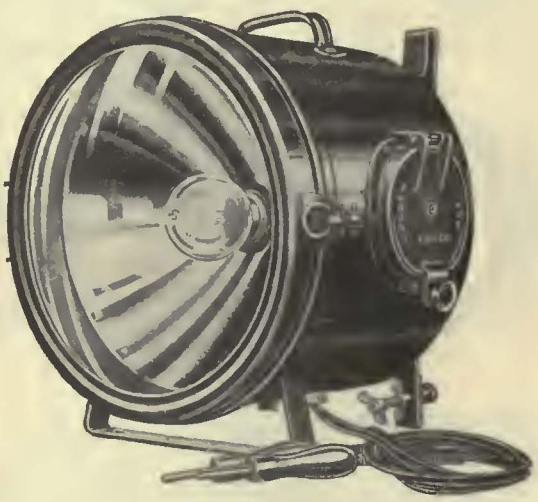
GOLDEN GLOW HEADLIGHTS

Dash Type

The Golden Glow reflector will not scratch, tarnish or corrode. It is a permanent reflector and easy to keep clean.

Golden Glow Headlights are made in various styles and sizes to suit any requirements. Portable or built-in, —dash installations and roof mountings.

See ESSCO Catalog No. 7 for further illustrations and descriptive matter.



Portable Type

Simplicity, the Keynote of the Christensen Brake

No outside levers, pull rods, cables, knuckles, universal connections, or cams.

A CYLINDER mounted inside the brake drum; two opposing pistons whose stems transmit a direct thrust against opposite ends of the brake shoe; nothing else.

The only connection between wheels and frame is the flexible reinforced hose that carries the air to the cylinder.

No adjustment is ever necessary from the time the brakes are originally set up until the linings are completely worn out, and because of the even, positive braking power, extremely long life is obtainable from linings.

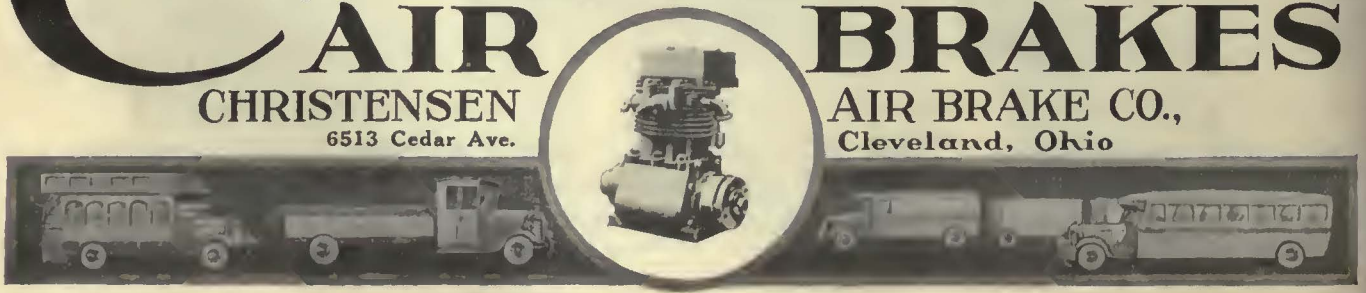
Very low brake maintenance costs result from Christensen simplicity. "Out of service" for brake adjustment or repairs is extremely rare.

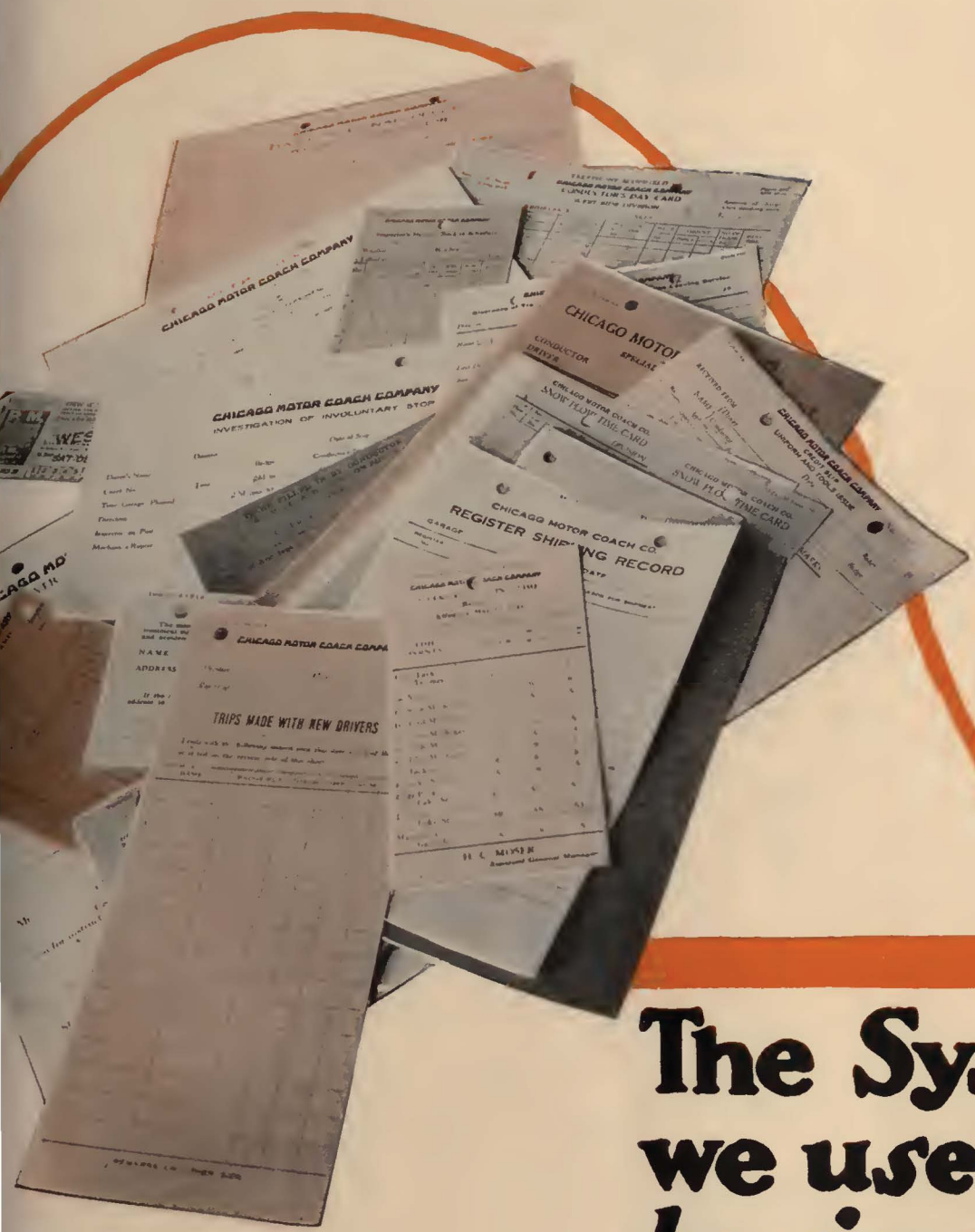
It will pay every one in any way responsible for bus operation or who is contemplating the operation of buses to read the descriptive booklet *"Christensen Automotive Air Brakes."* Send for your copy.

Christensen Air Brakes can be secured as original equipment upon the leading buses when specified.

Christensen AIR BRAKES

CHRISTENSEN AIR BRAKE CO.,
6513 Cedar Ave. Cleveland, Ohio





The Systems we use in our business as Operators

YELLOW KNIGHT

are available for your use!

YELLOW KNIGHT

OPERATING experience is the
to revenue earning, which mea
low-cost, profitable miles.

To operate 2½ million miles per mo
on the streets of New York, Chicago a

St. Louis, and ca
150,000,000 pass
gers a year, ca
for a vast orga
zation behind it

From this gr
laboratory, *on*
street, have come
the forms necessary to keep the syst
running smoothly and check operatio

Transportation is an industry t
calls for a business structure to back
the operation of motor buses, and Yell
Coach experience has accumulate

system which
completely at
disposal of a
railway.

When Yell
Coach reco
mends, it yields freely every meth
down to the last form card, that is u
in our own transportation business.

YELLOW

The result to the railway seeking advice is valuable beyond estimation. Factors secured are:

1. The proper sort of accommodation to the public: comfortable, reliable and safe.

2. Profit to the operating company, which means the carrying of the maximum number of passengers at the lowest cost per mile.

3. The installation of a complete working system.

4. The selection, as desired, of operating personnel and the training of the men employed.

In Yellow Coach, transportation units are used merely as a means to an end, but that end is *low-cost, profitable miles.*

Where else can this service be duplicated?

A study of Yellow Coach literature will likely answer some of *your* problems. Write for our catalog and other interesting data. We will be glad to make a transportation survey for you.

Strength of personnel—

AN ORGANIZATION is only as strong as the men who make it. This is particularly true of a company which sells *service,* or, in the case of Yellow Coach, *transportation* on a basis of *low-cost, profitable miles.*

Yellow Coach management has been built up with men who are specialists in their line of endeavor. Their transportation experience has been secured on the firing line of actual operation. Their engineering and manufacturing experience has been gained through close study and association with transportation practice and needs. For example—

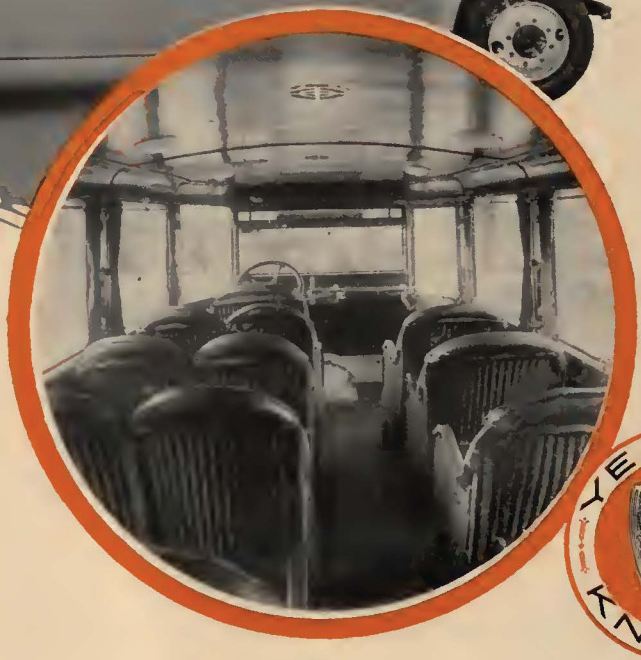
EDWARD WOTTON, *Equipment Engineer.* Mr. Wotton, Superintendent of Maintenance, has the distinction of being the first man to drive a motor coach in America. Mr. Wotton obtained his first experience in the mechanical field with the firm of Brazil, Holbrow and Straker, manufacturers of steam lorries in Bristol, England. He was a demonstrator for the company which constructed the first gasoline buses made in England. In 1906 Mr. Wotton came to the Fifth Avenue Coach Company. As general mechanical foreman for that Company, Mr. Wotton established a world-wide reputation in the development of the motor coach from a mechanical standpoint. As General Superintendent of Maintenance and Equipment for the Chicago Motor Coach Company, Mr. Wotton is in constant consultation with the mechanical staff of the Yellow Truck and Coach Manufacturing Company.

YELLOW KNIGHT

COACHES

There is no substitute for experience

Type X 17-21 Passenger
Parlor Coach



Interior view looking forward

Transportation experience expressed in interior fittings!

THE interior of Yellow Coaches clearly demonstrates the care used to incorporate transportation experience into every part of Yellow Coach design.

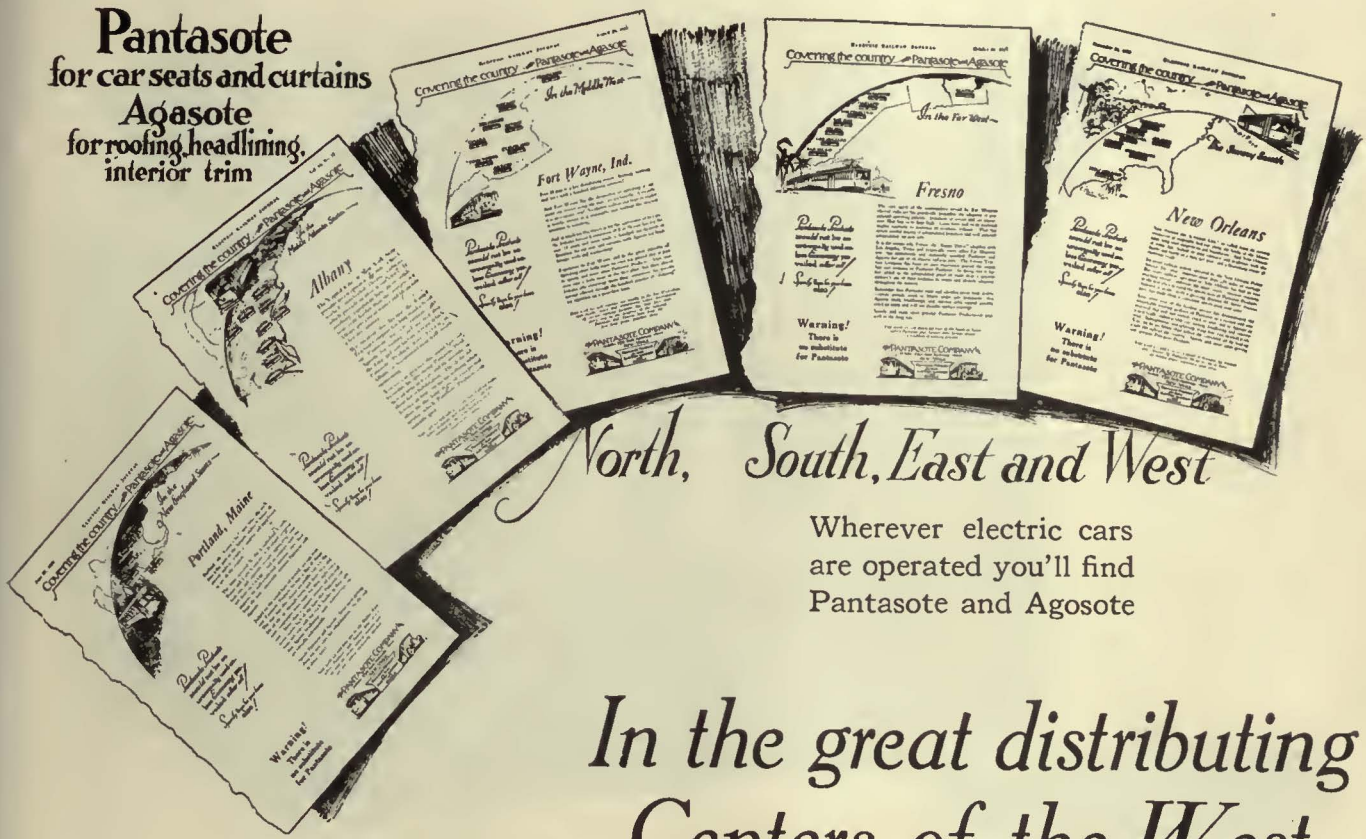
It is essential that the interior of public vehicles be kept clean and sanitary. The seating arrangements and finished interior must be planned for beauty of appearance combined with easy and economical maintenance.

In the design illustrated above, Yellow Coach has surrounded the passenger with a degree of luxury and comfort comparable to the finest privately enclosed cars. Seats are de luxe wicker chairs finished in frosted mahogany and upholstered in genuine brown Spanish leather. Side post panels and roof headlining are of matched grain mahogany. French plate mirrors on every sidepost.

Transportation experience is expressed in this construction—for the benefit of both riders and operators.

YELLOW TRUCK & COACH MANUFACTURING COMPANY
SUBSIDIARY GENERAL MOTORS CORPORATION
5801 WEST DICKENS AVENUE, CHICAGO, ILL.

Pantasote
for car seats and curtains
Agasote
for roofing, headlining, interior trim



North, South, East and West

Wherever electric cars are operated you'll find Pantasote and Agosote

In the great distributing Centers of the West

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Records of Pantasote and Agasote service cover a period of more than a quarter century. They embrace every phase of railway operation,—steam railroad, street railway and electric interurban. And still, when new car orders or supplies requisitions are made out, Pantasote and Agasote are emphatically specified.

Such experienced and successful operators as those in the cities listed above can have only one reason for consistent adherence to Pantasote and Agasote,—*proved satisfaction and economy in service.*

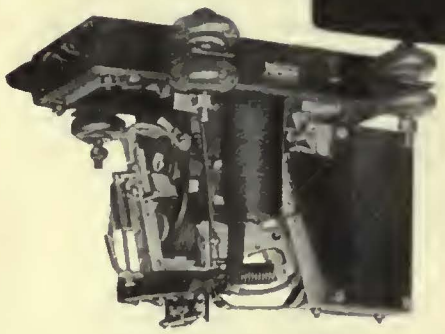
You, too, will find that it pays well to specify and insist upon only genuine Pantasote Products.

Pantasote Products would not be so universally used unless Economy prevailed after all!

Specify them for your buses also!

WARNING!

There is no substitute for Pantasote



The cover is readily removable

This G-E Line Breaker is new and better

The new G-E Line Breaker control handle replaces the usual main operating handle of the controller, as well as ratchet-switch, slip-ring or cam-operated contacts, which previously have been placed inside of the controller. It makes installation of line breaker equipment easier and operation better than ever before.

Reasons why it is better:

Lighter weight—in line with the lighter weight of modern car equipment.

The cover is readily removable—permitting access to working parts.

Parts are more accessible—which also facilitates inspection.

Improved blow-out.

Less installation expense—made possible by the new operating handle.

If you are not familiar with the purpose and advantages of Line Breakers, get in touch with our local railway specialist.

54C-27

GENERAL ELECTRIC

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Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Published by McGraw-Hill Company, Inc.

MORRIS BUCK, *Managing Editor*

Volume 67 New York, Saturday, January 16, 1926 *Number 3*

Modern Maintenance Means Putting Equipment in Better than Original Condition

MANY things can be done as a part of the regular maintenance work on cars that will improve appearance and provide greater comfort and convenience for passengers. It is not enough when a car comes into the shop merely to have it put back as nearly as possible into its original condition. The master mechanic should have in mind that many improvements, developed perhaps since the car undergoing repair was built, are available and may be incorporated into the design.

An example of this is the modernization of car trucks practiced by the Lehigh Traction Company, as told in an article by James W. Brown in this issue. New parts have been used that give the trucks operating qualities comparable with those of most recent design. As to the cost of doing this, of course, there is some question as to whether there is real economy as compared with the use of entirely new trucks.

Many other details of car equipment can be improved so as to give more effective service at even less proportionate cost. Among these opportunities are reduction of step height; elimination of narrow, inconvenient doors and poorly placed stanchions and barriers; location of rails and hand straps; seats; destination signs; window shades, and floor coverings.

Some of these changes can be made at no additional cost if the work is carried on at a time when the car must be overhauled anyway and new parts installed for replacement. A study of the possibilities is sure to reveal many other ways in which the older car can be vastly improved and made more acceptable to the patrons.

Extensive remodeling of old equipment is not advocated, as there are many examples where the money used for such work could have been spent much more profitably in purchasing new equipment, but there is often room for improvement in cars that are of fairly recent date. Modern maintenance requires particular attention to appearance and convenience so that the bad features of old equipment will not be thrust continually upon the rider's attention.

Lowered Step Heights Possible on Some Existing Types of Equipment

STEP heights have been given particular attention in the design of the newest types of cars. Lower steps have come with reduced motor heights, and thus are a tribute to the electrical manufacturers. Some railways which have purchased new equipment have decreased wheel diameters on old cars correspondingly in order to reduce the number of sizes of wheels used. This has also reduced step heights.

Mechanical departments are loath to decrease the clearances between the roadbed and the bottoms of motor shells which are obtained with new small diameter wheels, as such a reduction necessitates increased attention in order to prevent trouble when wheels become worn. On a large number of roads it has been found that the clearances of one type of equipment are considerably less than for all others. There is no reason why the clearance should not be standardized at the minimum. This will simplify the inspection and it will have the further advantage that it will reduce the step height. The sizes of wheels used under old cars were seldom determined by the height and number of steps obtained and their effect on the traveling public. Today it is felt that the added attention required to operate small diameter wheels with small motor and gear clearance may be amply repaid by more satisfied riders.

Car Signs Should Clearly Give Definite Information

DESTINATION and route signs on cars should be made to serve a real purpose and attract additional patronage instead of diverting it to other channels. A regular patron of a particular car line pays little attention to the route and destination signs unless several different lines are routed by the particular point at which he boards the car. When he has to take an unfamiliar line the case is quite different. Then, too, the stranger in the city and the casual rider on a line expect route and destination signs to give clear, concise and intelligent information.

It is little wonder that a stranger pays ten to twenty times the price of car fare and takes a taxi in order to be rid of the inconvenience and annoyance of finding out if any of the particular cars he sees passing will take him somewhere near the point he wishes to reach. The railway will also be benefited much by having signs of such size and with a contrast in color so that they may be seen and read readily at a considerable distance. Lengths of stops are decreased if the passenger can get to the loading point before the car stops. It is unnecessary for the railway to buy new equipment to improve the sign conditions on its cars. Desirable changes can be made a part of the maintenance program.

Selection and installation of even the most excellent signs are insufficient in themselves. Deterioration is fairly rapid, particularly with the roller curtain type now so generally used. The writer recently boarded a car on which the destination sign was illegible at a distance of half a car length. Certainly a condition such as this does the company little good. Particular attention should be paid to the repainting and replacement of signs as frequently as is necessary to give clearly

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

and legibly the information wanted by the patron, so that he can signal the right car without hesitation and without delaying other cars by unnecessary stops.

Arranging Car Colors to Give Streamline Effect

ONLY in comparatively recent designs of car bodies has particular attention been given to the elements of design that result in pleasing curves and streamlines. Many cars have vestibule windows and panels of doors out of line with the side windows. Where a distinct contrast in the color of the paint used for sash and the adjacent car body is used the lack of streamlines is made more pronounced.

Several railways are using a cream or light yellow color for the sides down to the lower edge of the belt rail, and an orange or red below this. By carrying the light color around underneath the end belt rails the dividing line of the two colors is made to line up so as to produce the desired streamline effect. A study and use of such painting effects as this is sure to result in added attractiveness for the cars and maintenance costs are affected but slightly.

A Continuous Supply of Coal Is of Vital Importance to Railways

FEW, if any, commodities affect the electric railway industry more than does coal. The fuel used in its power houses is but one factor; there is also the rise in the cost of metals that must result with increased coal prices, to say nothing of the demand for higher wage scales that follow increased living costs, by reason of the higher price of fuel. So while the present strike in the anthracite mines affects many of us personally, it should be of particular interest to us as railway men.

In regard to the nation's lack of authority to deal with the coal situation President Coolidge, in his recent message to Congress, said: "At the present time the national government has little or no authority to deal with this vital necessity of the life of the country. It has permitted itself to remain so powerless that its only attitude must be humble supplication." He suggests as a means of regulation that "authority should be lodged with the President and the Department of Commerce and Labor giving them the power to deal with an emergency."

This raises the question as to whether an emergency should ever exist or whether regulation should be applied to avoid the possibility of an emergency. There is in this country a great supply of coal ready to be mined. There is a supply of labor more than sufficient to mine it as fast as it is needed. Why then should an emergency occur? There is no doubt that an emergency exists. There is already a considerable use of makeshift fuel substitutes and there are rumors of large coal importations from Europe. The present controversy affects the anthracite mines particularly, but the anthracite industry affects the entire fuel industry as surely as a complete failure of car service would cause a stampede to other means of public transportation and the demoralization of their service. Emergencies are liable to occur in any business. But they have come to be expected regularly in the coal industry. When an emergency exists much of the damage is already done. Action should come before the emergency begins to avoid the kind of crisis we are now facing.

We are all tired of over-legislation. But when the coal industry assumes monopolistic aspects by having the miners arrayed solidly on one side and the operators lined up solidly on the other, yet both restricting the supply and forcing up the prices, there is need for a little direction from the outside.

An attempt to regulate a commodity like coal would not be without its difficulties. Among the complications would be the question of whether such control should be exercised by the state or the federal government. The many interstate transactions would almost require some phase of federal control. Perhaps the nearest to a parallel to this is the ruling of the United States Supreme Court that gas transmitted from one state to another to be sold at wholesale comes under the regulatory powers of Congress, but that gas transmitted from one state to another and distributed to various retail customers comes under the jurisdiction of the state. Such regulation need not be a strict fixing of prices, but rather should provide a means of insuring a continuous supply of coal, and the prices would take care of themselves through the channels of competitive trade. Among the things to be considered would be a fair basis for wages, which is largely the cause of the present controversy.

No doubt the coal operators, and the miners too, would violently oppose such regulation. Yet in time they would profit by the stability that would be given to this industry, just as public utilities have become so stabilized financially that their securities are looked upon by the careful investor almost as favorably as municipal bonds. Let's stop having coal emergencies.

A Statement that Carries Its Own Encomium

REJUVENATION is a word that is being bandied about a great deal in electric railway circles these days. There have been many notable cases of properties that have been revitalized, but none in its way is more significant than that of the Brooklyn Rapid Transit. The evil day of that road was Dec. 31, 1918. It was an evil day in the sense that it marked the road being placed in receivership, but it was not evil in the sense of the good that has since followed.

Of course, it would have been better, perhaps, if the necessity had not arisen for such action, but since it did, the court and the receiver, Lindley M. Garrison, proceeded to work out the salvation of the road. How well this has been done is shown now by the fact that the common stock of the successor, the Brooklyn-Manhattan Transit Company, has been placed on a dividend basis in less than a year and a half after reorganization. It is a new company in spirit, in hope and in outlook, in charge of a progressive personnel, largely the same as the old one.

In the last year and a half $8,500,000 has been spent for improvements and the directors have just authorized the expenditure of from $4,500,000 to $5,000,000 for the purchase of new cars. The company stands committed to the policy of being ready to deal with the city on the matter of additions to the rapid transit systems when the city is ready to deal with it. Under Hylan the officers were unable to get anywhere, but Chairman G. M. Dahl carried the fight to the ex-Mayor, much to the latter's discomfiture.

But that is done and gone. Just at this time two matters in connection with the affairs of the company

are of particular interest. One is the fact that the company has been able to do so well and the other is the stress put by Mr. Dahl on the probable future trend of financing for the company. His statement to the stockholders, which was widely quoted, sets forth the need for a balanced financial structure along the lines suggested by the committee on finance of the American Electric Railway Association, and would seem to indicate that the hope for the future is to finance by issuing junior securities. Moreover, Mr. Dahl's statement brought out forcefully the wide distribution of the securities of the company, showing as it did that only 8 per cent of the preferred and common stock is owned by those holding more than 100 shares each. The average number of shares per stockholder is 96. Mr. Dahl said that it is not only in the interest of investors in the common stock that they should have a return on their investment, but that it is in the interest of the public and the city. Then he proceeded in direct language to point out why. This was an excellent piece of publicity. To the initiated very little explaining needs to be done about a statement of earnings that shows operating revenue of $18,636,971 for the five months ended Nov. 30, 1925, compared with $17,788,580 for the similar period in 1924 and nets of $2,514,802 and $2,093,314 for these comparable periods. The figures carry their own encomium.

Public Utility Operation on Plan of a Regulated Monopoly Not Completely Understood

CLARENCE K. CROSSAN voted "No" to the Philadelphia Rapid Transit plan to purchase taxis. He cast the lone negative vote of the ten members of the transportation committee of the Philadelphia City Council. Fortunately for the progressive plans of the P. R. T. there were nine affirmative votes and the measure has been approved for city co-operation in the taxi co-ordination plan.

The principle back of Mr. Crossan's logic is the deplorable feature of his reasoning. "There is no such thing as a good monopoly," Mr. Crossan is quoted as saying, and thus the philosophy of a bygone age was revived. To him "monopoly" and "trust" still call to mind the incongruous monster of the past. Fortunately, there appear to be fewer Crossans each year who fail to realize that a monopoly under public regulation is the most economical means of providing public service, and that a monopoly under regulation is in reality not a monopoly in the sense that it has a strong-arm control of the industry.

Only in recent years and often by means of expensive receiverships is the country getting rid of the duplication of capital expenditures occasioned by competitive building of railway lines years ago. In more recent times we have had the experience of the dual telephone system in many parts of our country, to the aggravation of the merchants and business houses that were required to make a double expenditure for telephone service.

Our present national administration is tending strongly toward consolidation of the country's railroads into balanced non-competitive groups, always under the regulation of the I. C. C. The regulatory body created and controlled by a just and a wise public service company law gives to the public the advantage of non-competitive service by private capital, and protection against unjust practices and abnormal profits.

Some Advantages of Foremen Conferences

GROWTH of interest in the training of foremen is an encouraging sign of the times in electric railway circles. If the facilities for educational work on electric railway properties are limited, they may profitably be concentrated on the supervisory force, at least at the start. Foremen are in intimate contact with the workmen on one hand and the management on the other. They have the point of view of the workman, because in general they have been promoted from the shop or track forces. As foremen they are part of the management, because they have been transferred from "work jobs" to "responsibility jobs."

Experience with foremen conferences in many industries has shown a keen desire for training in foremanship. Most of the men, of course, have been good workmen, but many have been promoted to the position without much insight into its duties, responsibilities and opportunities. Their very promotion showed that they possessed qualities of leadership. Such qualities need to be developed. Efforts made to develop them meet with response.

At its December meeting in Boston the New England Street Railway Club witnessed a demonstration of a foreman conference, conducted according to a plan which has proved successful in the conducting of such conferences generally. The interest of the club in this demonstration was so keen, and its appreciation of the possibilities of the plan so genuine, that the committee on education of the American Association, which was in session in Boston at the time, was reinforced in its determination to push this form of educational activity in 1926. This decision is a wise one. If the committee can get the foreman-training idea over to electric railway managements throughout the country, and if these managements will exert initiative in learning how foreman conferences should be conducted, there will be a noticeable advance in this industry along educational lines during the coming year. The committee cannot do it all. It must have co-operation. It has no axe to grind; only the good of the industry is behind its efforts. Give the foreman conference a fair trial this year.

Study of Car Appearance and Comfort a Desirable Move

MOST promising as a sign of the advent of a new era in electric railway history is the creation of a sub-committee at the recent meeting of the equipment committee to study means by which the comfort and appearance of electric cars may be improved. The subject is most timely. That the task was self-imposed augurs well for its success. Equipment men have been accused at times of being "stand-patters" and satisfied with things as they are, but the starting of this study shows a commendable progressive spirit and the industry at large should co-operate in every possible manner to help the committee produce some worth-while results.

Just how far reaching the work of this committee will be only time can tell. It is apparent, however, that there is a wide field of endeavor open which has had little previous exploration. This study should supplement the investigations and work of other committees, with the result that the composite will be of lasting benefit to the industry.

Unifying the Transportation Features of Toronto Rolling Stock

More than 300 Cars Taken Over by the Commission from Private Companies Have Been Remodeled for Front-Entrance Operation—One-Man Cars Have Been Equipped with Automatic Rear Exits—Lights and Mirrors Are Designed to Insure Safety of Passenger Movement

Front-Entrance, Automatic Rear-Exit Car as Remodeled by Toronto Transportation Commission from Rear-Entrance, Pay-as-You-Enter Car

WITH the assumption in 1921 of the control and operation by the Toronto Transportation Commission of the street railway systems of the Toronto Railway and the Toronto Civic Railway, one of the major problems was that of bringing to some uniform design the various types of car inherited from these two organizations. After a careful and extended investigation it was decided to adopt the front entrance as standard for the system. Standardization in this respect would avoid the confusion caused by differently located entrances, it was thought, and the universal front entrance was considered to be helpful in furthering the speedy operation of the system under the prevailing conditions. After this had been decided the commission procured new cars of the Peter Witt type, and now has 350 of these in service. With 225 two-door and three-door trailers for use in the rush hours they handle the traffic in the most heavily traveled routes. More than 300 of the older cars have been remodeled.

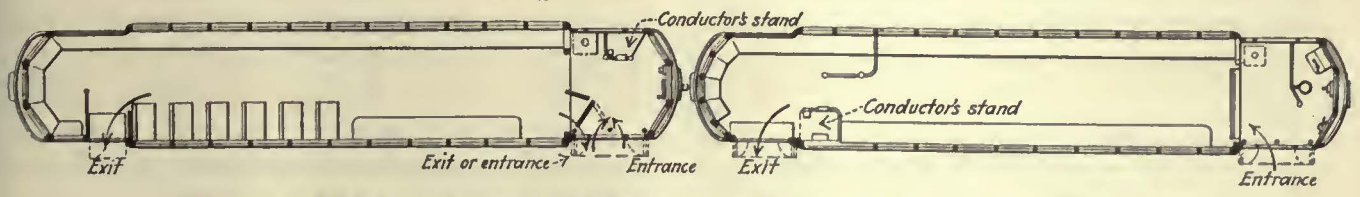
Cars taken over from the Toronto Railway numbered 832, of which 348 are now in service and the balance, numbering 484, composed of old-fashioned double-truck motor cars with semi-inclosed vestibules, and a varied assortment of single-truck motor cars and trailers with semi-inclosed and open vestibules, have been scrapped. Some of these cars dated back to 1892 or beyond.

Some 70 cars were taken over from the Toronto Civic Railway, and with the exception of 25 Birney safety cars and eight single-truck, double-end cars they were of the double-truck, double-end, pay-enter type. These cars were all of more modern design and in fairly good physical condition. All have been retained in service, but the double-truck, double-end, pay-enter type has been remodeled in a manner outlined below.

Of the 348 Toronto Railway cars retained in service, 215 have been or ultimately will be converted to the pay-leave design, as exemplified by the first car of the train shown in an accompanying illustration. One hundred have been rebuilt as one-man, single-end, front entrance and exit, rear treadle exit cars similar to the second car of the train. Ultimately the remaining 33 will be converted to motorized trailers for the six-motor trains.

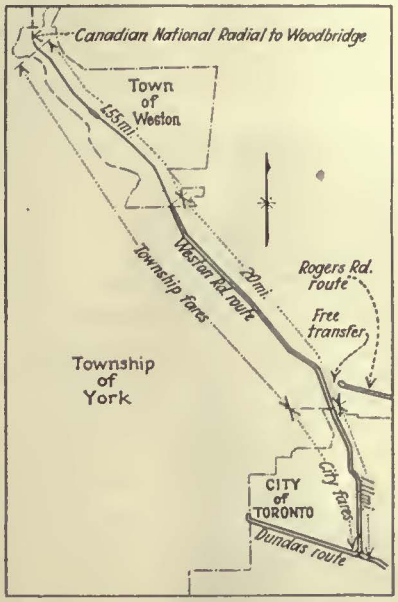
In the pay-leave type the seating capacity has been increased considerably by extending the closed side longitudinal seats around the rear vestibule. The conductor's station is located at the rear end of the car body on the open side in a position to insure full control and safe operation of the exit door. A railing has also been installed, which, as is shown in an illustration, provides a considerable area of "prepaid accommodation." Because of its quick loading features this type of car is eminently suitable for handling the evening traffic peak when loading facilities are taxed to the utmost.

All cars rebuilt for pay-leave operation are similar in every respect in so far as the body, doors, conductor's location and seating arrangements are concerned. However, a group of 90 have been equipped with line and drum switches and automatic couplers, to enable



Entrance and Exit Arrangements on Cars Remodeled for Use in Six-Motor Trains. The First Car Seats 46 and the Second Car 48 Passengers

them to pull standard trailers. A second group of 33 will be equipped in a similar way in the near future to haul either a standard trailer or a motorized trailer. This will require the introduction of an additional drum switch to that required for standard trailer operation, and additional electric contacts on the coupler head. These drum switches are independently operated and designed to be foolproof, so that the operator, no matter what type of trailer he is picking up, must have the switches properly set to make the necessary connections for that particular type of equipment. If this is not done correctly, the line switch control circuit will remain open. The same applies when a car of this type is being operated as a single unit; if the drum switches are not thrown for unit car operation, the motors will remain inoperative. In the correct position for unit car operation, all the electric coupler contacts are dead, and similarly the exposed contacts are dead when hauling a standard trailer.



Separation of Township Fares and City Fares on This Route Necessitates Use of Two Fare Boxes

An auxiliary resistance also has been installed on this car for use only when running in a two-car six-motor train. This resistance is interlocked with the control, and is automatically cut out or in by the additional drum switch. Helical gears and pinions have been installed on the motors of these cars and the gear ratio altered to protect the equipment hauling trailer loads. This arrangement of the first car of the train makes it extremely flexible for various kinds of service. The third group, numbering 92, of this pay-leave design is equipped for unit car operation only and has no line switches.

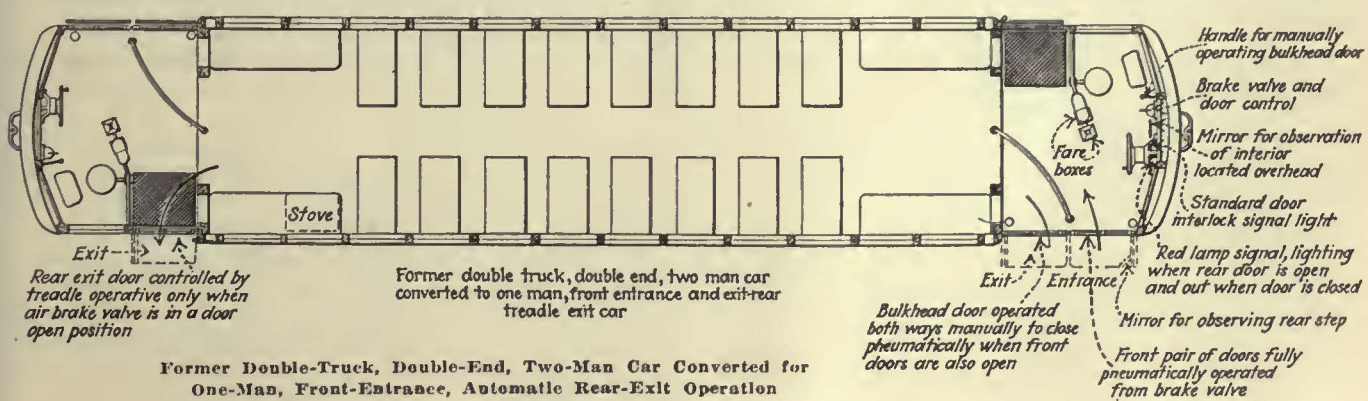
Birney cars were introduced originally in Toronto by the Civic Railway, and were successful if not routed on heavy traffic lines. After careful observation of conditions it was decided by the commission that the operation of one-man cars was a practical proposition, provided that larger cars could be operated safely, giving a much needed reserve of carrying capacity during the two acute daily traffic peaks. Reasonable frequency of service, it was also realized, would be economically impossible on many routes with the comparatively light off-peak traffic without one-man cars. Desire to make the service an attractive one made the management keen to evolve a satisfactory one-man car suitable for universal operation at all hours.

Evolution of the treadle-operated door paved the way for the elimination of all the principal objections previously apparent in one-man cars with front-entrance and exit doors only. Eventually the type of car shown in an accompanying illustration was devised, of which there are now 100 operating in Toronto. This group, with the previous three, accounts for 315 of the original pay-as-you-enter type taken over from the Toronto Railway.

Seats as rearranged accommodate 51 passengers as against 38 seats available in these cars previous to alteration. The width of the cars permitted cross seats to be placed only on one side, and the longitudinal seat on the closed side was continued around the rear vestibule.

This car is equipped with full safety control, with no foot valve, and a line switch which provides electric door interlock. The elimination of the foot valve was to compel the operator to carry out instructions and complete all major transactions with boarding passengers before starting the car. The front-entrance door has full pneumatic operation from the brake valve, and the bulkhead or exit half is operated both ways manually, but only after the forward door is open. National Pneumatic Company door and treadle equipment is used.

Closing the front door also pneumatically closes the exit door. This gives a measure of selective door control with one engine, without the use of a selector valve. Operation of the rear treadle door is initiated



Former Double-Truck, Double-End, Two-Man Car Converted for One-Man, Front-Entrance, Automatic Rear-Exit Operation

by the brake valve to an electro-magnetic valve, which, when a passenger stands on the treadle, completes the magnetic valve circuit, permits door opening pressure to enter the valve puller and this operates the door engine rotary valve. A second electro-magnetic valve in series with the other, with a ball check valve in the valve puller cylinder pipe, puts the closing of the door in control of the passengers alighting from the car.

On these cars an additional position has been given the M-28 brake valve by a minor alteration. This is ahead of the standard door-opening position. When the brake valve handle is moved to the new position it

Treadle and Step of Automatic Rear Exit on Toronto One-Man Cars

causes the rear treadle-operated door to become operative, the front door remaining closed. This arrangement permits of selective operation of the rear door.

In addition to the standard control signal lights, the operator has similar standard red lights which are illuminated so long as the rear treadle door is open. Five lights are also arranged on the rear vestibule to illuminate the treadle and step synchronously with the operator's red signal lights. Two of these are red and located outside the rear vestibule, giving warning to all vehicular traffic that the rear door is open and that passengers are about to alight. A mirror is mounted on the outside of the front-entrance door in such a manner that the operator sees plainly the rear-exit step and door when open. A second mirror is installed above the center window of the front vestibule directly in front of the operator to give an interior view of the car.

Such cars have been in service since November, 1924. Extension of the use of one-man cars in Toronto was facilitated by the adoption of the front entrance as standard on all cars of the system. Cars of this type now operate with capacity loads, partly or wholly over the same route with cars of other types, in some cases through the busy downtown area, without any confusion or doubt as to boarding location. Speed of loading, as was anticipated, is somewhat slower than with other types, but it is easily the speediest in unloading of any car operated in Toronto, and no trouble has been found in maintaining schedule speed. Where routes equipped with this car coincided with routes equipped with two-man cars, no interference has developed in maintaining the running time of other two-man cars.

Remaining Toronto Railway cars to be converted number 33. These will be operated as the second cars of the six-motor trains. This second car is front entrance and exit, with rear treadle exit, and, so far as seating arrangements and general layout are concerned, is similar to the one-man double-truck car type described. A movable barrier permits the conductor to use both doors at the front for entrance, as the traffic movement requires. This operation of the barrier materially assists in speeding up the loading and unloading of the car. This car is equipped with two motors of similar type and gear ratio to those used in the first car of the train. Both motors are installed in the forward truck. There is also a trolley pole, circuit breaker, reverser switch and resistor unit included in the equipment. When the car is coupled to the leading car the trolley pole is hooked down to the roof, the circuit breaker opened and the reverser switch set in forward position. When it is desired to move this type of car in yards or buildings, or to make up trains, the trolley pole is placed on the wire, the reverser switch is set in the desired direction of movement, and by means of the circuit breaker and staffless hand brake well controlled and safe movement is secured.

Control of both front doors and the rear treadle-operated exit door is from the conductor's station. The front door is equipped with a pneumatic door engine operated in the usual way by lever and rod to engine valve. The rear treadle exit door is operated by a switch of the push-button type, which, when in position for train movement, closes the train control circuit and opens the circuit in which is connected up the main electro-magnetic valve of the rear treadle exit door engine, keeping it inoperative while the train is in motion. When the train is at rest, and it is desired to have the rear exit door become operative, the door control switch is pushed to rear door operating position. This movement opens the train control circuit and connects the break in the main electro-magnetic valve circuit. Depression of the treadle completes the circuit and the exit door will open. An auxiliary electro-magnetic valve is installed in a manner to prevent the door from being slammed in the face of alighting passengers while there is weight on the treadle or step. This feature is independent in operation irrespective of any action of the conductor in pushing his control switch while passengers are alighting. This auxiliary valve application, however, is not effective on the valve puller cylinder until after the permissive switch movement is initiated by the conductor in charge.

Opening of the door is controlled by the conductor and the closing of the door is controlled by the alighting passengers. Due to control interlocks the trains cannot be moved until the doors are all closed and proper circuits established. Red signal lights located in front of the motorman of the train and the conductor of the second car become illuminated while the rear treadle door of the second car is open, and by means of another special colored signal light the conductor of the second car is informed when the motorman is ready to proceed. This feature is also standard on all trail cars. The single-stroke bell and buzzer system is common to both types of trail cars.

Of the 70 cars taken over from the Toronto Civic Railway, 37 were of the double-truck, double-end, pay-as-you-enter type with rear entrance and exit and front exit doors, all manually operated. After the pronounced success of the one-man, double-truck, single-end front entrance and exit and rear treadle exit cars, it was decided to convert 28 of these 37 to cars of the one-man, double-truck, double-end, front entrance and exit, rear treadle exit type. There are two groups of this type, and although one seats 44 passengers and the of equipment in both vestibules is essentially the same in plan and general layout as shown. The arrangement of equipment in both vestibules is essentially the same as in the single-end car, except that the protective barrier beside the treadle is extended at an angle to the center of the car and used to support the operator's seat, fare box and change tray.

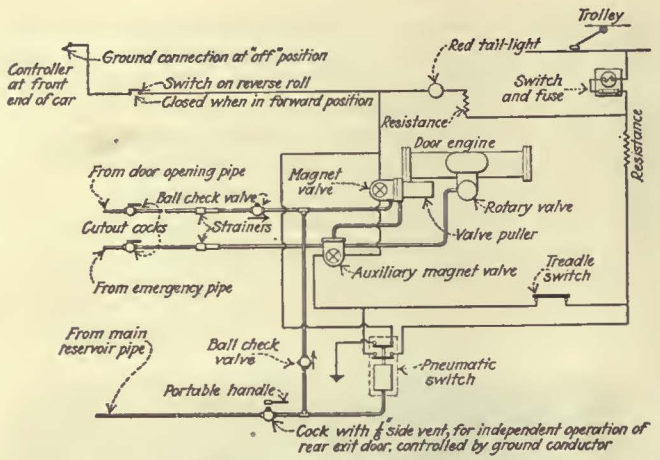
As it was desired to reduce the operator's duties to a minimum when changing from one end of the car to the other at terminals, the Nichols-Lintern red and green lights were interlocked in the controller by means of small additional switches fitted to each reverse drum. These switches are so connected that the operator in removing his controller handle and reverse lever, and adjusting them at the other end for forward movement, automatically completes or breaks the circuits to suit the direction of car movement. The Nichols-Lintern red light is grounded at the off position on the main drum of the controller at each end, and the latter part of this same circuit is used for completing the treadle electro-magnetic valve circuit at the respective ends. When the brake valve handle is removed the corresponding treadle-operated doors are made non-operative pneumatically. Interlocking of the electro-magnetic valves of the treadle door in the controller also makes them non-operative electrically in a semi-automatic manner to suit the particular direction of car movement.

On one group of fifteen of these 28 cars which is operated on a route having a periodic heavy volume of traffic loading and unloading, especially at one terminal, a ground or street conductor's control of the treadle-operated door has been designed and installed. Operation is by means of a special key which is applied by the street conductor to a concealed air cock located below the vestibule framing adjoining the door. The opening or closing of this cock opens and closes the treadle-operated door and is entirely independent of any movement by the operator on the car or a passenger stepping on the treadle. The air cock for street conductor's control of the door is connected to the main reservoir pipe, and from this to the valve puller cylinder pipe between the ball check valve and the main electro-magnetic valve. A branch pipe also goes to a double contact disk type pneumatic switch, and just ahead of this branch a ball check valve is fitted to prevent air acting on the pneumatic switch in the normal operation of the door. Closing of this pneumatic switch short circuits the contact switch below the treadle plate, and the other contact completes the electro-magnetic valve circuit to separate ground. When the ground conductor opens the special cock, air is admitted to the valve puller cylinder pipe and simultaneously, by means of the pneumatic switch, the electro-magnetic valve circuit is completed, energizing the valves, and air is admitted to the valve puller. The door will then open for alighting or boarding passengers. To close the door, the

Twin Fare Boxes Are Used to Permit Separate Accounting on One-Man Cars on Weston Road

street conductor simply closes the cock with the special key, and by reason of a small side vent in the cock, air is vented from the pneumatic switch, and the whole apparatus is promptly and automatically ready again for normal operation.

The equipment of this latter group of cars was evolved with a view to operation on a line that extends from a terminal at Keele and Dundas Streets in Toronto—West, in a northwest direction to the city limits at Northlands Avenue. From the city limits the line proceeds through the township of York, via the Mount Dennis district, to the north end of the town of Weston. The section in York and Weston was until recently owned and operated by the Toronto Suburban Railway, latterly acquired by the municipalities through which it passes. Control and management was vested in the Township of York Railway. The whole line at one time was owned by the Canadian National Electric Railways, but ownership of the city section some years previous passed into the hands of the Toronto Transportation Commission. The length of the line to the



Pneumatic and Electric Details of Street Collector's Control on Toronto Car Rebuilt with Automatic Rear Exit

city limits is 1.11 miles and from there to the north end of Weston 3.54 miles, a total distance of 4.65 miles.

The Township of York Railway, associated with the other municipalities, has made a service-at-cost agreement with the commission, for the supply, operation and maintenance of the necessary rolling stock to equip this new co-ordinated through line. Revenue from the two zones must be kept separate, owing to the receipts being subject to an independent accounting, and so means had to be devised to keep separate the fares collected in the two zones. At each end of the car there are two fare boxes, painted contrasting colors, adjoining the operator's position and the passenger stream, and so mounted that either one or the other can be revolved into position for deposit of fares, depending on the zone of travel. The mouth of the box that is out of use is on the inside of the barrier and further concealed and blocked by the change tray adjacent.

On leaving the Toronto terminal, the red (or T.T.C.) fare box is in position, and the car proceeds to the city limits operating pay-as-you-enter, with passengers entering by the forward half of the front door and alighting by the rear or bulkhead half of this front door, or by the rear treadle exit door as desired. T.T.C. fares in this zone are collected on the outbound journey when passengers enter. On arrival at the city limits and after all passengers have alighted the black (or York Township Railway) farebox is moved into position, and the operator makes the rear treadle-operated door inoperative by closing the cut-out cock above mentioned. The car proceeds to the Weston terminal on the pay-as-you-leave principle, and all passengers desirous of alighting must deposit fares on leaving by the front door. Boarding passengers use the bulkhead half of this door, or both halves can be used for this purpose if no passengers are alighting. Township fares are collected only when leaving the car in this zone when outbound from the city. Inbound to the city the method is reversed.

During the traffic peak periods on this line, inbound in the morning and outbound in the evening, the heaviest loading and unloading occurs at the Toronto terminal. It is here that the street conductor's control of the rear treadle exit door on these cars has proved of great assistance as an auxiliary fare collecting point. It has enabled these one-man cars to load and unload quickly and maintain prearranged schedules quite easily.

Track Reconstruction in Sheboygan, Wis.

Modern Methods Employed by the Wisconsin Power & Light Company in the Rebuilding of Its Carhouse and Eighth Street Tracks

BY ALF A. OLDFIELD
Engineer Maintenance of Way Wisconsin Power & Light Company

RECONSTRUCTION of the entrance tracks to the carhouses on South Eighth Street and the reconstruction of ⅝ mile of double track and ½ mile of single track has advanced to a considerable extent the reconstruction program of the Wisconsin Power & Light Company in Sheboygan. One of the illustrations shows the completed six-track entrance to the carhouse from Eighth Street, including the special work required and the method of bringing the tracks from the street into the carhouse yards. The plan adopted eliminates the curbs, gutters and separate sidewalks, allowing the company's buses to enter the carhouse with ease.

Since service was maintained during construction, the plan of placing the operating track to one side was adopted, as shown in another illustration. A third picture shows the method of connecting a curve to a branch line during construction, while a fourth illustrates one completed track of the double-track line and the second track which has just been brought to grade and aligned ready for concreting.

The special work was built according to the engineering standards of the company and was supplied by the Lorain Steel Company. Solid manganese switches equipped with drain boxes were used, as were

Views Showing Reconstruction Work at Sheboygan by the Wisconsin Power & Light Company. At Left Is the Temporary Track Used During Reconstruction. At Right Is a Stretch of Finished Track Alongside of a Short Section Ready for Concreting

Reconstructed Entrance to Carhouse of Wisconsin Power & Light Company's Property at Sheboygan, Wis. Sidewalk, Curb and Gutter Have Been Eliminated to Provide Easy Access to Yards for the Company's Buses

hard center mates and frogs. The curves were built with section 140-468 guard rail on the inside and 93-507 T-rail on the outside. Under the special work 6-in. x 8-in. timbers were placed, with 8 in. of ballast under the ties. Reinforced concrete pavement is placed on top of the ties and the rolled ballast, which after tamping partially fills the space between ties.

For the straight track a relayer rail, section 80-362, originally rolled for the Victorian Railways of Australia, was employed, this rail having been recovered from the railroad that previously was in operation between Oshkosh and Omro, Wis., and which was abandoned during the year 1924. This rail showed very little wear. The straight track is supported on Dayton Resilient ties set in concrete.

For experimental purposes one track was built with Carey elastite rail filler and the other track without any filler. The result of this experiment indicates that the track in which the filler was used is considerably quieter in operation than the one without rail filler. The difference is so marked that it is planned to specify this rail filler in other reconstruction jobs. Rail joints on straight track were welded by using Alumino-thermic welds.

It is intended to complete the reconstruction of the Eighth Street line north of the carhouse this year.

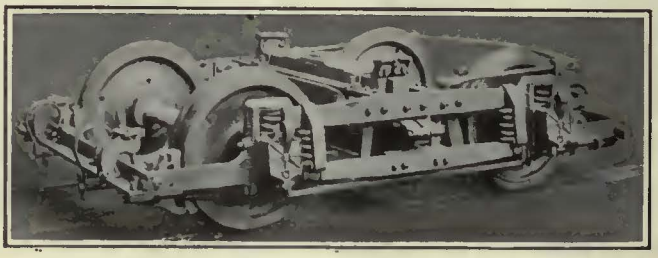
Temporary Crossing of Branch Line During Reconstruction Work at Sheboygan, Wis., Used While Rebuilding Main Line Tracks on Eighth Street

Modernizing Old Trucks

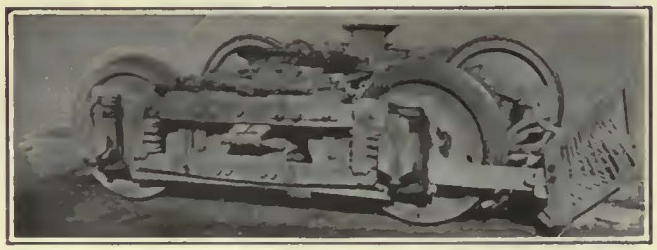
Weight Reduced 1,400 Lb. per Car by Incorporating Late Truck Improvements to Revamp a Type Purchased Nineteen Years Ago by the Lehigh Traction Company

BY JAMES W. BROWN
Superintendent of Shops Lehigh Traction Company, Hazleton, Pa.

THROUGH the use of a number of late truck improvements some Brill type 27-E-1 trucks which were placed in service by the Lehigh Traction Company nineteen years ago have been reduced in weight approximately 700 lb. per truck or 1,400 lb. per car from that of the original type. The improved construction has also increased safety of operation and reduced troubles in service and maintenance costs. About two years ago the brake rigging on 24 cars was changed from an outside to an inside-hung type. This remodeling included the addition of necessary gusset plates, half-ball hangers, etc. This change reduced the weight of each truck 250 lb., or 500 lb. per car, and did away with twelve brake rods per car. A further remodeling is now being carried out which consists of applying Brill twin-swing links, steel bolsters, bolster guides, semi-elliptic springs, and a graduated spring system. This change has further reduced the weight 450 lb. per truck or 900 lb. per car. Twenty trucks have already been changed and the four remaining will be completed shortly.



Original Type of Brill 27-E Truck Purchased Nineteen Years Ago



The First Step in Remodeling Was Taken Two Years Ago, When Brake Rigging Was Changed to Inside Hung Type, with a Saving of 250 Lb. per Truck

The Modernized Truck as Now Completed with a Total Truck Weight Reduction of 700 Lb. Has Improved Riding Characteristics

Accompanying illustrations show the truck as originally purchased, the truck after its first rehabilitation, and the truck as now being modernized. To make these changes, all truck parts are dismantled except the side bars, end angles and transoms. Rivets and bolts are tested carefully and if any are found loose they are removed, the holes are plugged and redrilled, and new rivets and bolts inserted. Before riveting, the trucks are carefully squared. All corner brackets that are worn or broken are renewed, and any holes in the bolster transom that interfere with holes in gusset plates to be added are plugged, redrilled and reamed to fit turned bolts, which are used to secure the gusset plates to the transom. When the gusset plates are in place on the truck frame, holes in the side bars are drilled and reamed for 1⅛-in. turned bolts.

In order to apply the twin-swing links, it is necessary to dress out the truck frames with an air chisel, to fit the swing link top casting. This casting is shrunk onto the truck frame and a ½-in. hole is drilled through the frame and casting, into which countersunk rivets are applied. After the gusset plates are finished and bolted to the frame, the plates have a hole 1½ in. in diameter drilled for the bolster guide pin. New bottom tie rods are installed which are made of 2½-in. x 1-in. flat machine steel. This flat portion is carried out 7 in. from each end and then welded to a 1½-in. round steel rod. The first portion acts as a safety hanger for the elliptic spring in case this should break.

One of the principal reasons for modernizing these trucks at this time comes from the fact that ten wooden type car bodies are being replaced with late all-steel type. These new bodies provide a seating capacity of 70 as compared with 46 for the wood type. All this is accomplished without increased weight in the car body.

At the time that the first changes in the trucks were made about two years ago, steel pilots were installed in place of wooden pilots previously used on these cars. This produced a weight reduction of 110 lb. per truck or 220 lb. per car. In the construction of these pilots particular care was taken to make them interchangeable, so that their removal and replacement take but from fifteen to twenty minutes.

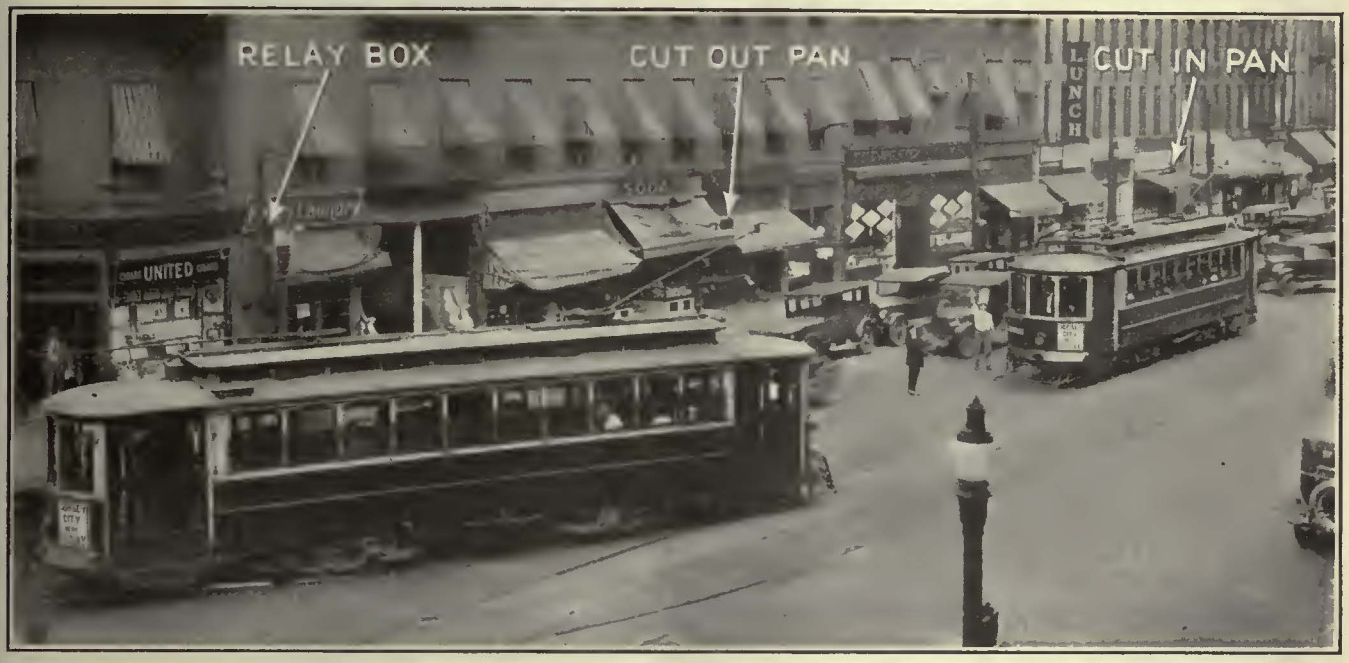
The work of modernizing these trucks is carried out by the regular shop forces and so a definite schedule cannot be followed. Four men are used in making these changes, and in addition one air brake inspector oversees the work and two machinists, one acetylene welder, one blacksmith and helper and one electrician and assistant take care of the necessary work in their particular lines. The cars are brought in for this general rehabilitation at a time when the wheels need turning. At the same time general repairs are made to the motors, brake rigging and air equipment. The cost of rehabilitating the trucks, together with the other repairs made, averages $830.

The shop in which this work is done has but one track with a pit running its entire length. Work of rehabilitation is done on this track. A 15-ton crane operates the entire length, and in addition, two 30-ton hydraulic jacks are used for lifting the car bodies from the trucks. The shop equipment used consists of a 60-in. lathe on which all wheels are bored and turned, a 24-in. lathe, a 14-in. lathe, one drill press, one twist drill grinder, one wheel for general grinding, a shaper, drill, power hacksaw, bolt and pipe cutter, and a 400-ton wheel press, two air and one electric drills and an air riveter.

Safe Methods of Operating Electric Track Switches

Thorough Instructions Given to Motormen in Rochester Have Reduced Troubles from Throwing Switches Under Rear Trucks of Preceding Cars

By Leon R. Brown
Director of Safety New York State Railways, Rochester, N. Y.



Location of Cut-In Pan, Cut-Out Pan and Pole Box. The Rear Truck of the Leading Car Has Passed the Track Switch

WHILE an electric railway car operator knows that if he passes the "cut-in pan" with power off the switch will throw for the straight track and if he passes with power on it will throw for the curve, still he does not know why it acts nor why it sometimes does not work. Since some difficulty was experienced on the Rochester Lines of the New York State Railways from motormen throwing switches under the rear trucks of preceding cars the safety director prepared charts and diagrams and gave a series of talks to the men at the various carhouses. At these conferences the men were encouraged to discuss their problems and to tell their experiences. Many valuable things were learned.

Two posters, copies of which are shown herewith, were prepared. One of these shows the general layout of an electric switch installation giving the location of the "cut-in pan" and the "cut-out pan" on the trolley wire and the track switch under the "cut-out pan." The poster also explains what not to do and why not to do it. The other poster shows in detail a diagram of the apparatus and explains how it operates. Of course it was not expected that many of the men would be interested in the technical manner in which the switch operates, but in order that they might understand the reason why they must operate slowly on the pan and why they must do other things, the explanation was given. It was surprising how many of the men were interested in the technical description of the operations of the electric switch.

Another line drawing shows a detail of the "cut-in pan" and just how the trolley wheel bridges the gap between the contact pieces, completing the various circuits. The first contact determines whether the car is going to take the curve or the straight track; the second throws the switch, while the last locks it by breaking the circuit, thus preventing another car from throwing the switch until it is unlocked by a car tripping the cut-out pan.

The relays, coils and resistances are on the pole at the curb. The wires come overhead from the trolley and underground from the switch. The "cut-in pan," which is on the trolley wire about 60 ft. back of the switch point, is about 4 ft. long. As the diagram shows, it is not in contact with the trolley wire, which passes over it. The "cut-in pan" itself consists of one long contact strip on one side and a series of shorter contact strips on the other side, each of which is insulated from the others. When the trolley wheel passes over the "cut-in pan," one flange comes in contact with the long strip, while the other flange comes in contact with the series of shorter strips, closing the circuits between them. This operation takes place whether power is on or off. When the trolley wheel crosses the cut-out pan it acts as a switch and closes and opens several electric circuits in the short interval it takes to cross this pan. These

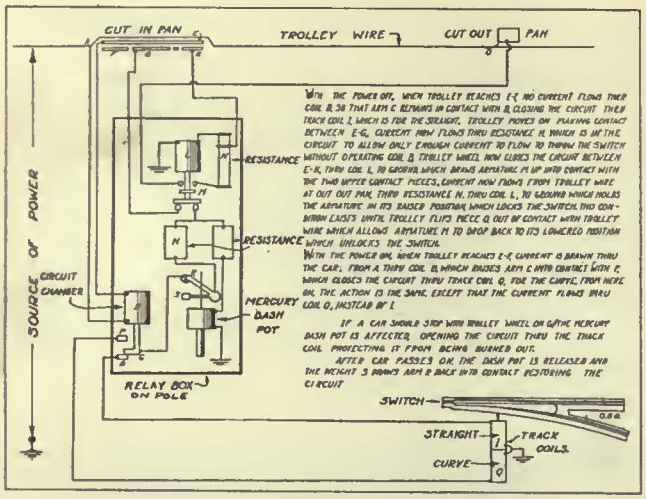
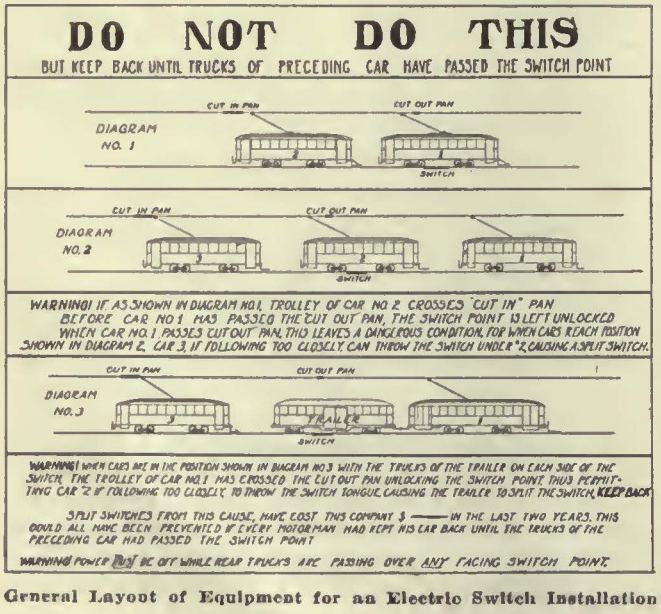


Diagram of the Switch-Throwing Circuits

operations always take place in exactly the same sequence. The opening and closing of these circuits energizes the magnets on the switch and throws the switch point.

The switch point is thrown to the curve or to the straight according to whether the controller is on or off when the trolley wheel passes across this pan. If power is turned on or off at any time when the trolley wheel is on the pan it is probable that the switch will not be operated as intended. It may not throw, it may reverse or it may be left unlocked, depending on which contact point the trolley wheel touched when the power changed. This doubtless explains many of the queer stories which are told of the failures of electric switches to operate properly. If the car is going too fast while passing over the "cut-in pan" it readily can be seen that not enough time will elapse between the various operations. The chances are that the switch will not operate properly. There is also danger of injuring the complicated mechanism. Speeds of 3 to 4 m.p.h., or about the rate a man would walk, are approximately correct for passing under the "cut-in pan."

The last operation, as the trolley wheel leaves the cut-in pan, is to lock the switch so it cannot be thrown until the car passes the cut-out pan. This latter is merely a flip on the trolley wire, which is tripped when the trolley wheel passes under. The locks and cut-out

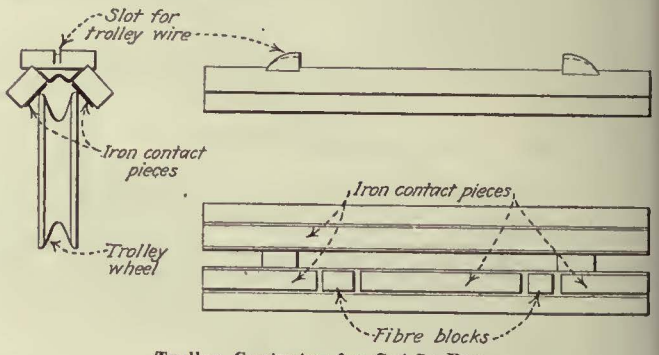


General Layout of Equipment for an Electric Switch Installation

pans are not on the electric switches in Syracuse and Utica and there seems to be a misunderstanding about them by the men in Rochester. Nearly all the men were under the impression that by this arrangement they could not throw a switch under a preceding car. It was the principal purpose of these talks to explain that it was possible to throw a switch under a preceding car and what must be done to avoid doing so. The only safe rule to follow in order to avoid throwing a switch under a preceding car is not to allow the trolley wheel to pass the cut-in pan until the rear trucks of the preceding car have crossed the switch point.

There are two conditions where it is possible to throw a switch under a preceding car. If car No. 2 has come under the cut-in pan before No. 1 has gone under the cut-out pan car No. 2 is left unprotected, because when car No. 1 goes under the cut-out pan the switch is left unlocked, thus permitting car No. 3 to throw the switch under car No. 2 if it comes under the cut-in pan before No. 2 has passed the switch.

The other condition where a car following too closely can cause a split switch is with a trailer train. When the first car passes the cut-out pan it leaves the switch



Trolley Contactor for Cut-In Pan

unlocked. The car following the trailer train will of course throw the switch under the trailer if it comes under the pan too soon.

There was much discussion as to how many points of power were necessary in order to throw the switch. The old motormen seem to have learned by experience just how many were necessary for the different types of cars. On the ordinary four-motor car usually two points of power will throw the switch. On a two-motor car at least four points are necessary. To throw a switch which is on a down grade it is necessary to bring the car nearly to a stop on approaching the "cut-in pan" and then throw the power on. This prevents crossing the cut-in pan at too high a speed and insures enough current to throw the switch.

Another point brought up was that sometimes the combination of electric heaters, air compressor motors and lights produced enough current to throw the switch even with the controller off. The magnet coil which selects the curve or the straight position for the switch point has an adjustment so that ordinarily it cannot throw the switch except by power from the controller. Adjustments are made every spring and fall to compensate for heater and light current. However, in the early fall and late spring, when the electric heaters are used for only a short time morning and evening, the switches may not be adjusted and motormen should be cautious. On the interurban cars it usually is necessary to cut off the heaters and air motors when passing electric switches. Study of the electrical operation of switches indicates that the apparatus is quite delicate.

Co-ordinated Bus Service for Cincinnati

Routes Proposed by Cincinnati Street Railway Designed to Supplement Existing Rail Lines —Crosstown Service to Facilitate Travel in City—Express to Reduce Time to Outlying Communities

CO-ORDINATED bus and rail routes which will give maximum transportation service with minimum duplication of facilities is the principal objective in the plan recently submitted to the City Director of Street Railroads by the Cincinnati Street Railway. In a letter accompanying the formal application for a permit to operate buses, which was abstracted in the Dec. 19, 1925, issue of ELECTRIC RAILWAY JOURNAL, page 1091, President W. A. Draper outlined the advantages to be obtained, as follows:

1. Provide the beginning of a system of motor bus operation which may be extended as later warranted.
2. Formulate present plans with a view to their adaptability to the future.
3. Provide service where there is a lack and a need of it.
4. Avoid disturbing existing transportation facilities more than is necessary to provide the additional facilities considered needful.

The initial bus system, which is shown on the accompanying map, comprises eight routes to serve various sections of the city and suburbs. These are of three general classes: (1) Crosstown routes; (2) express routes to cut the time to outlying sections where ample local service is now provided by street cars; (3) feeder routes reaching districts not adequately provided with street car service.

In his letter to the director of street railroads President Draper carefully outlined the principles on which

Eight Bus Routes Will Give a High-Speed Service Supplementing the Street Cars in Cincinnati. The Arrow Points Show Where Express Operation Begins

the plans for a co-ordinated transportation system are based. The advantages accruing to the community from this co-ordination of rail and bus are pointed out. While recognizing these advantages, he proposes a careful separation of bus and railway accounts for the purpose of fixing rates of fare on the buses that will provide a revenue commensurate with the character of service rendered. Mr. Draper covered these principles as follows:

It is believed that the beginning of a bus transportation system has been worked out that will be of distinct advantage to the communities served and yet will be sufficiently remunerative not to add an unwarranted

burden on the hundreds of thousands of street car riders who will continue to be so served. It has not been forgotten that the motor buses now proposed to be put on the streets will become a part of the whole transportation system.

Due regard has been given to the fact that while some are attracted to the newer type of transportation, there are many to whom the lower street car fare will always be a consideration. The recent reduction by which 5 cents is saved on every three rides should not be endangered by motor bus operations that would add unduly to the operating cost under the service-at-cost franchise.

Buses to Pay Own Way

Therefore a separate and accurate system of accounting will be kept that it may be known if the motor bus operation is paying its own way; and if it does not do so it is believed that the patrons of the motor bus service will be willing to pay such a rate as the city may find necessary to make it self-supporting.

It is believed that the express or preferential service proposed will be of distinct advantage. The argument advanced in favor of motor bus service is that it is a time saver. The greater the distance to be covered the more possible is the saving of time. On some of the shorter bus lines now operating there is actually no saving in time over street car operations, while on some of the longer lines the saving in time is appreciable.

A study indicates that there are points within a certain distance from the center of the city where prospective passengers will ride either the car or the motor bus that comes first. Applying this experience, it is proposed to operate the longer radial lines for the benefit of those outlying communities that are far enough from the center of the city to make such service desirable.

The two crosstown lines will meet a need that has long existed. Route E, the Clifton-Hyde Park line, will connect the residential suburbs indicated by the name, as well as Corryville, Avondale, Evanston and Norwood, and will also offer a direct line to the University of Cincinnati, Hughes High School and the other institutions in the same neighborhood. The Cumminsville-Oakley line will tie those suburbs and Winton Place, Ivorydale, St. Bernard, Bond Hill and Norwood, with the several factory and residential districts in those sections.

Future Needs Considered

It will be apparent that the system of motor bus operations, of which this is a beginning, will lend itself to a development of transportation facilities of all forms. While motor bus transportation from its flexibility is generally considered as quite easy to change or discontinue in one section or another, nevertheless it should not be established unless it is reasonably certain that it can be continued. The operations now proposed are all planned to take care of future needs as well as present, and there is probably only one line proposed, the Cumminsville-Oakley line, that will not meet a continuing need. The operation of the rapid transit line in the future may render the continued operation of this line unnecessary. All of the other lines but two can be operated as feeders to the rapid transit line if it is so decided.

The four radial lines—A, B, C and D on the accompanying map—are to be express lines. Between the business district and the arrow marks shown on the map inbound buses will stop only to discharge passengers, and outbound buses will stop only to pick up passengers for points beyond the limits indicated by the arrows.

A fare of 10 cents for buses inside the city limits is contemplated. On lines which extend beyond the city lines an extra 10 cents will be charged. Free transfers will be issued from buses to cars at all intersections. Transfers will also be issued from cars to buses on payment of the full bus fare of 10 cents instead of the car fare of 8⅓ cents. Where two bus lines intersect transfers will be issued between them free.

Details of Routes

The various routes proposed, together with the principal features of their operation, are outlined below. It is planned to use 29-passenger single-deck buses for all routes.

Route A (Oakley-Mariemont).—From Government Square to Main Street, to Eighth Street, to Gilbert Avenue viaduct, to Gilbert Avenue, to Windsor Street, to Kemper Lane, to McMillan Street, to Woodburn Avenue, to Madison Road, to Plainville Pike, to Wooster Pike, to Mariemont town center. Returning on Wooster Pike to Plainville Pike, to Madison Road, to Woodburn Avenue, to McMillan Street, to Kemper Lane, to Windsor Street, to Gilbert Avenue, to Gilbert Avenue viaduct, to Eighth Street, to Walnut Street, to Government Square.

Number of buses—Nine.

Schedule—Non-rush hours, every twenty minutes from Government Square to the Mariemont town center; rush hours, every ten minutes from Government Square to Oakley, and every twenty minutes from Government Square to the Mariemont town center.

Fare—Ten cents from Government Square to Madison Road and Gomien Street, Madisonville, and between intermediate points; 10 cents from Mariemont town center to Madison Road and Dunbar Place and between intermediate points on this bus line only without transfer privilege, and 20 cents between all other points.

South and west of Madison Road and Observatory Avenue inbound buses will stop only for the purpose of discharging passengers boarding buses north and east of that point, and outbound buses will stop only for the purpose of receiving passengers destined beyond that point.

Route B (Bond Hill-Lockland).—From Government Square to Main Street, to Ninth Street, to Sycamore Street, to Reading Road, to Paddack Road, to Seventy-third Street, to Carthage Avenue, to Springfield Avenue, to Wyoming Avenue, to Benson Avenue, to Central Avenue. Returning on Benson Avenue, to Wyoming Avenue, to Springfield Avenue, to Carthage Avenue, to Seventy-third Street, to Paddack Road, to Reading Road, to Sycamore Street, to Ninth Street, to Walnut Street, to Government Square.

Number of buses—Seven.

Schedule—Every twenty minutes during non-rush hours, and every fifteen minutes during rush hours.

Fare—Ten cents from Central Avenue, Lockland, to B. & O. crossing, Bond Hill, and between intermediate points on this bus line only without transfer privilege; 10 cents from the Cincinnati-Wyoming corporation

line to Government Square and intermediate points, and 20 cents between all other points.

Express operation south of Reading Road and Dana Avenue.

Route C (Westwood-Cheviot).—From Government Square to Main Street, to Sixth Street, to Race Street, to McMicken Avenue, to Mohawk Place, to Central Avenue, to Harrison Avenue, to the Harrison Avenue viaduct, to State Avenue, to Harrison Avenue, to the Cleves-Bridgetown Pike. Returning on Harrison Avenue, to State Avenue, to Harrison Avenue viaduct, to Harrison Avenue, to Central Avenue, to Mohawk Place, to McMicken Avenue, to Race Street, to Fifth Street, to Government Square.

Number of buses—Six.

Schedules—Non-rush hours, every twenty minutes; rush hours, every 15 minutes.

Fare—Ten cents.

Express operation east and south of Beekman and Harrison Avenues.

Route D (Price Hill).—From Government Square to Main Street, to Sixth Street, to Race Street, to Ninth Street, to McLean Avenue, to Eighth Street viaduct, to Eighth Street, to the Price Hill inclined plane, to Matson Place, to Price Avenue, to Woodlawn Avenue, to Warsaw Avenue, to St. Lawrence Avenue, to Rosemont Avenue, to Glenway Avenue, to Overlook Avenue, to Rapid Run Pike. Returning on Rapid Run Pike, to Glenway Avenue, to Rosemont Avenue, to St. Lawrence Avenue, to Warsaw Avenue, to Woodlawn Avenue, to Price Avenue, to Matson Place, to the Price Hill inclined plane, to Eighth Street, to the Eighth Street viaduct, to McLean Avenue, to Ninth Street, to Race Street, to Fifth Street, to Government Square.

Number of buses—Five.

Schedule—Non-rush hours, every fifteen minutes; rush hours, every ten minutes.

Express operation east of Eighth Street and State Avenue.

Fare—Ten cents.

Route E (Clifton-Hyde Park).—From Clifton Avenue and McMillan Street on Clifton Avenue, to Glenmary, to Vine, to Erkenbrecher Avenue, to Burnet Avenue, to Rockdale Avenue, to Reading Road, to Dana Avenue, to Montgomery Road, to Williams Avenue, to Floral Avenue, to Robertson Avenue, to Duckcreek Road, to Edwards Road, to Erie Avenue. Returning via the same route.

Number of buses—Nine.

Schedule—Non-rush hours, every fifteen minutes; rush hours, every ten minutes.

Fare—Ten cents.

Route F (Cumminsville-Oakley)—From Knowlton's Corner on Spring Grove Avenue, to Murray Avenue, to Laidlaw Avenue, to Paddack Road, to California Avenue, to Reading Road, to Dale Road, to Carthage Avenue, to Montgomery Avenue, to Smith Road, to Robertson Avenue, to Brownway Avenue, to Madison Road, to B. & O. crossing. Returning via the same route.

Number of buses—Nine

Schedules—Non-rush hours, every twenty minutes; rush hours, every ten minutes.

Fare—Ten cents.

Route G (Price Hill-Westwood).—From Eighth Street and Nebraska Avenue, along Nebraska Avenue to Rapid Run Pike, to Overlook Avenue, to Bridgetown Pike, to Boudinot Avenue, to Bridgetown Pike, to Glenmore Avenue, to Harrison Avenue. Returning via the same route.

Number of buses—One.

Schedules—Every 30 minutes.

Fare—Ten cents, but without transfer privilege.

Route H (Fairmount-Cumminsville).—From the Hopple Street viaduct and Beekman Street, on Beekman Street, to Powers Street, to Colerain Avenue, to Knowlton's Corner. Returning via the same route.

Number of buses—One.

Schedules—Every twenty minutes.

Fare—Ten cents.

Electric Shop Truck Earns $6,000 a Year

For Cutting the Cost of Handling Heavy Material a High-Lift Electric Truck Operates Through the Milwaukee Shop on a Definite Schedule

BY HAROLD J. PAYNE

Staff of the Society for Electrical Development, Inc., New York City

WITH skilled labor high and unskilled workers expensive and also difficult to obtain, the Milwaukee Electric Railway & Light Company was faced with a definite need for conserving man power. Two years ago a high-lift electric truck was purchased for doing general handling work about the Cold Spring shops. Since that time the machine has been earning the wages of six men by taking the place of hand trucks and wheelbarrows which were previously used for moving parts and materials. Additional use for the truck has been found continually, so that it has been kept busy loading material into supply cars for transportation to other stations or towing trailers, tool wagons, etc., moving snowplows and like equipment for storage during summer months, hoisting stoves into cars, where these were used for heating; putting car compressors

SCHEDULE CARD FOR NINE TRIPS OF THE ELECTRIC TRUCK

Department	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9
Machine gallery	8:20	8:24	9:06	10:30	11:12	12:35	1:12	2:36	3:18
No. 1 storeroom	8:18	8:28	9:10	10:34	11:16	12:39	1:16	2:40	3:22
Armature room	8:15	8:30	9:12	10:36	11:18	12:41	1:18	2:42	3:24
Machine main	8:10	8:35	9:17	10:41	11:23	12:46	1:23	2:47	3:29
Forge shop	8:00	8:38	9:20	10:44	11:26	12:49	1:26	2:50	3:32
Steel shop	7:56	8:39	9:21	10:45	11:27	12:50	1:27	2:51	3:32
Brass foundry	7:55	8:40	9:22	10:46	11:28	12:51	1:28	2:52	3:34
Motor and truck	7:50	8:45	9:27	10:51	11:33	12:56	1:33	2:57	3:39
No. 2 storeroom	7:45	8:48	9:30	10:54	11:36	12:59	1:36	3:00	3:42
No. 6 storeroom	7:10		9:35		11:41		1:41		3:47
Bus department	7:15		9:38		11:44		1:44		3:50
Paint shop	7:20		9:40		11:46		1:46		3:52
Tin shop	7:30		9:45		11:51		1:51		3:57
Carpenter shop	7:35		9:50		11:56		1:56		4:02

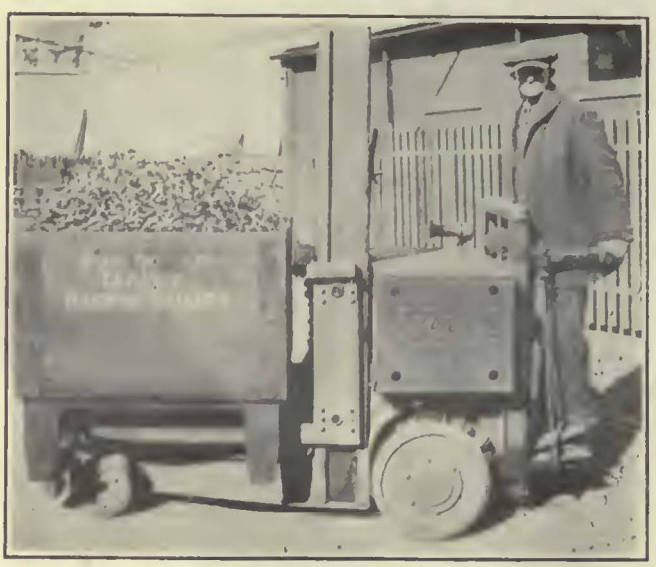
Loading Material Directly to the Electric Truck as It Is Received in the Shop

into position and hauling barrels of oil and other heavy parts to specific locations where they are used.

The particular type of truck adopted is a model K-22 Yale, made by the Yale & Towne Manufacturing Company. It can raise and lower its load 26 in. This has proved of particular benefit, as much material requires loading and unloading at an elevation. Smaller parts and materials used in the maintenance and repair of equipment are nearly all stored in box containers or on platforms. These are arranged with supports so that the platform of the truck can be driven directly underneath and the material elevated and taken away without trouble. Four-wheel steering is provided in the equipment, which makes it very flexible and capable of working in close quarters.

Accompanying illustrations show two classes of work in which the truck is used. One illustrates the convenience of loading material directly from a large highway truck to the smaller shop truck. A barrel of gasoline has been placed in position and a box of other materials is being added. The second illustration shows the method of picking up and transporting scrap turnings from the machine shop.

In common with other types of industrial equipment, the electric truck requires reasonably intelligent use if it is to yield a maximum return on the investment. At the Cold Spring shops a preliminary survey was made of the routes over which material was flowing. Information was also assembled as to the nature and quantity of the material. This survey showed that in the routine operations of the shop approximately the same volume of material had to be moved every day. Consequently it was decided to operate the truck on a schedule over a fixed route, covering fourteen divisions of the shop. The accompanying table gives the various departments that are visited by the truck and the time that stops were made at each department for nine trips. The driver punches a time clock at the start and finish of each trip. In an ordinary day he moves 100 loads of material, each of which may run up to 7,000 lb. in weight. The schedule time for a trip is about 50 minutes. When trips are completed in less than scheduled time the truck is available for odd jobs, such as stacking materials and placing equipment in cars.



Picking Up a Box of Machine Shop Turnings Preparatory to Delivering It to the Scrap Storage

In addition to eliminating the need for a gang of hand truckers the use of the electric truck has accomplished other objects. By having material ready for use ahead of time skilled workers are not kept idle waiting for supplies. Operations can also be scheduled and the schedules can be rigidly adhered to. This insures that the service requirements of all the divisions of the shops will be met. The elimination of congestion throughout the shops has followed handling of materials by the electric truck. The operator has a much less trying and fatiguing job to handle material in this manner and as a result it is handled more promptly. In the Milwaukee shop approximately 200 skid containers are used for this service. Their use has assisted materially in maintaining a perpetual inventory of stock and the keeping of this inventory has been simplified through their use.

In the two years that this truck has been in service repairs have been a negligible quantity. The truck has been overloaded frequently and its popularity has necessitated almost continuous service inside and outside the shop. Outside weather conditions such as snow and ice have not interfered with its operation.

One problem was encountered in connection with the transporting of material to the machine gallery, which is located on the second floor of the shop. The elevators serving this gallery were of insufficient capacity to carry the trucks when fully loaded. This difficulty, however, was overcome by carrying the trucks and loads separately, hand-lift trucks being used for moving the loads over short distances such as on and off the elevator.

Solid Colors for Denver Cars

THE Denver Tramway, Denver, Col., painted about 50 of its cars with an aluminum paint, a flat silver hue. They were very pretty, and as the sunbeams struck them as they rounded a curve they glistened with a real splendor, but they are so hard to keep clean the color is impracticable. This silver color was flat and unvarnished, but now a chrome yellow, part varnish, is being tried. As to which is the prettier, that all depends upon the individual. It is the plan of the company to omit stripes, to use a solid color and to spray on the paint. With about 370 cars to be painted every three years, it is estimated that the paint bill for this work will be reduced more than $11,000 under the new method.

Rebuilding Pole Rack

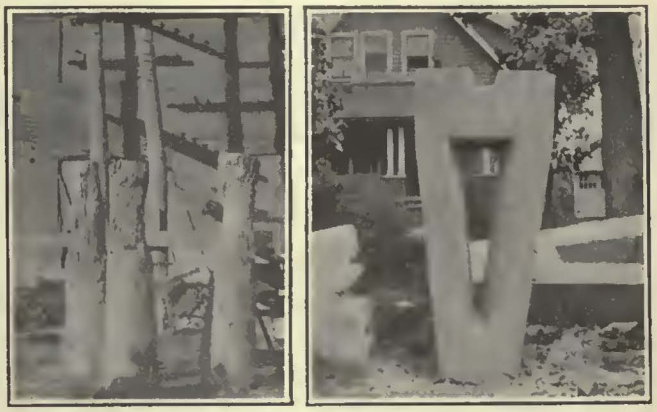
New Concrete Bases Were Placed Under Old Poles Alongside Berlin Substation of the Connecticut Company at Small Cost

ADJACENT to the Berlin substation of the Connecticut Company a 40-ft. six-pole tandem rack is maintained to carry five three-phase circuits of 11,000 volts each and seven 600-volt direct-current feeders ranging in size from 300,000 to 500,000 circ.mil. The latter supply current for the local electric railway lines. Chestnut poles in the rack had been in place about eighteen years. As they had been set in swampy ground, consisting of moist red clay with an upper fill of cinders, the bases were badly deteriorated. Crossarms and insulators, however, were in excellent condition, as were the poles themselves above the ground line. Possible alternatives were either to replace the poles with new ones, with the consequent expense of new upper structures and overtime rates to workmen changing over at hours when the high-tension circuits could be killed, or to reclaim the present poles and not disturb the upper structures or interrupt the service.

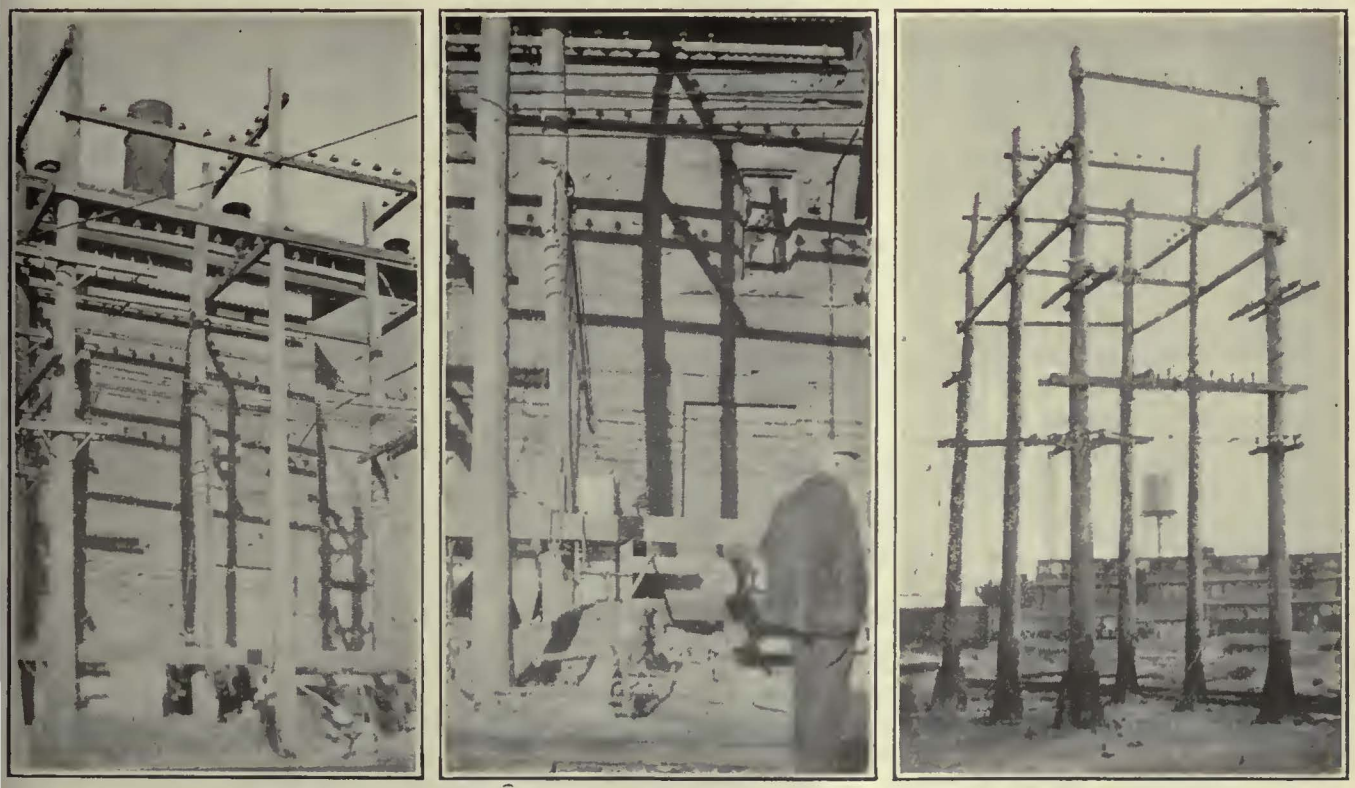
The second plan was considered the more satisfactory and it was decided to reclaim the present poles by cutting off their bottoms and mounting them on concrete bases. These consisted of V-shaped blocks into which four 1⅜-in. x 5-ft. anchor bolts had been cast, the entire concrete base with bolts weighing about 1,350 lb. On top of the base were mounted two malleable iron castings. The pole was securely clamped between the castings by means of six "U" bolts, three on each side.

Three of the poles in the rack were bolted together as one unit with an 8-in. x 10-in. x 25-ft. timber. Jacks were placed under this timber and sufficient pressure applied to remove all perpendicular strain on all poles in the unit. The timber was then securely shored up to hold it in this position. The decayed butts of the poles were cut off 6 in. above the ground line, the butts removed and the hole enlarged sufficiently to take the concrete bases. These were lowered into the holes, using the cut-off poles in the unit for support. The bases were then leveled and the earth filled in and tamped around them. The malleable iron castings were bolted to the concrete bases and the poles moved into place between them and fastened with the "U" bolts. All metal parts had been previously painted with red lead and were finally coated with black asphaltum. The process of remounting the rack was carried out under the supervision of Harry Hill, line foreman of the New Britain division of the Connecticut Company.

It is estimated by the company that $335 was saved by reclaiming the rack rather than replacing the poles and installing new arms and insulators. As a sound piece of timber above ground has a period of life three times greater than a similar piece of timber in the ground, it is thought that the reclaimed poles will last 25 years longer.



At Left, Decayed Butts of Old Poles Being Removed. At Right, Concrete Base Installed Under Old Poles



At Left, Shoring Up Poles After Old Butts Had Been Cut Off. In Center, Lowering New Concrete Base Into Position. At Right, Malleable Iron Castings Were Used to Hold Poles in Place

The Readers' Forum

The Renewal Parts Question

THE CAPITAL TRACTION COMPANY

WASHINGTON, D. C., Jan. 2, 1926.

To the Editor:

The writer has been much interested in the articles in ELECTRIC RAILWAY JOURNAL recently on the cost of renewal parts for electric railways. An investigation of this subject shows that there are fewer operating companies manufacturing renewal parts today than there were two or three years ago. The reason for this must be either that they are able to purchase these articles cheaper or that they are able to purchase better articles than they can manufacture in their own shops.

The question of the cost of renewal parts manufactured by an operating company depends on what is charged as part of the cost; by that I mean what overhead charge is included in the cost. I have heard this subject discussed many times, but very few agree on what should be included as a proper charge. The overhead cost is there and is paid for somewhere, whether it is included in the cost or not. It must be reckoned with in determining the cost of renewal parts manufactured in operating shops as compared with costs of similar articles purchased outside. If no charge, or an incorrect charge, is made for overhead expenses a true cost is not obtained and the comparison is not correct.

It has been stated that a well-organized shop can manufacture repair parts to some extent at a profit because the same men and tools used for repair work can be used to manufacture repair parts when work is slack. My answer to that would be that it is not a well-organized shop, for there should be no slack time. There might be times when the force employed might not be able to keep the work up due to unusual conditions, but the number of employees should not be so large that it is necessary to bring in outside work to keep them busy. The regular force can be better employed on maintenance work than on the manufacture of repair parts.

A question which in my opinion is of more importance than the cost is, can you make the renewal parts as good as the manufacturers who make them in large quantities? The large manufacturer has facilities for determining the quality of his raw material that is a most important factor. He is able to buy this material on specification. His men become experts as they are constantly working on the same kind of work and do not have to shift from one class of work to another. The facilities for inspecting the work are better because there is more of it to do and it pays to assign inspectors to see that it is produced accurately. Therefore the loss from rejections is less.

The life, then, of the material should be longer. After all, that is what we are after. The cost of an article should be based on how long it will last and give good results, not on what the initial cost may be. Material purchased from a responsible manufacturer carries his guarantee. If the material does not give satisfactory service, he is ready to replace it or make an adjustment that protects the operating company from loss. On the other hand, if similar material manufactured by the operating company is not satisfactory, there is no adjustment and the loss must be taken care of by the company itself. When repair parts are manufactured by the operating company their performance should be compared with the performance of similar material purchased outside before deciding which is cheaper. No matter how cheap an article may be, if it causes delays in service due to failure it becomes an expensive article.

The extent to which the operating companies will enter into renewal parts manufacture depends on what the manufacturer has to offer them in delivery, price and quality. The question of delivery is important, for if the operator can depend on getting good material delivered in a reasonable time he is not compelled to carry such a large stock on hand and is thereby enabled to reduce the amount carried in his stock account.

The amount of material carried in the storeroom of an electric railway is large and represents a large amount of money which is not revenue producing. It is therefore necessary to keep the amount on hand as small as possible. Close co-operation between the purchasing department and the engineering department will materially assist in procuring better material and also tend to reduce the amount of material carried in stock. The question of importance after all is, can you manufacture cheaper than you can buy? Before deciding this question, a careful study should be made to determine the cost and performance of the material in question.

H. E. Jordan in his article in the JOURNAL of Oct. 10, 1925, said: "This question deserves greater consideration by railway companies." That, in my opinion, is the answer to the argument, for if the question is given sufficient consideration it will be found that, when quality is considered, it is cheaper to buy than to manufacture.

R. H. DALGLEISH,
Chief Engineer.

Chicago Has Record Holiday Traffic

IF THE number of street car rides is any indication of the amount of Christmas shopping, Chicago merchants must have had the biggest business in their history this year, according to Chicago Surface Lines officials. All previous records for peak loads were left far behind and the company used more than 99 per cent of its equipment in an effort to meet demands. On some days all but seven of the 3,539 cars owned, or 99.8 per cent, have been on the streets.

The highest record in riding was made on Saturday, Dec. 19, when there were 4,962,313 riders, the greatest number ever carried in one day. November showed an increase of more than 6,000,000 rides as compared with November, 1924. There was a steady increase in riding every month since June, but the shopping season brought tremendous peak loads. There were more rides on Oct. 31 than ever before in one day, but that record was broken three days later.

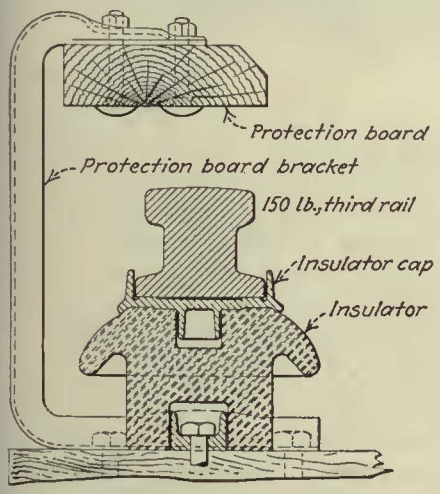
The rerouting of street cars and prohibition of left-hand turns of automobiles in the Loop last year, the elimination of parking on the Loop sections of Van Buren, Wabash, Lake and Franklin Streets and other traffic reforms have proved of great benefit in handling the crowds, G. A. Richardson, vice-president of the Surface Lines, said. Without these improvements, he declared, street congestion would have choked every important traffic lane.

Equipment Maintenance Notes

Third Rail Insulator Maintenance

BY G. H. MCKELWAY
Engineer of Distribution Brooklyn-Manhattan Transit Corporation, Brooklyn, N. Y.

ON ALL of the more recently equipped lines of the New York Rapid Transit Corporation the third rail is of 150-lb. section and is supported on porcelain third rail insulators resting directly on the ties. These insulators are prevented from moving horizontally by means of cup



Method of Supporting 150-Lb. Third Rail

castings lagged to the ties and projecting up into holes in the bases of the insulators.

The rail rests directly on a pronged cap with a projection on its bottom which fits into a similar hole in the top of the insulator, so as to keep the cap in place. At one time considerable trouble occurred due to the porcelain insulators splitting. Investigation showed that the splitting was caused by the rusting of the boss on the bottom of the cap.

Accumulation of rust on this lug increased its size so that not only was it impossible to separate the cap from the insulator, but the wedging force of the rust first caused hair-line cracks in the porcelain and eventually split it into pieces.

Owing to the fear that a serious accident would occur due to the breaking of large pieces of porcelain off of the insulators when they were installed on the elevated lines, and their resultant falling into the street and striking people passing by, it was decided to examine all insulators of that type which were installed on the elevated structures. During this examination each insulator was removed and the cap taken off. In many cases the lug on the cap had swelled so much from the rust that it was impossible to pry it out of the porcelain, and the latter was broken in the attempt.

Not only were many of the bosses on the caps found to be so badly rusted that it was not safe to put them back but, on close inspection, many of the porcelain insulators which seemed at first sight to be uninjured were found, after careful wiping off, to have developed hair-line cracks. These insulators were discarded.

When installing new insulators and caps as well as when replacing those which were uninjured, the boss and hole were given a thorough application of a heavy graphite grease. This, it is believed, will decrease rusting of the lugs. This careful inspection of the insulators has been made not only on the elevated lines but in damp portions of the subways as well.

From Log to Finished Car Parts

The Woodworking Machinery in the Shops of the Havana Electric Railway, Light & Power Company Provides for Taking Native Wood as Delivered in Logs and Making the Finished Parts for Car Body Repairs

BY OTTO GOTTSCHALK
Engineer of Railway Equipment Department, Havana Electric Railway, Light & Power Company, Havana, Cuba

FOR maintenance repairs to car bodies and also for new construction, the Havana Electric Railway, Light & Power Company, Havana, Cuba, has found it economical to use native Cuban hard wood with the exception of pine which is imported from the United States in board lengths. The native wood is delivered to the railway in logs, some of which are as much as 40 ft. long and 50 in. in diameter. The railway company's equipment thus contains machinery required to rip these logs into slabs and timber framing of various dimensions as well as that necessary for finishing the various parts required.

In order to provide for carrying out this work in an economical manner, a modern fireproof building has been constructed for the large band-saw which is used to rip the logs. Formerly this equipment was located in an old wood-frame building and the machinery was driven by belts

New Woodworking Department of the Havana Electric Railway, Light & Power Company Has Increased Production 33 per Cent

through a long and complicated system of power transmissions. A single motor was used for the operation. It was desirable to decrease the fire hazard and also to increase the output without a great expenditure of money, so a modern fireproof building was constructed for the smaller woodworking machinery and a separate corrugated iron building was constructed for preparing the rough timbers. This latter building is located conveniently to the log storage and has a standard gage track running through it. The bandsaw is located at one end of this building and a large pit with foundation for the saw has been constructed of concrete. This provides a firm base for the machines and eliminates vibration, which is objectionable. The bandsaw is driven by a 50-hp. motor through a 12-in. belt. The motor is located in the pit under the loading platform in the building, so that no space is lost on the floor. A compartment has been constructed in the pit, into which sawdust falls, and an exhauster driven by a belt from the saw flywheel shaft deposits the dust into barrels outside the building.

Logs Are Sawed Into Convenient Sections in This Building Previous to Delivery to the Woodworking Section

Logs are brought into the building on flat cars and are rolled off to the concrete ramp, which has the same elevation as the floor of the flat car. On the ramp the logs are cut by hand into the desired lengths and are then rolled down to the saw carriage, clamped in position and fed to the saw. As the slabs are cut they drop to another platform, where they are loaded on flat cars and are hauled to the woodworking machines in the other building.

The building which houses the bandsaw has several features which result in labor saving. The ramp construction of the platform permits logs to be rolled easily to the carriage for sawing; a cable with an overhead trolley and differential hoist enables the workman to select any special log section that is desired without excessive handling. As a result of the improved equipment four men supply all labor for attending the saw where previously eight were required. The output has also been increased about 30 per cent.

The slabs and different special sections as they come from the bandsaw are taken to the building containing small woodworking machines. Each part is marked so that it can be cut into the particular shape desired, such as end sills, side sills, front sills, window posts, bulkheads and end posts.

The machinery in the woodworking department is arranged so that each section will pass from one machine to the next with a minimum amount of movement. Particular attention has also been given to the locating of machines so as to give ample space for handling large sections without difficulty. In general, each machine has an individual motor either direct connected or driven by a belt. In some cases, where two machines require a motor of the same horsepower and it appears that both machines will not be used at the same time, one motor has been used to drive both machines. In this case the machines are located so that the same belt lengths can be used.

A large motor-driven exhauster has been installed as a part of the equipment for the woodworking department. Each machine is served by a tube and there are also numerous tubes provided for floor sweep-ups. All sawdust and shavings are automatically deposited in a specially constructed car outside the building. The relocating of the machines and the installation of the new exhausters have increased the capacity of the woodworking department about 33 per cent with no additional labor.

Providing Sockets or Sleeves for Cables

DIFFICULTY experienced in getting permanent connection with soldered terminals or sockets which are used with stranded wire has led the Bridgeport Brass Company to make a survey of practices of various railways in connection with its Phono Hi-Strength wire. Information developed in this manner, together with data obtained in a socketing test of samples, has led the manufacturer to recommend the following:

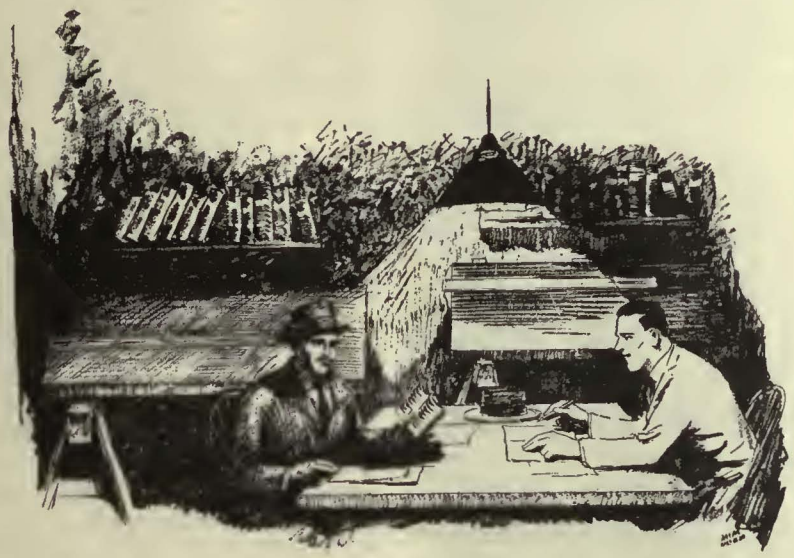
Sockets.—The sockets should be of the open-end or sleeve type, as it is impossible properly to fan and clean the strands if the closed-end type is used. The open end also makes it easier to determine if the soldering is done properly. For cables ½ in. in actual diameter and under the sleeves should have a conical chamber at least 3¼ in. deep with a taper of about ¼ in. per inch. For cables from ½ to ¾ in. actual diameter a conical chamber at least 4 in. deep with the same taper as given above is desirable. Sockets may be malleable iron, steel or bronze, but where corrosion is an important factor it is of course better to use bronze fittings.

Preparation of Cable.—The end of the cable should be carefully bound with light brass or copper wire pushed through the socket. It should then be bound again at a point which, when pulled back into the socket, will leave the ends of the cable extending approximately ⅛ in. above the top of the opening. The end binding should then be removed and the wires fanned out. The wires should then be cleaned by hand with emery cloth, or, better, by dipping in a 50 per cent water solution of nitric acid. If the nitric acid dip is used care must be taken not to dip the cable quite up to the binding or else the acid may feed into the cable due to capillary action. The cable must be thoroughly washed after the nitric acid dip and then dipped in a zinc chloride soldering flux. After the flux has thoroughly dried the wires should be tinned by dipping them in the molten socketing mixture. Any moisture on the wires when dipped in the metal will cause it to boil and blow. It is best for the operator to wear goggles and gloves in the operation.

Flux.—Zinc chloride flux can be made by adding more zinc than can be dissolved to hydrochloric acid or what is commercially known as muriatic acid. It is well to keep a

Dick Prescott Works Overtime

And Learns Something About Cars



FOR several days following his talks with the shop foremen regarding the work of the new engineering department, Dick Prescott, engineer of equipment of the Consolidated Railway & Light Company, was busy putting some of his plans into action. He saw so many opportunities of taking detail off the hands of various foremen and at the same time laying out definite standards and practices to replace the old rule-of-thumb methods that he was impatient to get to work as quickly as possible. This filled so full the days immediately following that he and Steve White, the carpenter shop foreman, had little time to get together and consequently they spent several evenings in the new engineering office making the study of car repair practice that they had both agreed to do the day following their return from their inspection trip.

Steve had managed to make up an inventory of the several different major items of equipment in service on the property. The figures summed up as follows:

City passenger cars	320
Different types included	11
Types of trucks	9
Types of motors	10
Wheel sizes	3

"Gee, that's some mess," said Dick when they had summarized the figures in this form.

"I'll say it is," agreed Steve.

"How do those cars run in weight?" asked Dick, starting on a fresh sheet of paper.

"Well, I didn't get a chance to get each type on a scale, but I've got the figures on some of them," said Steve, consulting the worn notebook in front of him. "The old battleships—that's the group of 40 cars in the 200 series—go about 48,000 lb. The twenty bowling alleys run around 46,000 and the six rebuilds—those are the ones we rebuilt after the fire—weigh about 49,500. Then the maximum tractions scale 44,000 and the big turtlebacks average 45,500."

Steve paused a moment to check back the figures in his book.

"Oh, yes," he continued, "here's the center-entrance cars. They're on two different trucks. Twelve of them weigh 42,000 lb. each and the other nine are 43,500. Then I've got the new cars. There's fifteen of them and they average 32,000 lb."

"How does the seating capacity on the new cars compare with the battleships?" asked Dick.

"Four seats less."

"How old are the big fellows?"

"Let's see, I think about 22 years."

"What do you suppose is the relative maintenance cost on those two groups?"

"Gosh, that's the whole trouble. We don't have the figures in shape so they tell the story. If we did we wouldn't be spending money right now to patch them up."

"Well, that's our job now; to get some way of estimating what the costs are on each group of equipment," said Dick.

"All right," replied Steve, "let's see what we can do." He laid down his notebook and pulled a pad of paper in front of him.

small piece of zinc in the solution to be sure that there is no appreciable amount of free acid. Any other non-corrosive flux recommended for use with tin-lead solders may be used provided it is found that a satisfactory union between the solder and the wire is obtained.

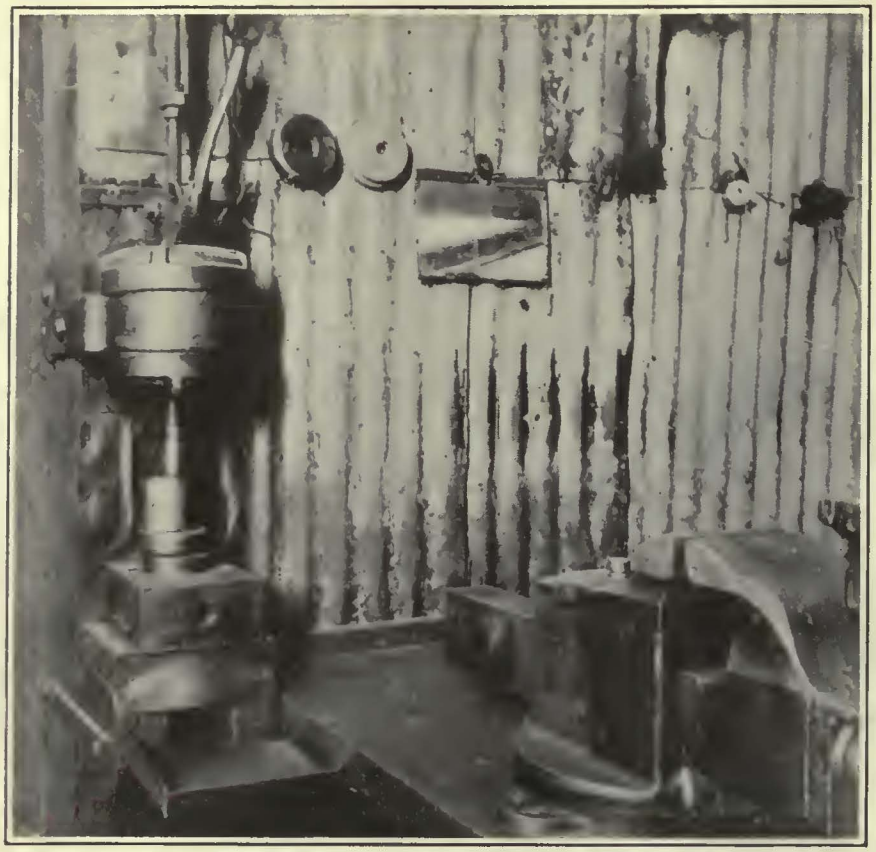
Socketing Mixture.—The mixture used for pouring into the socket and also for tinning the wires should be made up of two parts of tin and one part lead. This mixture melts at about 360 deg. F. and can be poured easily at temperatures from 370 to 390 deg. F. The temperature of the metal should not be over 410 deg. F. when the wires are dipped for tinning or when it is poured into the socket. If it is used at a higher temperature there will always be danger of annealing the wire.

Making the Socket. — After the wires have been tinned and prepared the cable should be drawn back into the socket so that the ends project slightly above the end of the conical opening. Care must be taken to have the cable leave the socket straight and in line with the axis of the socket, otherwise the stresses will not be uniformly distributed on the wires. It is also important not to have any of the fanned wires in contact with the sides of the socket, otherwise the solder will not surround the wire completely and poor holding power will result. All parts of the cable and socket which will come in contact with the molten metal when it is poured into the socket should be thoroughly dried, but it is sometimes desirable to wrap a wet piece of waste or cloth around the small end of the socket to chill the solder more quickly. The socketing mixture should be poured into the socket slowly and at as low a temperature as can be used and still obtain a good sound casting. It is usually well to hold the socket in a vise and neither the cable nor the socket should be moved until the solder has thoroughly set. After this the socket may be quenched in water to cool it rapidly.

Trolley Wheel Bushing Press*

FOR forcing bushings in and out of trolley wheels a pneumatically operated press has been designed and constructed in the shops of the

*This article is based on material included in the brief submitted to the Charles A. Coffin Prize Committee of the American Electric Railway Association by the company named.



Shop-Constructed Trolley Wheel Bushing Press

Denver Tramway, Denver, Col. The construction consists of a piece of 6-in. pipe with two pipe caps and a piston and plunger. The whole device is mounted on the wall near the workmen's bench. An anvil necessary for convenience of the workmen is located underneath and a three-way air valve is provided for control of the press.

Car Cleaning Methods in Boston

CLEANING more than 2,000 cars for the year 1924 cost the Boston Elevated Railway slightly more than $477,000. The entire outside surface of each car in service, including the glass, is cleaned daily with a soft mop. Vestibule glass is cleaned on both sides and the inside of all windows is gone over with a damp chamois or cloth to remove streaks and spots.

After every storm all surface cars are washed thoroughly with clean water as the car surface becomes streaked from dirt washed from the roof. Outdoor storage is used quite extensively in Boston. This renders more difficult the problem of keeping cars clean in winter since little or no water can be used. Daily, generally at night, the floor of the car is swept clean, a solution of water and disinfectant being used to lay the dust and sterilize the interior. After the car is swept and the dust has settled, it is thoroughly dusted and the lamps, hand straps, window sills, and register glass are wiped with a dry towel.

At intervals of from one to two months, according to the condition of the car, both inside and out are given a thorough cleaning by using in addition to water some cleansing compound that will effectively remove all stains without injuring the paint or scratching the glass.

Car cleaning in Boston would be much simplified if all cars could be treated alike, but as the service on different lines is quite different cleaning requirements are quite varied. Cars running through paved city sections present a different problem from those running where the streets are macadamized. Also cars stored under cover require much less work than those stored in the open. The problem of keeping cars clean in rainy weather is different from that in fair weather, and cars which run in subways or tunnels are harder to keep clean than those which do not. Underground, the dry dust with its fine particles of iron which come from brakeshoes is kept in motion continually by the rapid movement of trains. An accumulation of this dust on the cars in a wet condition becomes iron oxide or rust, which is one of the most difficult things to remove from glass and painted surfaces.

Overcoming Trolley Breaks Due to Severe Temperature*

CONDITIONS in El Paso, Tex., are such as to render the maintenance of trolley wire on the lines of the El Paso Electric Railway a serious problem. Extremely hot days followed by cold nights cause an expansion and contraction that is excessive and decidedly harmful to the wire. To overcome troubles from trolley wire breaks, the company has installed Phono-Electric wire over special work in the downtown sections. This is inspected on a regular maintenance schedule and since its installation a very marked improvement has resulted in the number of trolley breaks. The following figures show the results obtained. During 1921, 239 breaks; 1922, 193 breaks; 1923, 102 breaks; 1924, 33 breaks; 1925, 15 breaks for first six months of operation.

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New Equipment Available

Heavy-Duty Quick-Set Detachable Wrench Set

DESIGNED to fill an urgent need of electric railway shops for a heavy-duty wrench set, the Blackhawk Manufacturing Company, Milwaukee, Wis., has just placed such a set on the market. In order to determine the suitability of this set for electric railway work, one was placed with the Milwaukee Electric

Extra-Heavy-Duty, Quick-Detachable Wrench Set

Railway & Light Company for a test of one year. This set has been used daily putting in motor studs with a 5-ft. extension bar on the ratchet wrench. Force has been exerted by the weight and pull of two men. This set has given satisfactory service and no replacements have been found necessary during the trial. An accompanying illustration shows the new heavy-duty set with quick detachable wrenches.

Atomizing Type Oil Burner

DESIGNED to give maximum combustion and great heat quickly, an atomizing type of oil burner and preheater has been brought out by the Alexander Milburn Company, Baltimore, Md. The cheapest grade of crude fuel, kerosene oil or distillate and compressed air under pressure varying from 50 to 100 lb. is used. In addition to furnishing a direct supply to the burner, the compressed air also maintains pressure in the oil storage tanks. This creates a greater velocity in the oil feed line and insures a positive and uniform flow.

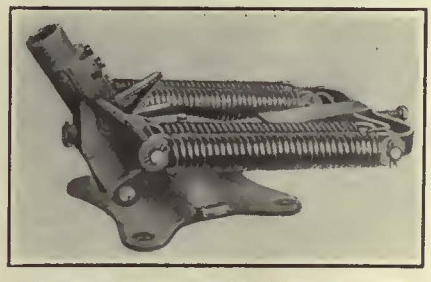
New Atomizing Type of Oil Burner and Preheater

The flow of both air and oil is through straight-line orifices unhindered by coils or staggered passages. The oil under pressure enters the atomizing chamber at right angles to it and in an annular form. The compressed air flows directly through the center, striking the filament of oil and atomizing it. There is no siphoning effect of either oil or air. Immediately upon opening the valves, the gas at the burner can be ignited and work can be started.

This burner is particularly convenient for use in preheating castings for welding in electric railway shops. Preheating is now considered quite essential for large castings in order to neutralize expansion and contraction strains and to effect economy of gas. Without preheating, complicated castings are liable to develop new breaks at points remote from the weld when they are again placed in service.

Tapered Roller Bearing Trolley Base

FOLLOWING nearly four years trial on a selected number of railway properties a trolley base incorporating the tapered roller bearing



Tapered Roller Bearing Insures Great Durability and Sensitiveness

features is now being offered to the market by the R. D. Nuttall Company, Pittsburgh, Pa. This is now designated as U. S. No. 20-A and is standard equipment with the company. The main forward step taken in the design of this base is the use in the swivel of roller bearings with hardened raceways and a suitable means of adjustment.

A trolley base must withstand a heavy cocking load due to the weight of the pole, harp and wheel and to the wire pressure. These pole loads cause the swivel to tip to an extent depending on bearing clearances and wear. The result is that in bases employing a center pin, rollers and outer raceway the rollers bear at their upper ends on the side of the trolley base opposite the pole and at their lower ends on the pole side. Between these two points the rollers must be slightly cocked and crosswise of the raceway, each roller being in a slightly different position, depending on its location around the swivel.

With the new construction this localized end pressure is distributed over the entire surface of the tapered roller by the use of two tapered roller bearings located one at the top and one at the bottom, since the pressure at the top and the bottom of the swivel is practically perpendicular to the rollers. The cocking tendency is still present, but the perpendicular pressure just mentioned is produced and the tendency to twist is minimized by closer tolerances which are possible with these adjustable bearings.

More even distribution of pressure over the area of the roller results in less pressure per unit of area than is obtained with the longer rollers now commonly employed, either loose or assembled in a cage. A further advantage is that the base actually hangs on the roller bearings, as compared with the usual arrangement in which a large amount of the weight is supported on the center pin with consequent friction and loss of freedom to the swivel.

Arm Feeds Metal Cutting Saw Into Work

BY USING a horizontal arm instead of a vertical one on a bandsaw, a cutting head is produced which, by its own weight, feeds the saw into the work instead of the usual method of feeding the work into the saw. This is a feature of the new metal cutting bandsaw produced by the Metal Saw & Machine Company, Inc., Springfield, Mass.

The weight of the horizontal cutting head is counterbalanced by a powerful spring which gives an automatically variable feed pressure to take care of differences in hardness in the piece of metal being sawed. This construction saves the bandsaw blade and gives a straight cut regardless of variations in the stock. With the positive feed of the vertical type of bandsaw commonly used, the stock is forced into the saw and results in crooked cutting, stripped teeth and broken blades. With the new construction, constant attention

Horizontal Napier Bandsaw for Metal Cutting

by the operator is unnecessary after the material is secured firmly.

The new machine is driven by a Westinghouse motor, which is regulated to give a particularly high speed. This is possible since the blade travels in the cutting direction only and the pressure adjustment gives a smooth, even movement.

American Association News

Metropolitan Section Devotes January Meeting to Bearings

Design, Lubrication and Maintenance of Electric Railway, Motor and Car Building Received Active Consideration at the Jan. 8 Meeting Held in New York

MOST of the secrets about the bearings of electric motors and car journals were aired at the meeting of the Metropolitan Section of the American Electric Railway Association held in New York on the evening of Jan. 8. Before one of the largest attendances in the brief life of the Metropolitan Section, the manufacturers told of the practices and the solutions of problems that have helped to develop the modern railway motors. A carefully prepared paper by M. Guynes, of the railway motor engineering department of the General Electric Company, is abstracted elsewhere in this issue. It is filled with the technique and the detail adhered to in the manufacturing process and is full of pertinent information and practical suggestions that visualize to the maintenance engineer the importance of good lubrication and good maintenance of bearings, to avoid their rapid wear. One workman called a bearing a heat generator. This is true, and the efforts of the manufacturer and the maintenance engineer must be devoted to make it a poor generator. A number of lantern slides helped to visualize the important points.

Mr. Guynes' paper was followed by an excellent presentation of the same subject by J. F. Dean, of the engineering department of the Westinghouse Electric & Manufacturing Company. This paper was also filled with information of interest and many practical suggestions. It is also abstracted elsewhere in this issue.

The January meeting was called to order at 8 o'clock by President J. W. Hulme, having been preceded by a Dutch-treat dinner at Keene's English Chop House. On account of the length of the meeting only the treasurer's report was given, indicating that there was $1,337 on hand and that the membership committee had increased the number to 1,122 members, an increase of 47 in the past month.

A telegram from C. E. Morgan, who was in Cleveland attending the exhibit committee meeting, sent the best wishes of the committee, including J. W. Welsh, Morris Buck, F. C. J. Dell.

Following the presentation of the two papers on the design and maintenance of bearings, Joseph F. Lamb, staff engineer of the Texas Company, discussed the papers, saying that the experience of the Texas Company has shown that the best car oils were manufactured from high grade steam cylinder stock, made up in seasonal grades to compensate for the great differences in temperature. Mr. Lamb does not agree that it is best for motor bearings to receive free oil when worn. While this method may be satisfactory under ideal mechanical conditions, the facts are that the oils used and the oiling system used must operate satisfactorily under other than ideal conditions. The down feed type of oiling frequently results in flooding the armatures, thus doing great harm.

Emphasis was laid on the statements of the two manufacturers' representatives that a long fiber all wool waste has the characteristics most desirable in capillarity and resiliency. There are in use grades of waste containing mixtures of graphite, talc and mica which have proved to be disadvantageous because these fillers slip out and cause restriction and plugging of the opening between the oil and waste chambers in motors and prevent the bearings from receiving the proper supply of oil.

The Texas Company has achieved excellent results in the use of electrically heated, thermostatically controlled waste saturating tanks. With these tanks the waste saturation time is accomplished in four hours as against 120 hours in unheated tanks or tanks with uncontrolled heat.

While all of the ideas brought out have been good, Mr. Lamb stated that the best ideas find their value only in proper application and therefore his company is pleased to note the tendency among railway mechanical department officials to select more intelligent labor, take care of lubricating duties, and when this improvement becomes general, the results will justify the judgment of those responsible.

Alfred A. Green, of the Galena Signal Oil Company, outlined in an interesting manner the progress in the art of lubrication. Lubrication was first gained by old-fashioned grease cups. About 1900 the use of oil became recognized as a better practice. Also about that time the practice of putting long covers on the axles was started. The straight bronze bearings then gave way to the babbitt lined bearings and somewhat later the use of waste wick type of lubrication came into operation. Mr. Green laid great stress on the success that his company has had with lubrication on the mileage basis, the theory being that the right amount of lubrication is applied to bearings and the waste and promiscuous use of oil is avoided. Too much oil, he avers, does the bearing no good, and is apt to cause difficulties in other parts of the equipment.

The axle collar gave trouble, and the fiber collar came into use, giving some measure of success. Now the axle bearings are covered and lubricated with much greater success.

A film of oil in the bearing surface is all that can be used. Why use a barrel to supply the film, when a pint will do as well or better? To this point the manufacturers of bearings and oils held the center of the stage. D. D. Owenn, general foreman New York Rapid Transit, then told of some of the problems of the operator. Shortage of cars and consequent necessity of keeping the cars almost continuously in service, in his mind, practically prevent the use of many of the refinements possible in the manufacturing processes. Limited shop conditions do not allow the same grade of machine or workmanship possible in the original manufacture.

Mr. Owenn's road now has running 22 cars and 88 bearings, all journal brasses, using a cotton waste with a series of small springs placed in and behind the waste in order to hold it against the revolving axles. Mr. Owenn stated that it was impracticable to pack bearings properly in a truck while under a car, and that except in emergency cases, the waste is allowed to stay in the journal until periods of general overhauling, when the truck can be removed from the car and the motor bearings properly repacked with new waste. He reported little trouble from loose axle cap bolts. Occasionally one bolt will be broken, but the three other bolts hold the cap in place and the broken bolt is repaired upon inspection.

The practice recently adopted by the Metropolitan Section of passing blank cards around on which questions may be asked brought forth several interesting questions. One question asked in regard to the success of roller bearings brought forth the answer from Mr. Guynes that roller bearings had been used successfully in motor bearings. They could not be well applied to axle bearings and he said he could volunteer but little information in regard to the use of roller bearings in car journals, except that the Pennsylvania Railroad was now testing a number of roller bearings on some of its steam road equipment.

L. M. Clark, vice-president of the Railway Improvement Company, then gave a short discussion of the papers. He emphasized the use of good practices and the use of good oil in the lubrication of bearings, but stated that the responsibility for purchasing good oil did not end there, that it was necessary to have the oil 100 per cent clean when it reaches the bearing. One can hardly realize more difficult conditions

for lubrication than under an electric car, which is subjected to the filth and dirt of city streets, the temperature changes and the water and snow often encountered. Another point to take into consideration is the fact that fresh oil should replace old oil that has done its duty. The mere fact that a space is filled with fluid does not necessarily mean that this is good oil. Railway motor bearings, as you know, are so designed that oil may pass out at both ends. This is not a total loss, as it is a protection to the flange end of the bearings against wear, and the open end against water; where oil comes out, it is rather difficult for water to get in.

Mr. Clark further stated that it is far easier to insure perfect contact of the waste with shafts or axles if the waste is located at the top of the bearing much more so than if it is carried in the side or below. When the oil is carried above the bearing, gravity is added to capillarity in supplying oil to the bearings.

With the top feed arrangement, the oil that is held in the waste naturally settles to the bottom, which is in direct contact with the shaft or axle. This is not the case with the side feed or underfeed type. The oil settles in the waste after the motor has been stopped and is at the greatest distance from the bearing at the time when the oil is needed and needed quickly, when the motor or car is first started after a long layover.

Engineers well advised in motor lubrication have questioned the advisability of applying oil at the top of the bearing, which, as you know, is the high pressure side. Experience, however, has demonstrated that no difficulties have been encountered on account of the waste opening being on the top. In fact, the opposite results predominate on account of the direct application of the oil to the shaft.

In summing up the situation, the motors and car journals should be put in first class mechanical condition. Old frames should be thoroughly annealed so as to normalize the internal stresses that have accrued through millions of vibratory shocks. This is best done after any necessary welding has been completed. Armature and axle bearing openings should be accurately rebored to the proper sizes and all precautions taken to see that these bearings are afterward accurately held in place. For good operation motors should be run as the manufacturers designed and built them. Limit bearing wear as closely as you can. The spreading of gear and pinion centers causes noisy operation and is detrimental to their life. The oil companies recommend good oil; use it and keep it clean.

Interspersed among some of these papers and following, a number of entertainment features were given by employees of the Interborough Rapid Transit Company. Prof. J. Haugher performed a number of tricks with a series of rings and later did some clever card tricks. Now you see it and then you don't. A banjo and song entertainment was given by Messrs. Sutherland and Readyoff.

Two other entertainment numbers were later given, one a dance by F. Heide and R. Haggerty, with H. Gilday at the piano, and then several songs by the well known tenor, E. Wager, were given, with H. Gilday at the piano.

The informal dinner before the meeting was attended by 89 members and the meeting following by 230. The next meeting will be held Feb. 5 and will be a series of motion picture films depicting the manufacturing processes of steel.

Bearing Life and Lubrication of Electric Railway Equipment*

By John S. Dean
Engineering Department, Westinghouse Electric & Manufacturing Company

QUITE frequently practical railway men in various parts of the country have asked this question: "Why is it that the armature bearings furnished by either the General Electric Company or the Westinghouse company have so much longer life and give better service than any other bearings we have ever used on our motors?" This may not be the experience of all operators. There is, however, enough evidence available to show that this is quite generally true. It may be satisfactorily explained by saying that the bearings are designed to have ample capacity and great care is given to all details. The materials used are of the best quality obtainable, the bearing shells are properly babbitted, the workmanship is of a high grade, backed by many years of experience and training. When the bearings are mounted they have a good tight fit in the housing and are accurately aligned. They are also constructed with minimum allowable radial and end clearances and are of the correct size.

*Paper delivered at meeting of the Metropolitan Section, American Electric Railway Association, Jan. 8, New York City.

Design of Armature Bearings

Modern railway motors are fitted with bronze bearing shells lined with ⅛ in. thickness of tin base babbitt metal and are liberally designed to carry their load and resist the pounding and vibration to which they are subjected in service. A minimum size window with well-rounded edges and corners is provided through which oil is fed to the journal by means of a waste wick, the lower part of which rests in an oil chamber.

The bearing shell is made from a good grade of dense bronze, the composition of which is approximately 80 per cent copper, 10 per cent antimony and 10 per cent tin. The Brinell hardness of this alloy is around 70. The babbitt metal is made from a tin base alloy made from virgin metals and is similar in composition to the original Isaac Babbitt formula, which is 88.9 per cent tin, 7.4 per cent antimony and 3.7 per cent copper. The babbitting of bearing shells must be accomplished with great care. The shells must be carefully cleaned and then tinned. The use of an acid flux speeds up this work. The bearing shell must then be preheated before being assembled in the babbitting machine. The hot babbitt should be continuously stirred before pouring to keep the metals properly mixed. Use of babbitting pots with automatic temperature control insures a correct pouring temperature, which should range between 460 deg. and 480 deg. C.

All finished bearings that do not give a clear, bell-like tone when suspended and struck with a small hammer should be rebabbitted, as a dull, dead-like sound indicates that there are air pockets between the babbitt lining and the bearing shell, which are sure to cause trouble in operation. Good workmanship in the machining operation, press fitting, alignment and assembly are absolutely necessary. The clearances allowed in babbitt-lined bearings are those standards adopted by the American Electric Railway Engineering Association.

COMING MEETINGS
OF
Electric Railway and Allied Associations

Jan. 20-21—Central Electric Traffic Association, Miami Hotel, Dayton, Ohio.

Jan. 22-23—Central Electric Railway Accountants' Association, Miami Hotel, Dayton, Ohio.

Jan. 26-29—Society of Automotive Engineers, Annual Meeting, Detroit, Mich.

Jan. 27—New York Electric Railway Association, Hotel Commodore, New York, N. Y.

Jan. 28-29—Central Electric Railway Association, Lincoln Hotel, Indianapolis, Ind.

Feb. 5—Metropolitan Section, American Electric Railway Association, Engineering Societies Building, 29 West 39th Street, New York, N. Y., 8 p.m.

Feb. 11—Central Electric Railway Master Mechanics' Association, Portage Hotel, Akron, Ohio.

Feb. 18—American Society Civil Engineers, American Society Mechanical Engineers, American Institute Electrical Engineers, and American Institute Mining and Metallurgical Engineers, joint meeting, United Engineering Societies Building, 29 West 39th Street, New York, N. Y., 8:15 p.m. Subject: "The Effect of the Diesel Electric Engine on Heavy Electrification."

Feb. 24-26—Electric Railway Association of Equipment Men, Southern Properties, Mobile, Ala.

April 13-16—Southwestern Public Service Association, Galveston, Tex.

In the Westinghouse plant the journals on new armature shafts are ground to exact size on a Norton grinding machine. This is not practical in repair shops, as the shaft would have to be removed from the armature. Armature shafts should not be allowed to run in service if worn tapered more than 0.005 in. If the wear is greater than this the shaft should be trued up to a maximum size or reduced in definite steps of $\frac{1}{32}$ in. on the diameter, so as to use standard under-size bearings.

When journals have reached their scrapping limit it is the practice of some operators to restore them by the use of sleeves made from Shelby steel tubing, while others build them up by welding. Our experience indicates that shafts made from heat-treated or special alloy steels should not be welded.

Armature and Axle Bearing Life

Answers to a questionnaire sent out by the American Electric Railway Engineering Association several years showed that the minimum armature bearing life reported was 15,000 miles and the maximum armature bearing life was 200,000 miles, while the average of all reports indicated 80,000 miles. Reports have been obtained elsewhere of as high as 375,000 miles, which is probably the upper limit that has been obtained. It is probably reasonable to assume that the average life of armature bearings should be between 80,000 and 90,000 miles.

From the same questionnaire it was determined that axle bearings had a minimum life of 2,000 miles and a maximum life of 150,000 miles, averaging 55,000 miles. The average life can thus be generally assumed to be between 50,000 and 55,000 miles for axle bearings.

Maintenance and Inspection of Railway Motor Bearings

A careful inspection was made on a street railway recently and the data obtained were segregated into the maintenance records in two different carhouses. This inspection covered 88 motors over a period of thirteen months. The inspection and maintenance methods, including lubrication practices, at carhouse A were far superior to those in carhouse B, as was indicated by the results. Carhouse A reported 0.002 in. wear per 5,000 miles, whereas carhouse B reported 0.0095 in. wear per 5,000 car-miles. The bearing wear at carhouse B was thus some 62 per cent greater than at carhouse A and showed conclusively that too much stress cannot be laid upon the importance of regular and systematic inspection of equipment.

Oil, being the medium of lubrication, is of utmost importance. It is recommended that railway operators be guided by the suppliers of oil. Do business with a reliable and a dependable company. Guaranteed mileage contracts should be avoided, as they sometimes work out to be economically wrong. Temperature affects the oiling of motors and therefore the proper grade for summer and winter use should be used. A definite system and schedule of oil changes should be adopted and followed religiously. If the oil is too heavy, rapid wear of the bearings results, although they may not get overheated.

A suitable and convenient storage room should be provided and equipped with modern appliances for the handling and storing of all oil stock and lubricating material. Long strand wool waste, the strands varying from $\frac{1}{8}$ in. to $\frac{1}{4}$ in., should be used. Experience shows that such wool yarn when properly saturated will not glaze and will feed plenty of oil to the bearings. Further, it retains its springiness, which keeps the waste wick against the journal when once properly packed. The difference in price between low grade waste and a high grade of wool waste is about 15 cents per pound, and as the average bearing takes only a pound of dry waste to 4 lb. of oil the difference is practically 15 cents a bearing, whether a good grade of waste or a poor one is used. A bad bearing may cause maintenance difficulties in excess of $75 if the armature must be rewound. Experience of the Westinghouse company has found that the most satisfactory way of packing a motor bearing is to make up a wick of long wool yarn, which is placed in the oil chamber, so that it will extend from the bottom to the top of the housing. This wick should be made the maximum size that can readily be put in place to insure a good oil feed. After the wick is in place, fill the remaining part of the housing with bunches of waste packed in behind the wick, using great care to spread the wick at the bearing window. In making up the wick and in packing the bearing extreme care should be taken to use only clean and well-saturated waste. Ordinarily bearings should be repacked at least twice a year. The most suitable time for doing this work is when changing the grade of oil, due to change in seasonal temperature.

Definite oiling schedules should be adopted at periods equaling about every 1,000 miles of service. Maintain the oil at proper levels, determined by means of a gage, after receiving the advice of the manufacturers of the motors. Tests show that under similar conditions the flow of oil for a 1¼-in. lift is approximately five times more than at a 3-in. lift. The maximum possible lift for wool waste and car oil is 5 in. and the maximum lift for practical oil supply is 3 in.

Car journal bearings also should be carefully packed and lubricated. When the car is overhauled and the bearing is to be repacked the housing or journal box should be thoroughly cleaned out. A wick of waste is packed at the rear end of the box to lubricate the rear journal fillet and to keep out dust and water. Pack the box with a continuous bunch of waste, forcing it in place so that it makes a good contact with the underside of the journal. Care should be taken to see that all waste should be kept below the center line of the journal. See that no strands of waste are left hanging outside of the box after the cover is closed, as they will tend to drain the oil from the journal box. When properly saturated waste is used in packing the journal box; no free oil should be added.

Men responsible for the oiling of equipment should be trained. Simple typed instructions on packing and bearing oiling should be placed in the hands of oilers. These instructions should be supplemented by short talks to the men in charge of this work, explaining the fundamental principles of bearing lubrication, the advantages of good lubricating methods and the troubles that result from poor methods.

Capillary-Vacuum Oilers

The Railway Improvement Company has recently put on the market an oiler which works on the capillary-vacuum principle. It has been applied to a large number of older type of railway motor bearings, which originally used grease lubrication. Reports indicate that this device has greatly improved the operation of these bearings. It is claimed for this oiler that bearing costs can be reduced 50 per cent by eliminating the dirt, grit and other foreign substances which are constantly finding their way into the bearing housing, clog the packing waste and help to grind out the bearings.

In discussing the question of oiling and lubrication, similar care should be given to all other parts of the equipment.

Regular and systematic lubrication of the above details will not only result in a smooth running car but will produce a longer life, less vibration and noise and a consequent reduction of general maintenance expense.

Federal Bill Limiting Exemption Now Given on Interest from Municipal Bonds

IN THE discussion on the present federal income tax bill before the finance committee of the United States Senate, a plea was recently presented by Philip H. Gadsden of Philadelphia for an amendment to Section 213 of the revenue act of June 2, 1924. This is the section relating to the exemption given under the law to interest received on bonds of a state and its political subdivisions. The arguments were presented in behalf of the American Electric Railway Association, the American Gas Association, and the National Electric Light Association. Mr. Gadsden proposed that the present exemption of the interest on these bonds should not apply to obligations issued since Jan. 1, 1925, "in payment for or to be used in paying for the construction, acquisition, operation or maintenance of any utility, which bonds, warrants or obligations do not constitute general indebtedness of issuer, but are payable out of the revenues of such utility or otherwise than by general taxation, and from the rents, dividends, securities or transaction of any business carried on for gain or profit and income derived from any source whatever."

According to the speaker, Congress has the constitutional power to make a distinction between the governmental activities of a state or city and its business activities when it enters the fields of public utility and ownership. This position was justified by Mr. Gadsden in a series of quotations from decisions of the courts of last resort of a number of states and by the Federal Supreme Court.

The argument was made that unless this change is made in the federal income tax law, at least two classes of the community suffer serious disadvantage. One is the rural dweller, whose utility service is nearly always supplied by a private company, since practically no municipally owned electric plants extend their service lines into the country. Through his payment of rates he assists in the support of the federal government, while the user of service from a municipally owned plant is free of this burden. The other discrimination comes between the dwellers in cities served by a private utility and in those where the utility is owned and operated by the municipality. In the latter case, the car rider is relieved from contributing some part of his car fare to the federal government, while the patrons of electric railways where the utility is privately owned must pay a rate of fare which includes their proportionate share of the federal tax. The point is made that in these days of friendly but keen competition between cities in the same territory for industries, such a different street railway fare or gas or electric rate might confer a distinct advantage on the city which owns its own utility. Consequently it constitutes a discrimination on the part of the federal government against all the other cities which do not.

The conclusions of the argument are summarized by Mr. Gadsden as follows:

1. The ownership and operation of public utilities by a municipality or other governmental agency are not governmental functions.
2. When a municipality or other governmental agency engages in the ownership and operation of public utilities, it does so in its proprietary capacity and cannot claim the exemption from taxation applicable to the discharge of governmental functions.
3. The proposed amendment would not apply to bonds issued by municipalities or other governmental agencies in their capacity as such, and the tax sought would not and could not be a burden upon any governmental function of such political subdivision.
4. The tax by the terms of the amendment is confined strictly to the interest on such bonds as on their face appear to have been issued for the construction, acquisition, operation or maintenance of a public utility, which do not constitute general indebtedness of the issuer but are payable out of the revenues of such utility or otherwise than by general taxation.
5. Every consideration of public policy on the part of the federal government supports the contention that municipalities or other political subdivisions entering into the field of business should be subject to the same conditions and limitations as those imposed by the federal government upon like classes of business.

Design, Lubrication and Maintenance of Railway Motor Bearings*

By M. Guynes
Railway Motor Engineering Department, General Electric Company

NO DOUBT every one would like to have a railway motor designed without bearings, and this has been approached in the bipolar gearless locomotive motor. This motor does not have any bearings of its own, the locomotive journals being used to keep the armature in its place. Owing to the speed of a one to one ratio between the armature and the wheel and to the necessity of using only two poles the bipolar gearless motor is too heavy and too expensive for any except high-speed passenger locomotives. A less expensive motor can be made by using a speed reduction between the armature and the wheels. So at present the multipolar, geared railway motor is almost universally used for operating single and multiple unit cars.

However, the geared motor must have bearings, because the motor must be held to the axle to keep the gearing in line, and the armature must be retained in its place with respect to the poles and brush-holders. Various types of construction have been employed, but the most satisfactory are incorporated in the modern box frame motor, with its overhung axle brackets, its clamped axle linings, its solid frame heads driven and bolted in place and its keyed armature linings pressed into the frame heads.

In order to have low friction in the bearings the shaft or axle must be held away from the bearing lining by a lubricant film. Oil was used in the first railway motors and is still the best lubricant. In the early days the oil cup for feeding the oil to the bearing was tried. Today all over the world there are a great many motors with grease lubrication and the combination of grease and oil lubricated bearings is still running. In Australia and elsewhere there are a number of motors running with oil rings in the armature bearings. Grease lubricated ball bearings and roller bearings have been tried and are operating now, but apparently the most satisfactory all-around bearing for a railway motor is the oil-lubricated, waste-packed sleeve bearing, which with good care will run 250,000 miles in the ordinary city service before removal is necessary.

Because of the relatively low pressures and speeds, unlined bronze axle bearings have proved the most satisfactory for small railway motors, although for large motors a tin-coated bore is desirable. But for armature bearings, where the pressures and speeds are fairly high, a bronze shell with a lining of tin base babbitt has justified the expense, because when first put in service, if there is any misalignment or if there are any high spots, the babbitt will flow and increase the actual bearing surface at a sufficiently low temperature to prevent serious damage.

As the shaft and axle diameters are usually fixed by the strength required, the application of a motor to a given service must be checked to make sure the surface speed of the shaft is not too high. Furthermore, shaft deflection must be checked on heavy multiple-unit cars or locomotives to make sure that the bending of the shaft at the operating speed is not sufficient to break down the oil film, and sometimes it is necessary to make the shaft larger than the strength requirement would demand.

The length of the bearing must be determined by the allowable pressure per square inch and the space available for lubricating the bearing. On some locomotive motors the pressures are as high as 500 lb. per square inch when starting a train and 185 lb. per square inch at the continuous rating of the motor, but on motors for single-unit or multiple-unit cars the pressures can be kept lower, some being as low as 200 lb. per square inch at starting and 20 lb. per square inch at the free running speed.

The waste chamber in the frame head or axle cap must be of sufficient size to hold a good sized wick extending from the top of the opening through the bearing to below the minimum oil depth. The thickness of this wick need not be more than 2½ in. at its maximum, but at the minimum the thickness should not be less than about ¾ in. for large motors where a great amount of oil is required for lubrication or about ½ in. on small motors. The entrance to the waste chamber should be accessible and of sufficient size to allow proper packing, also it should be covered to keep out water and dirt.

The oil chamber should hold sufficient oil to keep the oil depth within the desired limits from one oiling until the next and still have a settling chamber below the minimum oil depth.

Manufacture

In the manufacture of a railway motor care must be used to produce satisfactory finishes, fits, clearances, etc.

The centers in the ends of the shaft should be properly located in the rough bar so that straightening of the rough bar is not required. Because of warping it is desirable to rough cut all keyways before finish grinding of the keyways. The journal surfaces should be ground to dimensions shown in the accompanying table. To produce smooth journal surfaces they should be rolled between smooth-hardened steel rollers. After being rolled the journal surfaces should be protected by sleeves until the armature is assembled in the frame. During the stacking of the armature core the punchings must be assembled correctly or the shaft will be bent when the core is pressed.

After the cores are assembled, but before the windings are put on, the shaft should be checked for straightness. If the shaft runs out of true more than 0.00025 in. per inch of length of the journals and not over 0.00075 in. per inch it should be straightened to run within the limit of 0.00025 in. per inch. If, however, it is out of true more than 0.00075 in. per inch the shaft should not be used.

Armature bearing shells should be inspected just after the roughing cut operations are finished and those scrapped which are found to have shrink cracks or spongy spots. The bores of the shells should be tinned all over. The bearings should be brought to a temperature of at least 150 deg. C. when the babbitt is poured and the babbitting should be done in such a way that the layer of babbitt is compact and free from blow holes. A fair-

*Abstract of a paper presented at a meeting of the Metropolitan Section, American Electric Railway Association, New York City, Jan. 8, 1926.

sized radius should be provided where the bore joins the flange to allow the oil to flow around and out to all of the flange. After the bearings are finish bored and faced they should be mounted on arbors and the outside finish ground to the dimensions shown in the table. The edges of the waste opening should be trimmed to allow easy access of the oil to the journal.

The fits on the frame heads, for the frame, should be turned to within limits shown in the table and the frame heads should be finish bored true with respect to the fit for the frame. The finish of the bore should be very smooth to give a good fit of the bearings and the dimensions and the pressure required to assemble the bearings should be as shown in the table. After the bearings are assembled they should be broached to give a smooth bore of the correct diameter.

The tongue fit on the axle caps and the groove fit in the magnet frame should be machined to the dimensions shown in the table. When machining magnet frames for large motors it is desirable to rough machine the frame head fits and axle bores before finishing either, but this is not necessary on the small motors which do not warp so much. In order to obtain good alignment it seems best to finish the frame head fits with the axle joint face bolted to a fixture on the boring mill and then finish the axle bore on another machine tool, locating from the finished frame head fits. The fits for the frame heads and the axle bore should be within the dimensions shown in the table.

Experience has shown that it is good practice to put a heavy oil on the shaft journals near the thrust collars and on the thrust collars just before assembly of the armature in the frame.

After being finish machined the axle bearing shells should be carefully inspected for shrink cracks and spongy spots. If any of these faults are found the shells should be scrapped. The finished axle bearings should be checked in a pot fixture representing the magnet frame and axle cap to make sure the dimensions are such that they will operate satisfactorily. The outside diameter and the bore should be machined to the dimensions shown in the table. The edges at the split should be relieved and sharp corners removed from the waste opening to allow the oil to flow where it is needed. Where the bore joins the flange a large radius or chamfer with rounded edges is desirable to allow the oil to flow onto all of the face of the flange

An axle dust collar, to protect the flange of the commutator end axle bearing, and a tight fitting dust guard between axle caps will give much longer life of axle bearings.

LUBRICATION

Before being put in service the motor bearings should be lubricated. In an oil lubricated bearing the shaft or axle is separated from its bearing by a film of oil and it appears that low friction is the result of one side of the oil film adhering to the shaft or axle, the other side adhering to the bearing lining and the sliding occurring within the film of oil. Experiments have shown that the friction in the film of oil depends on the kind of oil used with a particular bearing material, the shaft or axle being of steel.

The oil used should adhere well to the shaft, axle and bearing and be of sufficiently high viscosity to maintain the required thickness of oil film under the operating conditions of bearing pressure and temperature. It should also be thin enough, at the temperature of the bearing housing, to allow capillary action to reach the journal.

The main requisite of the waste is that it should be of a springy nature so that it will not settle down or away from the journal and will allow the foreign matter, which is collected from the journal, to work back and down through it without glazing the surface. Also, the waste should be of such a nature that the oil will feed fast enough to allow of a relatively large variation in oil depths and still supply the amount of oil required to keep the bearing cool. Experience has proved that the long fiber all wool waste has characteristics most nearly approaching those desired.

In order to make sure that the process of lubricating the bearing will start immediately after being packed, it is necessary to saturate the waste with the oil before packing. As the oil flows so slowly at winter temperature it is desirable to provide some means of keeping the treating tank up to summer temperature and thus make a uniform minimum time for treating the waste. At summer temperature about 72 hours is required for soaking and 48 hours for draining. When properly saturated, a little oil will still flow out if a ball of the waste is squeezed.

No matter how good the oil and waste are, if the packing of the housing is not properly done hot bearings will occur. The waste must be placed so that it acts as a wick extending from below the lowest oil depth to above the top of the opening to the journal and of sufficient thickness to provide the quantity of oil required. Because of the shape of the waste pocket in the frame heads at the bearing flange end special care is necessary to provide a wick the full width of the opening to the journal. The tightness of the packing is important, for, if too loose, the waste will settle and not cover all of the opening to the journal. If a pad of the saturated waste is placed on top of the packing and next to the cover, it will catch and hold most of the dirt which falls in when the cover is opened. The covers to the oil wells and waste chambers should be kept tightly closed when the motor is in service because the water and dirt, which would otherwise enter, are the worst enemies of a railway motor bearing.

The location of the bottom of the opening to the journal with respect to the bottom of the oil well should be obtained from the manufacturer so that the desired oil depths can be determined. The desirable oil depths are from ½ in. below the waste opening to 3 in. below for ordinary city service or about 2 in. below for services where the shaft speed is high for a considerable time between stops.

Flooding of motors with oil results in serious damage to insulation of windings and commutators and is also the cause of much brush trouble.

On self-ventilated motors the openings to the drip pockets in the frame heads become air inlets if left open and much longer life of armature bearings will be obtained if these openings are loosely plugged with dry waste, which should be replaced with a fresh piece of waste at each oiling.

MAINTENANCE

On some of the modern small wheel cars the space allowed in the truck assembly is far too small to give the attention to the armature bearings which they must have in order to give satisfaction.

Hot bearings are serious, for they are not only likely to damage themselves, the shaft, axle and sometimes the armature, but may cause warpage, which can be corrected only be remachining of the parts. However, if the car were given a bearing run, as is necessary on an automobile before being put in regular service, the bearings would have a chance to give real satisfaction.

The records of one operating company show that 70 per cent of its armature troubles are due to mechanical failures, and bearings play the most important part. Worn and loose bearings are largely responsible for short life of gears and pinions, breakage of shafts, peening of bearing housings, flashing, broken armature leads and loose armature parts; in fact, they have more to do with high maintenance costs than any other part of the motor.

The inspections of bearings and bearing housings for worn bearings, loosely fitting covers and water and sediment in oil wells should be made at sufficiently short intervals to reduce the bearing troubles to a minimum. Radial wear of armature bearings can be found by checking the air gap. On single and operated equipment, where the wear is upward on some bearings, special care must be taken, as a great error may creep in. Radial

ALLOWANCES AND LIMITS FOR RAILWAY MOTORS

Part and Place	Allowance	Limits
Shaft		
Journals	None	+0.000 in. −0.001 in.
Armature Lining		
Outside diameter of body	+0.002 in.	+0.0005 in. −0.0005 in.
Bore up to 3½ in. diameter	+0.009 in.	+0.002 in. −0.002 in.
Bore 3½ in. diameter and above	+0.013 in.	+0.002 in. −0.002 in.
Assembly pressure		3 to 7 tons
Frame heads		
Fit for frame	None	+0.002 in. −0.000 in.
Bore	None	+0.000 in. −0.001 in.
Axle caps		
Tongue fit	None	+0.001 in. −0.000 in.
Magnet frame		
Groove fit	None	+0.000 in. −0.001 in.
Bore for frame heads	None	+0.002 in. −0.002 in.
Bore for axle linings	*	+0.004 in. −0.000 in.
Axle linings		
Outside diameter	+0.003 in.	+0.001 in. −0.001 in.
Bore	+0.030 in.	+0.002 in. −0.002 in.

* Before boring the axle preparation, 0.014-in. thick shims should be put between axle caps and axle joint face of the frame so that a clamp fit on the axle bearings will be obtained when the boring is finished and the 0.014-in. shims are removed.

wear of axle bearings can, of course, be found by noting the clearance at the bottom between the axle and the bearing. Wear on the bearing flanges can be determined for the armature bearings by moving the armature longitudinally and for the axle bearings by moving the motor along the axle, but on single-end-operated equipments having helical gearing most of the wear will be toward one end.

Fifteen hundred miles of service between inspections for both armature and axle bearings is about right for large motors and about 1,000 miles for small motors. It should be borne in mind that worn armature bearings are more serious than worn axle bearings. The radial wear on the armature bearings should not exceed $\frac{1}{8}$ in. on large motors or $\frac{3}{32}$ in. on small motors, while that for axle bearings should be not greater than $\frac{1}{8}$ in. on large motors or $\frac{1}{8}$ in. on small motors. The flange wear on armature bearings should be held to a maximum of $\frac{3}{8}$ in. on large motors or $\frac{1}{4}$ in. on small motors, and for the axle bearings $\frac{1}{2}$ in. on large motors and $\frac{3}{8}$ in. on small motors. If the wear allowed is less than that determined by the above limits, longer life of the other parts may be expected.

The one thing which causes as much wear on axle bearings as anything is loose axle cap bolts, and since this fault must be overcome the manufacturers should be glad to know of such troubles so that with united effort improvements will be obtained.

Satisfactory results should be obtained if the armature and axle bearings are oiled every 1,500 miles on large motors and 1,000 miles on small motors, but these periods must depend on the rate at which the oil is used.

One large operating company does not add oil to the axle bearings but depends on saturated waste, which is replaced at about 10,000-mile intervals, furnishing the necessary oil. While this practice is probably satisfactory where followed, it is doubtful if the average trolley company would be willing to use such a large amount of waste as would be required on the small motors.

Easier oiling will result from having the oil at summer temperature and oiling while the motors are warm. When necessary to open the cover of the oil well or waste chamber, less dirt will fall in if the dirt on the outside is removed from around the opening and in the winter care should be taken to prevent snow and water entering while the chambers are open. After measuring the oil depth the necessary amount of oil should be added, to bring the level up to the maximum desired depth, by pouring into the oil well and not the waste chamber.

The practice of stirring the waste to prevent glazing does not seem to be very satisfactory, but the replacing of all of the waste after cleaning at about 10,000-mile intervals has given good results. When cleaning, attention should be given to removing all of the sediment and as much care shou'd be taken during repacking as was taken at the first packing.

The practice of changing armature bearings each time an armature is changed should not prove satisfactory as it quickly results in the bearings becoming loose in the frame heads, and it is far better to have excessive clearance in the bore than to have the bearings loose in the frame heads. However, it should be borne in mind that serious damage may be done by endeavoring to operate a motor with small bearing clearance at the one end and excessive clearance at the other end.

When making a general overhaul of a motor all parts should, as far as possible, be brought back to the original finishes, fits and clearances by using as good material as was used in the original parts, and attention should be called to the fact that bent axles and shafts and tapered journals may cause trouble.

It is sometimes necessary to weld certain places on frames, axle caps, etc., and the manufacturers have found that it is almost impossible to do much welding at one place without having to weld all of the finished surfaces, because the heating to the welding point at one place usually causes a sufficient warpage to throw other parts out of alignment.

Low costs of operation should be the object of all, and manufacturers of railway motors should be glad to assist in solving any problems, for by so doing they would be better fitted to produce satisfactory apparatus. Satisfactory equipment means lower maintenance costs and hence an improved financial position for the company as a whole.

Bus Operation

SUBJECTS to be studied during the year were discussed and selected at a meeting of the committee on bus operation of the Transportation & Traffic Association held at association headquarters, New York, Jan. 4. Altogether some twenty subjects were suggested for consideration but four were later eliminated, leaving sixteen, for the study, of which sub-committees were appointed.

The committee indorsed the uniform classification of bus accounts as recommended by the Accountants' Association, urged its adoption by member companies, and advocated that efforts be made to have it adopted by the various state commissions. Sub-committees were appointed as follows:

Interurban Rates—R. N. Graham, D. A. Scanlon and E. D. Dreyfus.

City Rates—A. T. Warner, C. B. Cooke, Jr., and C. H. Chapman.

Taxation—S. W. Greenland, C. B. Cooke, Jr., E. D. Dreyfus and A. Hughes, Jr.

Rights of Steam and Electric Railways in Operation of Buses—C. B. Cooke, Jr., A. Shapiro, V. W. Berry and A. Hughes, Jr.

Franchises—S. W. Greenland, D. L. Fennei and R. B. Hill.

Chartered Service—C. B. Cooke, Jr., D. A. Scanlon, A. Hughes, Jr., and A. Shapiro.

Equipment (from the transportation standpoint only)—R. N. Graham, B. W. Arnold and V. W. Berry.

Carrying Packages and Mail—V. W. Berry, C. B. Cooke, Jr., A. Shapiro and R. B. Hill.

Opportunity of the Bus in Developing Public Relations—C. H. Chapman, J. B. Stewart, Jr., and E. D. Dreyfus.

Customer Ownership—R. H. Smith, E. D. Dreyfus and S. W. Greenland.

Rates During Development Periods—A. T. Warner, C. H. Chapman, S. W. Greenland, C. B. Cooke, Jr., and A. Hughes, Jr.

De Luxe Service—D. L. Fennel, A. Shapiro, E. D. Dreyfus and A. T. Warner.

Development Expense—C. B. Cooke, Jr., A. T. Warner, A. Hughes, Jr., and E. D. Dreyfus.

Tire Mileage Contracts—J. B. Stewart, Jr., S. W. Greenland and C. B. Cooke, Jr.

Liability Insurance—R. N. Graham, A. Hughes, Jr., V. W. Berry and J. B. Stewart, Jr.

Double-deck Operation—D. L. Fennel, S. W. Greenland, D. A. Scanlon and A. Hughes, Jr.

A telegram was received from B. W. Arnold saying that he had been called back to Milwaukee while en route to New York City on account of the death of his son. A telegram of sympathy was sent by the committee to Mr. and Mrs. Arnold.

Members present at the meeting were J. B. Stewart, Jr., chairman; S. W. Greenland, D. A. Scanlon, R. N. Graham, E. D. Dreyfus, A. Shapiro, A. T. Warner, C. D. Smith, C. B. Cooke, Jr., V. W. Berry, C. H. Chapman and A. Hughes, Jr.

Merchandising Transportation

ON JAN. 12 the merchandising transportation committee of the Transportation & Traffic Association held its first meeting this season at association headquarters. Chairman R. N. Graham, general manager of the Pennsylvania - Ohio Electric Lines, Youngstown, Ohio, presided. Other members present were S. E. Emmons, Baltimore; E. A. Palmer, East Pittsburgh; C. D. Smith, New Brighton, Pa.; E. A. Burleson, Schenectady, N. Y., representing J. C. Thirlwall; A. C. Spurr, Wheeling, W. Va.; J. A. Dewhurst, New York; O. A. Broten, Chicago; J. B. Donley representing W. H. Boyce, sponsor, Pittsburgh; E. M. Walker, Schenectady, sponsor; J. W. Welsh, executive secretary, and Guy C. Hecker, special engineer of association headquarters also were present.

After discussion of the accomplishments of similar committees in other years and the advancement of the art of merchandising transportation it was decided to break up the writing of the report into eight sections, each to be prepared by a sub-committee. The tentative divisions of the subject and assignments made by the chairman at the meeting are as follows:

Courtesy, Salesmanship and Appearance of Trainmen.—C. D. Smith, R. W. Emerson and J. B. Donley.

Advertising by Circular Letter, Car Cards, Newspapers, Billboards and All Other Forms.—A. C. Spurr, O. A. Broten and W. W. Holden.

Equipment.—The show window of the railway company, concentrating particular attention on details of lighting, heating, seats, painting, cleaning of cars—J. A. Dewhurst, W. E. Wood, S. E. Emmons, E. A. Palmer and J. C. Thiriwall.

Special Types and Classes of Service and Special Rates of Fare.—C. D. Smith, J. A. Dewhurst, S. E. Emmons, W. H. Burke and H. L. Brown.

Maximum Use of Facilities, Including Freight and Express Operation.—S. E. Emmons, E. A. Palmer, O. A. Broten, A. C. Spurr, J. B. Donley and J. C. Thirlwall.

Merchandising Methods Necessary in Changing Methods of Operation, Such as Establishment of One-Man Service.—O. A. Broten, E. A. Palmer and R. N. Graham.

General Company Interests in Civic Affairs.—W. E. Wood, C. D. Smith, R. N. Graham and J. A. Dewhurst.

Co-operation and Training of Employees in Merchandising Problems.—J. B. Donley, W. W. Holden, J. A. Dewhurst and R. N. Graham.

All sub-committees were asked to have drafts of their sections prepared and written in time for the next general meeting of the committee to be held some time in May.

Engineering Executive

ON JAN. 7 the executive committee of the Engineering Association held its second meeting for the season at headquarters, New York, with President R. C. Cram, chairman; C. R. Harte, R. H. Dalgleish, Daniel Durie, M. B. Rosevear and W. F. Graves in attendance.

Attention was called to approval by letter ballot of certain matters requiring action of the 1925 standards committee. These included a supplemental report on steel rails of the committee on way matters and a drawing in the report of sub-committee No. 6 of the power transmission and distribution committee relating to trolley contact devices.

President Cram reported on the action taken by the American executive committee approving the furthering of research by the Engineering Association. Mr. Cram spoke of this as being a forward step on the part of the parent organization in recognizing the work of the engineer.

Several research subjects under investigation by the Engineering Association were discussed. It was agreed that study of the committee on rail corrugation should be continued and carried to completion with the same personnel as previously. The committee on automatic substations was directed to proceed with its tests on ventilation, and the committee on noise reduction to continue its investigation. It was recommended that the latter committee investigate the possibility of obtaining co-operation from the technical schools. As to trolley wire specifications, Mr. Rosevear explained the significance of the twist test, which he said is not included in standard specifications for other current-carrying wires. It was brought out that line engineers consider this test of considerable value in determining the quality of trolley wire. It was planned to make a series of tests in actual service on wire of known qualities.

After some discussion, Mr. Hecker was directed to prepare a procedure for requesting expenditures from funds available to the various committees, for submission to the executive committee for approval by letter ballot.

The president announced that by letter ballot the executive committee approved the omission of abstracts of reports from the proceedings. A second letter ballot concerned the reduction of routine business on the floor of the convention. This brought out that nearly all of the time available at the annual conventions is devoted to the transaction of routine business, principally approval of committee reports and adoption of standards. The opinion was expressed that such approval could be obtained through letter ballot, freeing the convention for a program of original papers and discussion. It was decided to present the matter before the American executive committee at its next meeting.

A motion was adopted to form a committee on convention program for the purpose of selecting subjects and speakers on engineering subjects. Mr. Harte was appointed chairman, Messrs, Dalgleish, Durie and Miller given the asignment of preparing the program for an equipment day; Messrs. Rosevear and Scofield for a power day, and Messrs. Graves and Cram for a way and structures day.

Publication of Engineering Manual

Preparations for the publication of the 1926 Engineering Manual were discussed. It was voted that no rebate should be made for the return of first edition copies. It was voted to issue paper bound sections as heretofore. As to the way and buildings and structures sections, it was decided to retain the present subdivisions.

Mr. Hecker pointed out that the present practice of permitting revisions of Manual sections every year was leading to considerable confusion on the part of users and was resulting in large annual supplements. It was decided that revision of Manual sections shall be permitted only in the years of republication with the exception of revisions considered of sufficient importance to demand immediate attention if approved by the executive committee, or specifications taken from other associations or prepared jointly by the Engineering Association and other associations, which may be revised for the purpose of keeping such specifications up to date and uniform.

Mr. Durie suggested that a reduction in the number of drawings would be possible through the use of letter dimensions with tables. This plan was referred to the Manual committee with instructions to report back to the executive committee.

Additional Subjects Suggested

Several new committee subjects were considered. A letter ballot approved the inclusion of the subject of car lighting. It was voted to have this taken up by the equipment sub-committee on modern car design, increasing the personnel, if found desirable, by the inclusion of several manufacturer car lighting experts.

Letters from manufacturers of antifriction bearings were read, suggesting that the subject of roller bearings be considered. It was the sense of the committee that the subject had not yet reached a point of development warranting investigation by the Engineering Association.

Two additional subjects were assigned to the equipment committee. These are No. 7, "Study the modernization of car equipment with special reference to appearance and comfort and convenience of passengers," and No. 8, "Study motor leads, connectors and supports to provide a miscellaneous method and practice on the subject. This is to include size and strand of all leads, connectors, covering for cables, methods of supporting and marking of terminals."

The committee approved a motion by Mr. Dalgleish, seconded by Mr. Harte, that the study of the subject of substitute ties be discontinued.

Mr. Hecker outlined the experiences and results to date with the new procedure being followed by the way and structures division. The executive committee was unanimous in approving the new method of organization and was of the opinion that the committee reorganization be extended. It was suggested that First Vice-president Harte should start the tentative organization of a power group.

Simplified Practice

Mr. Dalgleish, chairman of the special committee co-operating with the Division of Simplified Practice of the Department of Commerce, gave the status of several subjects with which the association has had contact, as follows:

Simplification of sidewalk glass and roof lights: Recommendations of the division have been formally approved.

Recommendations for grinding wheels: These have been accepted and formally indorsed.

Recommendations for tacks and nails: The executive committee indorsed the sizes of tacks recommended for use in the upholstery department.

Simplification of shovels, spades and scoops: Formal indorsement of the association is being withheld pending approval by the way and structures committee.

Carbon commutator brushes: Simplification of sizes of carbon brushes has been started and a report is expected within a short while.

Mr. Hecker stated that at present no standard procedure has been set for presenting specifications to the A. E. S. C. It was the sense of the meeting that such procedure is necessary. The following was approved:

1. A specification intended for presentation to the A. E. S. C. shall, after preparation, be submitted to a standing committee or the standards committee of the association for criticism and approval.

2. The specification shall then be submitted to the executive committee for criticism and approval.

3. The specification, after approval by the standards committee and executive committee as above, shall then be presented to the A. E. S. C. as a tentative standard only. The status of "tentative" standard shall then be maintained for one year, after which it may be advanced in accordance with A. E. S. C. procedure to the grade of American Standard.

4. If the specification is turned down at any time by any of the bodies whose approval is required it must then be returned to the sectional committee for revision.

Mr. Dalgleish accepted appointment as the second representative of the association on the main committee.

Attention was called to the authorization of extension of the scope of the A. E. S. C. project on plain girder rails to include joint plates, omitted from the original report.

Specifications for tubular steel poles are now in process of preparation, including a simplified list of sizes as the result of a questionnaire circulated among approximately 100 companies using steel poles.

The representation of the association on the sectional committee on overhead line crossing specifications has been filled out and the committee is now about to function.

It was announced that H. S. Murphy has accepted appointment on the sectional committee on specifications for zinc coating on iron and steel.

A number of matters involving relations with other associations were considered. Principal among these were specifications being handled by the A. S. T. M. These included hard and medium-drawn copper wire, copper trolley wire, and carbon steel rails.

Representatives of the association on committees of the National Fire Protection Association were announced, as follows: L. D. Bale, power house committee; R. L. Weber, National electrical code.

Mr. Harte reviewed the standardization work of the American Institute of Electrical Engineers.

H. A. Johnson and E. J. McIlraith were appointed to represent the association at the American Road Builders' Association convention.

Manufacturers' Engineering Committee

TABULATING essential characteristics of new cars, analyzing financial reports of railways that have been operating new equipment and a study of reports on obsolete equipment kept the manufacturers' engineering committee busy Jan. 14 and 15 at association headquarters, New York City. The full committee was in attendance, consisting of G. C. Hecker, chairman; James A. Brooks, C. A. Burleson and W. J. Clardy.

A large number of blueprints of late car designs had been supplied by various car manufacturers. These were studied carefully and the governing dimensions were tabulated. Analysis of the various characteristics of modern car design enabled the committee to select a number of designs that appeared to embrace most of the essentials. These will be analyzed and studied further to determine definite sizes and types most desirable for various classes of service.

Representatives of the electrical manufacturers have assembled considerable information from properties that have been operating new equipment. Study of this information is being made by the committee at the same time as other data regarding savings in operation and maintenance that have resulted from operation of new equipment are being assembled.

The survey to determine age of equipment now operated is nearly completed and particular attention will now be devoted to tabulations and analysis that will enable the committee to draw definite conclusions.

M. & O. Committee Makes Preparation for Visits

SECRETARY G. C. HECKER of the management and operation committee of the American Association has sent to all members of the committee supplies of blank field reports and of a pamphlet prepared by Labert St. Clair outlining the purpose of the state committees on public utility information.

He also called attention of the members to the meeting of the entire committee, which has been called for Jan. 27. Through the courtesy of L. M. Brown this meeting will be held in Indianapolis at the Indianapolis Athletic Club. A Dutch-treat dinner will be served at 6:30 p.m.

A limited number of proofs of the forthcoming handbook of modern methods has been received by Mr. Hecker. He plans to distribute samples of these among the committee members so that they may become familiar with the contents and method of presentation adopted.

Atlantic City Being Considered for the Convention

CONSIDERATION of Atlantic City as the place for holding the October convention is being given by the committee on location. Arrangements were made for a sub-committee consisting of the same persons who visited Cleveland last week to inspect the proposed facilities at Atlantic City the evening of Jan. 15. Those making the inspection at Cleveland were Chairman C. E. Morgan, Executive Secretary J. W. Welsh, Director of Exhibits F. C. J. Dell, J. H. Alexander, Morris Buck, H. J. Kenfield, J. C. McQuiston, W. C. Parker, A. L. Price, A. M. Robinson and L. W. Shugg. In addition A. J. Purinton and J. R. McFarland have signified their intention of being present. A difficulty encountered in case Atlantic City is chosen is that the available space for exhibition purposes is insufficient to provide proper facilities and keep the delegates together. Even the arrangement of last year, with a portion of the automotive exhibits in a separate space across the Boardwalk, is impossible of repetition, as the property is being built upon. A proposition has been advanced to build a permanent exhibit hall fronting on the Boardwalk.

At Cleveland it was found that the immense auditorium with two large floors available for exhibition purposes will give only 50,000 sq.ft. of net space, or less than half that needed to house the show. There is available a large plot of city property immediately adjoining the auditorium on which it is proposed to erect a temporary building which can have a floor area of 70,000 sq.ft. or more if needed and still provide plenty of space for outside working exhibits. Through the co-operation of President J. J. Stanley and Vice-President J. H. Alexander of the Cleveland Railway it would be possible to build this at a nominal cost.

News of Other Associations

New Limit Gage Standard

WORK of preparing standard gages, including the method of using the gages and tables showing the degree of accuracy required in the inspection of parts for different classes of work, has just been completed through the standardization of limit gages by the American Engineering Standards Committee. As an example of the advantages from this standardization, a wheel intended for a certain sized shaft made by one manufacturer should fit upon the same sized shaft made by another manufacturer. Under present conditions, however, perfect fitting is rarely realized. The reason is that the wheel manufacturer bores a hole in accordance with one set of gages, while the manufacturer of the shaft uses a set of gages based upon a different system. In consequence, one piece may be either a trifle too large or too small for the other, with the result that the wheel will either not go on the shaft at all or else it will fit too loosely. With the new gages most manufacturers will use the nationally standardized uniform gages for determining the dimensions. Perfect fitting should be assured no matter when and where the new parts are manufactured.

The report now presented provides a classification of the various kinds of fits from the loosest as used in agricultural machinery and similar equipment to the forced or shrink fit, where the parts are pressed together under great pressure, so as to be rigidly attached to each other and to stay there, as is required for car wheels.

In general, a certain fit between two mating parts will be obtained by checking the size of each part by means of two gages, each representing one of the two limits between which the actual size of the parts must be kept. One gage is called the "go gage," the other the "no-go gage." If only such parts are accepted as are shown by these two gages to be correctly machined perfect fitting should be obtained.

The plan for standardized tolerances, allowances and gages has been developed through the co-operated effort of constituent national, technical, industrial and governmental bodies of the American Engineering Standards Committee. The committee itself has now placed its final approval upon it and has presented it as a national standard to American industry.

Gages of this type should save considerable time and expense on many occasions when equipment of different manufacturers are assembled in either manufacturing establishments or in car shops of operating companies.

Central Traffic Meeting

ON JAN. 20 and 21 the Central Electric Traffic Association will hold its next regular meeting at the Miami Hotel, Dayton, Ohio.

The morning session on Jan. 20 will begin at 9 o'clock, and will be in the nature of a round-table discussion. Committee work necessary during the session will be transacted during the afternoon of Jan. 20. In order that more time may be given to the transaction of business committee work will be completed as far as possible before the meeting.

The session on Jan. 21 will be devoted to reports of committees and such other business as may properly be presented.

The News of the Industry

Temporary Rate Increase in Oakland

Rates on the lines of the Key System Transit Company, Oakland, Cal., are to be increased as a result of the company's application for relief following a higher wage award made recently to carmen by an arbitration board. This is the decision of the California Railroad Commission.

Street car fare is increased from 6 cents to 7 cents and ferry fares are advanced from 18 cents to 21 cents, pending decision on the company's application for permanent higher rates, hearings on which will be resumed Feb. 3. The temporary rates were set to go into effect on Jan. 15.

It had been thought that there would be no temporary increase in ferry rates because the Southern Pacific rates will remain at 18 cents until the outcome of the hearings for permanent increase asked by this concern. The Railroad Commission, however, surprised nearly every one by granting a temporary raise in Key company ferry rates, and letting the 18-cent Southern Pacific rate stand.

The new rates awarded the Key company, it is estimated, will take care of the increases in pay given the platform men, amounting to between $400,000 and $470,000 for 1926, and enable the road to meet its fixed charges and pay its bond interest.

The 1-cent increase in street car fares, it was found, will bring in additional revenue of $526,000 and the 3-cent advance in ferry rate an additional $250,000. In addition the increase in monthly commutation rates from $4.80 to $5.20 will net the company $64,000 annually, making a grand total of $846,000.

C. O. G. Miller, president of the Key System Transit Company, said:

> After a brief study of the decision the Key System Transit Company is of the opinion that the temporary rates will enable it to meet its operating costs and fixed charges until there can be a permanent readjustment of the rates on the valuation of its property used in public service.
>
> However, the temporary rates are not sufficient to give a reasonable return upon the property so as to warrant the company in making the investment necessary to provide the service which it desires to give the public and to keep step with the growth and development of the East Bay cities.
>
> Not a dollar for improvements comes from fares. It is capital investment and the sums to be spent must be provided by bonds or by money secured in some other manner. It is the primary duty of the Key system to give service and it is the policy of the company to provide such service when and as needed.
>
> The Key system directors fully realize their responsibility in ordering a capital expenditure of nearly $3,000,000 before proper return has been granted on the value of the company's property dedicated to public service, but these expenditures have been authorized in the belief that the East Bay cities and the State of California want their public utilities to be operated at rates that permit a proper return and protect them from confiscation.

The announcement of the rate increases stirred a storm of protest in the East Bay, but most citizens have assumed an attitude of watchful waiting and it is believed the resentment that has flared up over the increase in rates will subside if the company gives improved service and puts through its improvement program. On this program are the purchase of two new ferryboats to cost $1,700,000, the reconstruction of 45 miles of track, the purchase of more buses, the purchase of 120 new cars and improvements at the Key pier.

Contract for the new ferryboats has just been awarded to the Moore Dry Dock Company, Oakland. They will have a passenger capacity of 4,000 each.

Ten-Cent Cash Fare Sought in Syracuse

It is expected that the New York State Railways will at once file its application with the State Public Service Commission for permission to raise the trolley and bus fares in Utica and Syracuse from 7 to 10 cents. Tickets, under the proposed new schedule, would be sold for 7½ cents.

When Benjamin E. Tilton, general manager of the New York State Railways for Syracuse and Utica, called on Mayor Hanna of Syracuse to serve notice on him that the company would apply within a week for permission to increase the fare, Mayor Hanna notified Mr. Tilton he would fight such action.

Rochester accepted the increase of its trolley and bus fares on all lines of the State Railways, effective New Year's Day, without protest.

Authority of Courts in Rate Cases Defined

Public utilities cannot appeal to the courts from mere fear of confiscatory rates or until they have exhausted other remedies provided by law. The Supreme Court has so held in affirming the decision of the lower courts in the case of the Henderson Water Company against the North Carolina Corporation Commission. In 1922 the water company applied to the commission for an increase in the rates over those fixed in the franchise granted a predecessor corporation in 1896. The commission permitted an increase of 10 per cent for a test period of six months. Before this test period expired the company, fearing that the increase would not be continued, applied to the court for an injunction against a reduction. Its petition was dismissed in the trial court on the ground that no order for reduction had been issued and that the law creating the State Corporation Commission provided other means of appealing from decisions of the commission. The Supreme Court, in a decision by Chief Justice Taft, agrees with the reasoning of the lower court.

Seven-and-a-Half-Cent Fare in Philadelphia Upheld

The 7½-cent fare charged by the Philadelphia Rapid Transit Company, Philadelphia, Pa., was upheld in a ruling by the Public Service Commission of Pennsylvania in Harrisburg on Jan. 12. The ruling makes permanent the temporary order of the commission of Sept. 8, 1924, which had been affirmed by the Superior Court, and was based upon the record showing in large part the actual experience of the company since the temporary order of the commission increasing the fares has been in effect.

The majority vote was cast by W. D. B. Ainey, chairman, and Commissioners Benn, Shelby and Stewart. A dissenting opinion from the findings and order of the commission will be filed by Commissioner Martin. Commissioners Scattergood and Evans reserved the right to express their views in a joint report issued on Jan. 13.

In general the commission found that the gross revenue produced by the rates of fare did not exceed the requirements of the company for operation, maintenance, and renewals, plus a reasonable fair return upon the $200,000,000 minimum valuation found by the commission in 1923.

The case now settled has been under procedure since the fall of 1924, when the company applied for an increase in its rate of fare from 7 cents cash with a 6¼-cent ticket rate to an 8-cent cash fare with a 7½-cent token rate. Not only were the hearings in the matter long drawn out but they were very often stormy ones.

In fact, the fare issue caused a breach between Governor Pinchot and his commissioners, which had many serious consequences. After the temporary order was issued Governor Pinchot publicly criticised the commission for its action. Shortly thereafter Samuel M. Clement resigned from the commission in protest against the Governor's denunciation. Later Governor Pinchot, while the hearing was still in progress, requested the resignation of Commissioners Benn and Shelby. Both these commissioners refused to accept the Governor's action and appealed to the State Supreme Court, which some weeks ago handed down a decision in their favor.

Gene McDonald's Gypsy Girl on the Air

Electric railway men will probably want to listen in on station WNAC on the evenings of Jan. 19 and 20, beginning at 8.15 p.m., when the Boston Elevated Musical Club's musical comedy, "The Gypsy Girl" by Gene McDonald, will be broadcasted from the famous Symphony Hall in Boston.

Discussion of Tractions Resumed in Chicago

Hearings have been resumed in Chicago with a general air of expectation that, with the traction ordinances expiring in less than a year, everybody means business. At a number of sessions Samuel Insull, Leonard Busby and Henry A. Blair, the latter through an attorney, submitted to personal questioning or furnished the material for aldermanic discussions. The outgrowth of the final tense session was a request that the three traction leaders draw up their own ordinances to determine on paper where their points of agreement rest.

Mayor Dever was dragged into the session after hearing reports of bitter words from the Aldermen for his previous absences.

Mr. Busby said that the traction interests were practically united in 1925 and were "even more so now."

Samuel Insull was absent. He received a broadside from the Mayor for his $23,000,000 elevated extension program, which has been hanging fire two years. The Mayor said the offer was made "to make a record," and that if Mr. Insull had wanted to build a cross-town elevated line and additions to the present structures to furnish additional express service he could have done so in the same way as he had started his loop platform extensions, which he sincerely wanted built.

Mr. Busby and Mr. Blair favor unification. Mr. Blair's program of "one city-zone fare" is before the committee. Mr. Insull wants most a subway and asked the members of the committee to permit him to build one, if they were not prepared to proceed.

The city was informed that some kind of a long-term grant, preferably, a good-behavior terminable permit, was essential to uninterrupted service.

The Aldermen have had it made plain to them that the Chicago Surface Lines are affording a service never before equalled in Chicago and that in spite of the blind future are developing morale and equipment to the highest possible point.

$110,123 Bonus in Los Angeles

Final figures show that the Los Angeles Railway, Los Angeles, Cal., paid $110,123 to 2,208 trainmen on Dec. 15 as bonus for faithful and efficient service during the period Dec. 1, 1924, to Nov. 30, 1925. In the ELECTRIC RAILWAY JOURNAL, issue of Dec. 19, 1925, page 1089, it was said that the amount would be about $106,000. This was the sixth year of the merit and bonus system and the amount paid the trainmen was higher than in any previous year. In 1920, when the merit system was established, 1,500 men received $50,000.

The bonus is paid on a basis of $5 a month or $60 a year. Trainmen are eligible for the bonus after they have been in the service for six months. At the time he becomes eligible each trainman is given an efficiency rating of 100 per cent. A clear courtesy and safety record for the month entitles the trainman to the full $5, but demerits assessed against him for infractions of the rules or for complaints made for discourtesy or inefficiency lower his record from the rating which he is given to start with and decrease his bonus at the rate of 25 cents for each five demerits. Commendations for particularly courteous and efficient service from patrons or supervisors add to the percentage of the trainman's efficiency rating.

R. R. Smith, assistant superintendent of operation, presided over the meeting on Dec. 15 at which the Christmas money was distributed.

Guelph Favors Return of Local Muncipal Control

In the recent municipal election for the by-law favoring the return of the Guelph, Ont., system to local municipal control, a large plurality was recorded. The Guelph system has been operated for the past four years by the Hydro-Electric Railways, which is controlled and operated by the Hydro-Electric Power Commission of Ontario. As the situation now stands, some of the city's leading business men believe it would be wise to scrap the system and depend upon the bus.

Some years ago Guelph, at its own expense, built a railway line to Guelph Junction to connect with the Canadian Pacific Railroad, a steam line, about 15 miles away. Later this line was extended to Goderich by the Canadian Pacific and Guelph now collects toll on every ton of freight passing over this important grain route. Several years ago some of Guelph's leading business men conceived the idea of having the street railway operated by the steam line and it was generally accepted as an opportunity to secure efficient administration, plus the fact that there had been a desire for outside radial connection, which this proposal would have effected. When arrangements were in the making the late Sir Adam Beck started a campaign against such management by an "iniquitous corporation" and he succeeded in persuading the people of Guelph at the eleventh hour not to accept an arrangement to have the road operated under conditions offered by the Canadian Pacific Railway, although such conditions were reputed to be very favorable.

The recent vote, favoring a discontinuance of Hydro operation, was recorded in the face of opposition from local Hydro supporters. They predicted that it was the first step toward a new deal with the Canadian Pacific Railway. A local newspaper states that in the years ensuing since the Guelphites have been under Hydro management the road has been improved, but with their own money; that deficits and not dividends have been the yearly portion, and that outside connections never materialized.

Coal for Boston Elevated Employees

The Boston Elevated Railway, Boston, Mass., has made agreements with the Fore River Coal Company covering storage of bituminous coal in pocket at the Lincoln Power Station wharf. Employees desiring this kind of coal delivered at the wharf at $6.50 a ton may apply to the superintendents of divisions.

Three Thousand Greet Santa Claus at Beaver Valley Party

Santa Claus called at the Beaver Valley Traction Company Christmas party on Dec. 23 for the fifteenth year.

Arrangements for his reception had been made at the pavilion, Junction Park, where more than 3,000 greeted him and hundreds of children and adults delved into his pack, carrying away generous gifts.

The pavilion was handsomely decorated and a wonderful tree was located in the center, in which myriad lights flashed in its ice-covered branches.

Motion pictures were shown for the children, while the adults were entertained by a large chorus which sang Christmos carols. The singing was accompanied by electric chimes installed for the occasion. There were peanut and marble scrambles for the children.

The "Traction Company Party" has become a fixture in the valley. Many children who attended the first party as babes in arms were present and reported having attended each year. Many adults also have attended the party annually since the practice was started fifteen years ago.

Each year the number who attend increases. Committees and chairmen strive to make each party better than the preceding one. New gifts are selected, new entertainment arranged and more care is given to decorations and refreshment menus.

John R. Marshall was general chairman in charge of the party.

Open Hearings on Baltimore Rerouting Plans

The Traffic Commission at Baltimore, Md., has set dates for public hearings at which four plans have been advanced for rerouting the cars of the United Railways & Electric Company will be discussed. The hearings are to be open to the public. The dates are Jan. 18, 19 and 20. The four rerouting plans have been prepared as a result of a survey by Kelker, De Leuw & Company, Chicago. Following the completion of the street car rerouting plan the commission will turn to the vehicular traffic problem.

New York Traction Companies Show Insufficient Revenues

The annual report of the New York Public Service Commission with jurisdiction throughout the state but not in New York City, sent to the Legislature on Jan. 11 shows that the revenues of this group of utilities have been insufficient to meet operating expenses and fixed charges. A slight decrease in operating revenues in 1924 over 1923 is more than offset by lower operating costs, it is said. The net loss for 1924 was approximately one-half that for 1922, "this seeming improvement being in part undoubtedly due to the discontinuance of various unprofitable lines and not wholly to increased efficiency in operation or increased traffic." On Dec. 31, 1924, there were 1,934 miles of road reported as available for operation compared with 1,999 and 1,971 at the close of the years 1922 and 1923 respectively.

New Franchise Voted in Sioux City

Sioux City, Iowa, voters recently reversed their decision of 1924 and approved a 25-year franchise to the Sioux City Service Company, operating the city traction lines. The vote was favorable in each of the 30 precincts, but only 7,580 votes were polled, dividing 5,546 in favor of the proposition and 2,034 against it.

The new franchise provides for an eighteen-hour service on all lines, removal of the Third Street tracks, elimination of the wye at Transit and Morningside Avenues, maintenance of the present fare of 7 cents, four tickets for 25 cents, as long as the company is able to show a 7 per cent return on its investment, but a reduction if this figure is exceeded; payment to the city of 2 per cent gross receipts in place of a $25 tax annually on each car and extension of tracks without specific franchise vote.

Nashville Sets Record for Safe Transportation

The street cars of Nashville, Tenn., operated by the Nashville Railway & Light Company, ran 1,025,000 miles in safety during 1925. This announcement was made when the 400 operators held a mass meeting in the Employees' Mutual Benefit Association auditorium during the last week in December, where they were praised for their work.

A great amount of credit for the record was given to H. A. Davis, superintendent of transportation, and to John J. Connors and the safety school, of which he is director, attended by 400 operators weekly. The local report for the year showed that the number of accidents had been reduced 328 during 1925 and that all cars had averaged traveling 6,577 miles per accident.

Official national recognition of the 1925 record was given by the men in a telegram from J. W. Welsh, secretary of the American Electric Railway Association in New York. He declared that the national average was far below the local record, for which he sent his congratulations.

More Transit Facilities, Says New York's New Mayor

J. J. Walker, New York's new Mayor, says it is time the traction controversy was ended and that the city had full and complete power to develop its own facilities to take care of its own transportation needs. As he sees it, this is entirely a local question which must be solved by the expenditure of local funds and does not affect any other community in the state. The Mayor feels that since it is entirely the city's money that is being spent and the city's needs that are being satisfied, the right of control, as well as of construction, should be vested in city authorities.

His administration will not permit of unnecessary conflict or controversy. In his inaugural address the Mayor said:

> Let the credit go where it will, but let us have better transit facilities. This administration will not seek to glorify itself at the expense of delay in this most essential necessity. More transit facilities must be provided without any kind of political or personal interference.
>
> The city is entitled to the co-operation of the State Legislature in its efforts to provide the additional transit facilities that are required. It is generally understood that the revenues from taxation are not sufficient to pay for the construction of the transit lines that are necessary, and that recourse must be had to the credit of the city.
>
> The borrowing capacity of the city under the present constitutional limit is not enough to construct these new transit lines as rapidly as the needs of the population demand. We shall ask the Legislature to permit the people to vote upon an amendment to the constitution to extend the city's borrowing capacity. At the time the present constitution was written it was never contemplated that the use of public funds would be necessary to provide transportation facilities or that the cost of transportation would reach the enormous amount that it has in later years by reason of requirements for subsurface construction. We are asking now to have the constitution brought up to modern conditions.

Bus-Railway Service for Celebration

Final details of local transportation in Philadelphia, Pa., during the Sesqui-Centennial celebration have been worked out by the city and the Philadelphia Rapid Transit Company. The expenditure by the railway will be about $2,100,000, of which $1,200,000 will go toward track extensions outside the Sesqui-Centennial grounds, $600,000 for extensions to the company's power distribution system required to meet the added load and $300,000 for intramural transportation. An extension of bus service is included in the plan. The company's outlay will be financed through the sale of its 7 per cent preferred stock, an issue of which was authorized recently by the Council.

Rights of State Commission Fixed in Duluth Case

The constitutionality of the act of 1921 which gives the State Railroad and Warehouse Commission of Minnesota control over electric railway rates and financing has been upheld. In the case under review the city of Duluth obtained a temporary injunction, restraining the state commission from acting on a petition of the Duluth Street Railway for an increase in fare. Three district court judges in Duluth upheld the 1921 act. This would dismiss the injunction. The city has announced, however, an appeal will be taken to the Supreme Court.

The city attacked the constitutionality of the act when the Duluth company asked the commission to set a new rate of fare in Duluth. The railway contended that the 6-cent fare then in effect yielded only 70 per cent of a fair return on the capital investment, as determined by the United States District Court.

Eight-Cent Fare in Effect in Rochester

An 8-cent cash fare went into effect on the Rochester, N. Y., trolley and bus lines of the New York State Railways on Jan. 1. The previous fare was 7 cents, in effect since the service-at-cost contract between the city and the railway was signed five years ago.

Early in December the railway filed with the Council notice of the fare increase. This action was based largely on the report of Commissioner of Railways Charles R. Barnes, which pointed out the necessity of a higher fare.

City officials did not oppose the advance. In fact, they agreed that it was justified by figures contained in the report of Mr. Barnes. Under the previsions of the service-at-cost contract fare changes do not have to be approved by the State Public Service Commission.

Under the new schedule four tickets will be sold for 30 cents. Prior to the advance four tickets were sold for 25 cents.

Passenger Traffic Holds Up Well in Syracuse

The Syracuse Railways Co-ordinated Bus Lines, Inc., subsidiary of the New York State Railways, carried 1,124,057 passengers on its lines during 1924, according to a report issued by Benjamin E. Tilton, vice-president and general manager of the corporation. This was the first yearly report on bus service for Syracuse.

The street car lines carried 32,418,356 passengers during the year. The total number of passengers, bus and trolley, was 33,542,413. This is a drop of 29,015 fares from the total for the previous year, 33,571,428.

New bus lines installed in Syracuse during 1924 are: Strathmore, Shotwell Park, Colvin Street shuttle and West Genesee lines. The Chittenango interurban route also was started during the year.

A bus line through South and North Geddes Streets to accommodate workmen going to and from factories is under consideration.

Frederick H. Fay, Boston, planning expert, is in Syracuse making a study of the entire traffic system. Mr. Fay has held several conferences with Thomas H. Mather, consulting engineer to the grade crossing commission, and city officials.

Power Deal Made at Columbus, Ohio

Announcement was made on Jan. 4 of the consummation of a 99-year contract, approved by the Ohio Public Utilities Commission, between the Columbus Railway, Power & Light Company and the Scioto Valley Railway & Power Company, whereby the former acquires valuable rights of way for transmission lines between Columbus and Lancaster, Ohio, and Columbus and Chillicothe, Ohio, over the Scioto Valley routes, and the Scioto Valley company in turn acquires exclusive rights to haul Rail-Light fuel and also agrees to buy all its energy from the Rail-Light company.

The contract forecasts the dismantling of the Scioto Valley power plant at Reese Station, Ohio. It also forecasts arrangements whereby the Rail-Light company will take over municipal power and light contracts at Chillicothe and Circleville, now held by interests closely associated with the Rail-Light company, and perhaps similar municipal contracts in other communities.

It is provided that the arrangement for the operation of Scioto Valley company cars in Columbus over Rail-Light company tracks shall continue.

Southern Pacific Seeks Fare Advance

On the heels of the higher fares granted the Key System Transit Company, Oakland, Cal., temporarily as a relief measure to meet the increase in wages recently awarded carmen by an arbitration board, the Southern Pacific has applied for an increase in rates to the California Railroad Commission.

The Southern Pacific requests that it be allowed to raise ferry fares to 25 cents for single trips and to charge $6.50 for monthly commutation. The present rates are 18 cents and $4.80.

A hearing on this petition will be held on Jan. 18 in San Francisco, but before that time—on Jan. 15—the new Key rates will take effect and for several days the Southern Pacific will be in the position of a rival line charging lower rates than its competitor.

Company officials claim that the new rates are needed to meet a deficit in revenues incurred during the first six months of last year. An application for permanent increase in rates is now before the commission. There have been several hearings, but the matter has been postponed until February. In its prior application for a rate increase the Southern Pacific did not go on record as requesting any definite amounts, leaving that to the commissioners after study of the testimony.

Fort Dodge Still Carless

Although the option on leasing the railway system of Fort Dodge, Iowa, dormant since Nov. 14, has expired, no statement as to probable resumption of service has been made public by the syndicate of residents which announced it would lease the trolleys. The Fort Dodge Street Railway, which operated the local cars in Fort Dodge for about 30 years, suspended service on Nov. 14.

The history of the railway and the company which began bus service was given in the ELECTRIC RAILWAY JOURNAL, issue of Nov. 28, 1925, page 975.

News Notes

One-Man Car Matter Up Again in Milwaukee.—The City Council of Milwaukee, Wis., has adopted a resolution asking the Railroad Commission for a rehearing of its recent order authorizing the Milwaukee Electric Railway & Light Company to use one-man cars on its Walnut Street line.

City Employees Must Pay Fare.—An ordinance has been recommended for passage by the City Council utilities committee of Seattle, Wash., amending an existing ordinance which permits policemen and firemen to ride free on the Seattle Municipal Railway. Under the new ordinance, these city employees will have to pay their street car fares. When the Council was working on the 1926 budget, it reduced an appropriation for policemen and firemen for car riding from $48,000 to $5,000, despite protests from the fire and police chiefs, who said the amount would not provide for the men's carfare, even limited to rides on official duties.

Company to Resist City's Fare Plan.—The Lynchburg Traction & Light Company has notified the city of Lynchburg, Va., that it will resist by injunction, if necessary, the effort of the city to cut the street car fare from 6 to 5 cents in the new part of the city. The railway is to ask for an injunction from the State Supreme Court of Appeals, and if this is granted the city will ask the court to require the giving of a receipt to all who pay the 6-cent fare so that there may be an adjustment in case the city wins the contention. The city's plan is to have the fare similar throughout the city.

Men Remain at Work During Wage Adjustment.—Trolleymen of the East Penn Electric Company, operating 36 miles of track between Pottsville and Mauch Chunk, recently demanded an increase of 5 per cent in wages. The former wage scale expired with the old year. The men decided to work for 30 days while a new scale is being adjusted. The company contends it cannot grant any increase of wages and might even curtail service because of the loss of business due to the mine strike.

What Can You Send?—The Los Angeles Railway, Los Angeles, Cal., is soliciting old photographs, time-tables, tickets or other material to show some of the history and development of the Los Angeles Railway. R. B. Hill, superintendent of operation, is at work compiling a book which will illustrate the history and development of that property. He is anxious to make the volume complete with pictures and records. He has promised to return the photographs immediately after they have served his purpose. Data should be forwarded to Los Angeles Railway Building, Los Angeles, Cal.

Wage Agreement Reached.—Under a recent agreement between the union and the Toledo, Fostoria & Findlay Railway, Fostoria, Ohio, trainmen will receive 47 cents an hour for the first year, 49 cents for the second year and 52 cents for the third year. Shop men will receive 55 cents an hour and track men 40 cents an hour.

Town Wants Railway.—The town of Long Beach, Miss., which had formerly adopted an ordinance authorizing the Mississippi Power Company to remove its tracks and abandon its trolley service within the town limits, by a close vote of its Board of Aldermen on Jan. 5 reconsidered its former action. It requested the company to resume railway service, and set Jan. 28 for the day upon which the townspeople will vote to establish their permanent public policy on the electric railway question. Meantime, the company, acting upon authority of the town's ordinance, suspended railway service, and has been operating motor coaches on the line.

Wage Issue Up Again.—Railway employees of the Cedar Rapids & Marion City Railway, Cedar Rapids, Iowa, who last July accepted a compromise on their 5-cent wage increase petition, on promise that the full scale would be granted if increased earnings warranted it, have opened negotiations to secure that scale. The traction lines, granting a 2½-cent increase in July, said if earnings under the new fare were sufficient the other 2½ cents would be granted. The men claim that condition exists, but the management says earnings are "nowhere near" the estimate. The matter will be considered in conference.

Company Receives Colors.—The Chicago, North Shore & Milwaukee Railroad Post No. 753 of the American Legion was officially presented with its colors by the railroad officials in Waukegan on Dec. 17, 1925. The North Shore Railroad Post is composed entirely of railroad employees. Every department is represented in the legion, with the largest number from the transportation department. The ceremony of presentation of colors and standards included the presentation address by Charles E. Thompson, assistant to the president of the company, "on behalf of the North Shore Line." The acceptance address was made by Claude L. Foubare, Illinois Department, American Legion. Many fine musical numbers afforded enjoyment for all participants.

New Order on Commutation Tickets.—By special permission of the Public Service Commission commutation tickets of the Southern New York Railway, Inc., Oneonta, N. Y., each good for 50 trips in either direction between Hartwick and Junction within 30 days from and including date of sale, will be sold for $6.50 each. The order became effective on Jan. 11.

Fare Appeal Heard.—A. D. Mackie, general manager of the Illinois Power Company, Springfield, Ill., testifying before the Illinois Commerce Commission recently in support of the petition to increase fares to seven for 50 cents from the present rate of four for 25 cents, outlined several contemplated changes in lines and substitution and extension of bus lines. He said passenger revenue had declined from $713,008 in 1922 to $684,432 in 1924, while operating expenses had grown from $533,143 to $563,990. The company contends that its earnings are at a rate considerably less than the 7 per cent return set by the commission.

Service Improved.—Indicative of the "please the public" policy adopted by the Steubenville, East Liverpool & Beaver Valley Traction Company, G. S. Wills, general superintendent, recently announced completion of improvements costing approximately $500,000. The improvements include the operation of the Ceramic flier, providing a Pullman car service between Beaver, Pa., and Steubenville; the maintainance of a faster schedule between terminals on the interurban line, with the idea of safety first in the operation, and faster schedules all over its upper Ohio Valley system.

Windshield Wipers for Trolleys.—Garfield S. Chase, manager of the local division of the Eastern Massachusetts Street Railway at Lawrence, Mass., has announced that the road plans to equip all the street cars with wipers such as are used on the windshields of automobiles. The idea will be applied throughout the entire territory in which the road operates. It is understood the wipers will be similar to those in use in Detroit and other cities, particularly in the central West.

Recent Bus Developments

New Jersey Board Wants Greater Authority Over Buses

In the opinion of the Board of Public Utility Commissioners of New Jersey the law for the regulation of the buses has not kept pace with the development of bus transportation. This is the view expressed by that body in transmitting its suggestions to Governor Silzer for action. In 1921 the public utility act was amended to include among the public utilities subject to the board's jurisdiction the operators of auto buses upon routes any part of which parallels on the same street the line of a street railway. There were excluded from the application of the act those operating under permits granted prior to March 15, 1921, and renewed on their expiration to the same owner for the same route.

The purpose of the amendment appears to have been to subject to regulation by the Public Utility Commission the operation of buses in direct competition with street railways, leaving free from such regulation those not in such competition and those already established in the business. The amendment did not provide for the granting by the board of permits to operate. The public utility act provides, however, that no privilege or franchise granted shall be valid without the board's approval.

The prospective operator of a bus, therefore, must first obtain licenses from the municipalities along his route and submit these to the board with an application for its approval. According to the board this procedure is simple and free from objection when the operation is in a single municipality, but during the past year the board has received numerous applications for approval where the routes passed through a large number of municipalities.

In some cases it has been proposed to parallel at various points the routes of existing bus and railway lines, without any necessity for additional transportation facilities at such points. In other cases it was evident the existing transportation facilities were inadequate and the bus service needed. In considering these applications the board met with many complications due to the lack of a law adapted to present-day conditions. It happens frequently that along a route extending through a number of municipalities permits are granted by some, while other municipalities refuse the grants or fail to act. This results in the buses running through some of the municipalities with the doors closed, doing no local business. In other cases the bus operators have attempted to stop in such municipalities at stations on private property.

In many of the jurisdictions the business of bus transportation is classified as follows:

(a) Urban or street transportation by buses within the limits of a single municipality.

(b) Interurban transportation, where the route is through numerous municipalities over long distant routes.

In the board's opinion a classification such as this is desirable and should be provided for either directly by law or by legislation authorizing the board to fix the classifications. In either event it should be specified that where the operation is within the limits of a single municipality it should be within local control to grant permits, subject to the prevailing conditions. Where the operation is interurban it is the board's opinion the prospective operator should receive from the state through the agency of the Board of Public Utility Commissioners a certificate of convenience and necessity for the operation, and that this should be regarded as sufficient authority to operate, subject to police regulation in each municipality.

It is suggested also that the law be changed with respect to the operation of buses in interurban traffic, so that buses so operated will be subject to the board's jurisdiction, without regard to whether any part of the route parallels on the same street the line of a street railway. As the law now is, it may be proposed to operate a bus between points not connected by a street railway, but if any part of the route, no matter how short, is upon a street in some municipality where there is a street railway track the operation is subject to the board's jurisdiction. If this part of the route is avoided the board has no jurisdiction. The result is that many of the long route buses are so operated as to avoid paralleling a street railway or operated in parts of the state where street railways are not in operation.

The board says that interstate bus lines are being multiplied without regard to public convenience. It refers to the fact that legislation to provide proper governmental supervision of this business has been under consideration by the commissions of various states, but says it is evident that congressional action may not be had immediately, and that with the rapid growth of the intrastate routes and the addition of the operation of the interstate buses to the present bus and other vehicular traffic the state will be soon confronted with a serious problem of congested traffic on the highways.

The law now provides that the operators of all buses in cities shall carry liability insurance. It recommends:

> We are of the opinion that legislation should be enacted requiring the operators of all interstate buses to carry liability insurance in a reasonable amount for the benefit of persons injured through their operation; that policies for such insurance be filed with the Commissioner of Banking and Insurance, or some other suitable department, and that no operation of interstate buses be permitted in this state unless such requirements be complied with. This we believe is a proper exercise of the police power of the state and is not an interference with interstate commerce. It is a necessary regulation in the interest of the public safety.

Bus Route Supplants a Trolley Line in Youngstown

The Youngstown Municipal Railway, Youngstown, Ohio, suspended service on Jan. 10 on the North Avenue car line, which serves a part of the northern section of the city, and substituted therefor bus service covering the same general section. The trackage taken out of service was 1.35 miles. The street car line was single track with passing switches. This made it impossible to improve service. Service on the line was further handicapped by a difficult grade crossing of the Erie Railroad.

By the operation of the bus line over a recently constructed bridge and for a part of the route through a broader street the handicaps to service have been overcome. The bus route, 2.4 miles in length, also permits of extension of service to a recently developed section of the city heretofore not directly served by the railway lines. The buses used in the new service are the standard city type of the company on White chassis.

Bus Transportation Grows in Madison

The Madison Railways, Madison, Wis., on Jan. 7 purchased all of the equipment of the Wingra Bus Company and will operate that bus line. The Wingra Bus Company for several years has operated an intracity bus line in Madison. The equipment purchased included five large buses. The transfer of ownership was made with the provision that the purchaser will continue fifteen-minute service from the Capitol to Wingra Park. The new line will be run in conjunction with the bus line of the railway. Fifteen-minute service will be furnished from all parts of the city.

Fares will prevail at 10 cents cash for adults and 5 cents for children, with tokens at seventeen for $1 for adults and ten for 50 cents for school children.

Express Service Between Richmond and Petersburg.—A through bus service between Richmond and Petersburg has been established by the Virginia Electric & Power Company. The trip to Petersburg, about 22 miles, consumes one hour. With the exception of stops to be made at the local hotels to pick up passengers, the service is an express service direct to Petersburg. The certificate granted by the Virginia Corporation Commission to operate a bus line was bought by the company recently from C. W. Edgerton, who purchased the right when the line was sold early in December.

Suggests Buses to Recoup Losses.—The Tri-City Railway, Davenport, Iowa, has asked the City Council to authorize the introduction of buses along the streets now served by the Fejervary and LeClaire Street car lines, at the same fare as the street car. Four buses would be regularly operated and six used in peak-load hours, with transfer interchangeable on both lines.

Financial and Corporate

Agreement on St. Louis Reorganization

Security Holders Reconcile Differences —Hearing on Foreclosure Suit Set by Court for Feb. 15

Security holders of the United Railways, St. Louis, Mo., have agreed on terms for the reorganization of the system. Federal Judge Faris of the Eastern District of Missouri was so informed on Jan. 5. As a result the court continued until Feb. 15 the hearing on the consolidated foreclosure suits brought against the property under which the receivership will be dissolved.

The mill tax debt of $3,000,000 owed the city of St. Louis has not been adjusted, but Judge Faris announced that this would not prove an obstacle to reorganization, since it is a matter for the city and company to settle independently.

The last financial barrier to reorganization was the objection of holders of $30,300,000 of generals 4s to the reorganization committee's plan to extend $8,300,000 of underlying bonds, $4,200,000 of which had been replaced with receiver's certificates. These will be paid off, but it is understood that $6,000,000 of new bonds will provide the capital needed for this purpose.

When Assistant City Counselor Senti informed Judge Faris that the mill tax matter had not been adjusted, the Judge replied:

> The mill tax cannot stop this proceeding. It is either a preferred claim or it is not a preferred claim. I allowed the city to participate here more as a matter of grace than of law.

The reorganization committee has indicated that it will endeavor to compromise the mill tax on the same basis it settled $500,000 in personal injury judgments, namely, payment of 66⅔ per cent of the principal and interest. It will probably ask ten years to pay.

Mr. Mitchell, counsel for the holders of $9,700,000 of St. Louis Transit Company bonds, made a brief statement in which he advised the court of the complete agreement of the security holders. He stated that within ten days he would file an amended bill of foreclosure. Claims against the company will be heard after this and the termination of the receivership will follow a decision as to the payment of these claims. It is probable that the mill tax matter may be adjudicated when the question of claims comes up.

Judge Faris said he hoped the matter would be pushed to a termination with all possible speed.

The reorganization is based on the assumption that the company will be permitted to earn 7 per cent on $57,000,000. The plan provides that the bonded debt be cut to $40,800,000 from $54,890,000. The present $24,913,000 of common stock will largely be wiped out, but holders of $16,383,000 of preferred stock will have an opportunity to subscribe to 343,645 shares of new common at $12.50 per share. Holders of the $9,070,000 St. Louis Transit bonds will receive 53,854 shares of new preferred.

The United Railways went into receivership in April, 1919. Several plans for reorganization were drawn, only to be rejected. In January, 1924, Judge Faris forced the issue by refusing to authorize Receiver Wells to extend three issues of underlying bonds totaling $4,100,000 and two issues of Suburban bonds totaling $6,500,000.

The active reorganization plans for the company were in charge of Newman, Saunders & Company, New York.

The St. Louis Public Service Company filed articles of association with the Secretary of State of Missouri on Jan. 13 and is to take over the properties of the United Railways if the reorganization plans are approved by the federal court and the Missouri Public Service Commission. The purchase of the properties would be at foreclosure sale and the new company would operate the system pending discharge of the receivers. The new company has a nominal capitalization of $15,000, but upon purchase and with the approval of the Public Service Commission additional securities based upon the amount invested in the system as determined by the commission would be issued. The incorporators named in the articles of association are members of the reorganization committee and men employed by them. They are: F. O. Watts, A. L. Shapleigh, J. Sheppard Smith, W. W. Smith, George W. Wilson, W. De W. H. Bradley, S. W. Greenland, L. C. Datz, Thomas Stanion, Stanley Clarke and J. K. Newman. Some of these men will occupy the position of director temporarily pending the election of permanent officers.

Marion & Bluffton Traction to Pass to Insulls

Purchase of four electric light and power and electric railway properties in eastern Indiana by the Indiana Service Corporation, a subsidiary of the Midland Utilities Company, of which Samuel Insull is president, is proposed in a petition filed on Jan. 7 with the Public Service Commission of Indiana.

The properties which it is proposed to merge with that of the Indiana Service Corporation are the Marion & Bluffton Traction Company, Berne Electric Light Company, the Bryant Electric Company and the Wells County Electric Company.

The value of the properties to be purchased is $1,594,197, according to the petition.

With the acquisition of these properties the Indiana Service Corporation will serve 39 communities with electric light and power and 37 towns will be interconnected by the company's electric railroad lines.

Operation of the combined properties will be under direction of Robert M. Feustel, president of the Indiana Service Corporation. No change in the working organization of the companies to be bought is contemplated.

The Marion & Bluffton Traction Company supplies electric service in communities south of Fort Wayne and operates an electric railway from Bluffton to Marion. As the Indiana Service Corporation already owns an electric railroad running between Fort Wayne and Bluffton, purchase of this new line will give the company a railroad connecting Fort Wayne and Marion.

The proposed purchase price of the Marion & Bluffton Traction Company is $1,403,953, subject to first mortgage bonds aggregating $504,000 and equipment gold notes totaling $32,000.

Gain in Traffic in November— Slight Loss for Eleven Months

There was a further and augmented increase in the traffic carried on electric railways during November, 1925, compared with November, 1924. The total number of revenue passengers, including bus passengers, reported to the American Electric Railway Association by 208 companies for the two months was as follows:

November, 1925	777,372,289
November, 1924	754,569,183
Increase	3.02 per cent

For the period of eleven months ended Nov. 30, 1925, compared with the similar period in 1924, the figures are as follows:

1925	8,573,758,955
1924	8,615,448,432
Decrease	0.49 per cent

Dry Dock Road, New York, Passes Interest Payment

The directors of the Dry Dock, East Broadway & Battery Railroad, New York, a part of the Third Avenue Railway System, has adopted the following resolution on the payment of interest on the $649,361 outstanding Series C refunding 5s of the former company:

> Whereas there is due and payable on Jan. 1, 1926, an instalment of interest on the bonds of Series C issued by this company as of July 1, 1915, and secured by the refunding mortgage made and executed by this company as of July 1, 1915; and
>
> Whereas this company has not sufficient funds to pay such interest, and the earnings of this company have been insufficient therefor; now therefore be it
>
> *Resolved*, That the officers of this company be, and they hereby are, directed to make no payment on account of the interest due Jan. 1, 1926, on the said Series C bonds of this company.

Requiem Sung for Phoenix Company

The Phoenix Railway, Phoenix, Ariz., was granted a judicial decree of dissolution by Judge Joseph F. Jenckes in the Maricopa County Superior Court on Dec. 29. The properties of the company were sold to the city of Phoenix not long ago for $20,000.

The petition for the decree was signed by the nineteen stockholders of the passing corporation. It was incorporated 43 years ago for $2,000,000, consisting of 20,000 shares of stock at a par value of $100. The petition for the decree, according to the local attorneys for the Sherman interests, has no significance other than the desire officially to close the business of the corporation.

$3,956,494 Net Income at Detroit

Accountants for Municipal Line Give This Figure of Operating Results for Period from Jan. 1, 1924, to June 30, 1925, Including $1,555,183 for Renewals and Replacements

THE third annual report of the Department of Street Railways at Detroit, Mich., for the fiscal year ended June 30, 1925, has just been issued. According to the audit by Price, Waterhouse & Company the net income from Jan. 1, 1924, to June 30, 1925, was $3,956,494. The report gives operating data for the fiscal year, but the audit shows the financial results covering the eighteen months period and is a continuation of the audit by Price, Waterhouse & Company as of Dec. 31, 1923.

The financial review contains also an audit by Price, Waterhouse & Company, giving $7,114,246 as the amount of "Surplus and Reserves," representing the city's equity in the street car lines after providing for accrued depreciation on the property to June 30, 1925. Without allowing for depreciation, this equity is fixed at $10,241,771. This latter sum is made up as follows: Debt retired from operation, $3,367,885; sinking fund reserves, $4,762,790; additions to property, $2,111,096.

The annual report shows that the D.S.R. had on June 30, 1925, 359.14 miles of running track, 2.51 miles of sidings, 5.87 miles of carhouse tracks under cover and 23.43 miles in the open, making a grand total of 390.95 miles. The total mileage embraced in the motor coach system as of the same date, one-way route-miles, is given as 49.14 for the thirteen routes.

Scope of the Audit

It is pointed out that the department furnishes transportation facilities for the cities of Detroit, Highland Park, Hamtramck and Springwells (now Fordson). Ninety coaches were purchased during the year and 89 coaches were being operated on June 30, 1925, with a combined seating capacity of 1,953 passengers.

The audit was so conducted as to enable the auditors to certify to the general accuracy and integrity of the accounts. The examination was stated to be of such a nature as would determine the substantial accuracy, or otherwise, of the accounts and records, but was not of such a detailed character as would necessarily disclose minor irregularities or inaccuracies, should any exist. The work of the auditors comprised: (a) A verification of the assets and liabilities as of June 30, 1925; (b) a verification of the results from operations during the period from Jan. 1, 1924, to June 30, 1925; (c) an examination of the disbursement vouchers taken up in the accounts during the period from Jan. 1, 1924, to June 30, 1925.

As a result of the auditors' examination and after making certain adjustments necessary to correct the book figures, including a charge of $1,555,183 in respect of depreciation and accruing renewals of the properties, it is found, as indicated previously, that the operations of the period from Jan. 1, 1924, to June 30, 1925, resulted in a net income of $3,956,494. It is pointed out that a considerable number of street cars acquired from the Detroit United Railway under the purchase agreement have been abandoned or retired from service. Inasmuch as the consideration under the purchase agreement represented a composite consideration rather than a total of amounts representing the purchase price of individual assets, the book adjustment necessary in order to relieve the property account of the value of such abandoned equipment was determined on the basis of the arbitrary valuations ascribed thereto by the equipment division at the time of acquisition. Using such as a basis a loss was developed (after allowing for accrued depreciation) amounting to $158,410, and this has been charged direct to surplus in the accounts by reason of the fact that the retirement from service of the rolling stock had merely been deferred to the period under review.

No specific provisions for depreciation have been made in the accounts of the department up to June 30, 1925, but alternatively, the total cost of the properties is being amortized by appropriations of income in respect to sinking funds for debt retirement and of equipment purchased fund.

In the accounts Price, Waterhouse & Company have given effect to a provision for depreciation calculated on the basis of 3 per cent per annum of the book value of the depreciable properties and for the period of operation to June 30, 1925, the reserve calculated on this basis amounts to $3,087,484, of which slightly more than one-half, or $1,555,183, has been charged against the operations for the period of eighteen months ended June 30, 1925.

In their report on the accounts for the period ended Dec. 31, 1923, they calculated depreciation on the basis of 2½ per cent per annum, calculated on the book value of the total property investment, which naturally included non-depreciable properties. They report that they have since been advised by recognized engineering authorities that a rate of 3 per cent per annum applied on the depreciable property would be fair and they have, therefore, adopted this rate. Furthermore, it is understood that it is the intention of the department to give effect in the accounts to the depreciation provisions as calculated to date and to make a relative provision monthly hereafter. The accountants say:

> It will be understood, of course, that the creation of this depreciation reserve is in effect merely a transfer to a separate account of parts of what otherwise would be stated as surplus and it is not specifically offset by a corresponding appropriation of cash available for replacement as and when required. The depreciation reserve in this instance is wholly offset by sinking fund investments, which will be applied toward the payment of the cost of the properties.

In discussing the procedure of accounting for expenditures in connection with rehabilitation on which the department's records show $1,965,287 has already been spent, it is stated that "In the present instance the necessity for a prompt survey and report on the rehabilitation of the property acquired from the Detroit United Railway is very apparent. The longer this work is delayed the greater will be the difficulty of separating the rehabilitation costs from the costs chargeable to maintenance applicable to the period subsequent to the date of acquisition on May 15, 1922."

It was recommended in the report on the examination at Dec. 31, 1923, that a rehabilitation budget be promptly prepared by the engineering department and formally adopted by the Board of Street Railway Commissioners so that the basis of future accounting in this respect will be definitely established. It is understood that such a budget has not yet been prepared.

The assessed valuations of the department's properties (exclusive of sundry leased properties) for personal and real estate tax purposes for 1925 in Detroit, Highland Park, Hamtramck, Grosse Pointe and Fordson was $27,678,622. By a comparison of the total assessed valuation with the depreciated value of the property accounts as shown by the balance sheet as of June 30, 1925, of $39,498,853 it will be noted that the assessed valuation amounts to approximately 70 per cent of the depreciated value of the properties.

Statement of Funded Debt

At June 30, 1925, there were outstanding the following funded debt and purchase money obligations, viz.: Construction bonds, $15,000,000; purchase bonds, $3,601,000; additions and betterment bonds, $1,450,000; Detroit United Railway purchase contract, $14,080,000. In addition, pending the sale of $3,500,000 additions and betterment bonds, the department was indebted to the city of Detroit in the amount of $2,602,286, borrowed for the purpose of liquidating liabilities for additions and betterments.

In commenting on sinking fund and reserves, the report states that with regard to the construction bonds, amounting to $15,000,000, the Department of Street Railways is making sinking fund provisions in accordance with that section of the charter which requires payments to be made into the sinking fund aggregating 75 per cent of the principal by the maturity date of each series. There was, on June 30, 1925, in respect to this issue an over provision of $340,484.

Maturity of the purchase bonds and of the additions and betterments bonds is being anticipated by setting aside monthly amounts calculated on the basis of days which will equal the principal of each series of bonds as they repectively become due. Interest on these funds is taken up as an earning in the income account. Since the additions and betterment bonds become due in equal amounts annually and the purchase bonds become due in approximately equal amounts annually, this method of setting aside the funds for their redemption is considered as practical as could be suggested.

The reserve for injuries and damages, amounting to $1,383,379, has been

TOTAL PASSENGERS CARRIED ON DETROIT MUNICIPAL LINES

	Rail Lines	Coach Lines	Total
Year ended June 30, 1923	471,070,493	218,622	471,289,115
Year ended June 30, 1924	481,729,567	429,231	482,158,798
Year ended June 30, 1925	454,036,811	4,171,585	458,208,396

REVENUE RIDES ON DETROIT MUNICIPAL LINES

Year	Population	Rail Lines	Coach Lines	Together	Revenue Rides per Capita of Population per Annum
1923	1,219,275	357,386,437	218,622	357,605,059	293
1924	1,310,169	367,120,260	429,231	367,549,491	281
1925	1,401,064	338,155,230	4,171,585	342,326,815	244

STATISTICS OF DETROIT MUNICIPAL LINES FOR THE YEAR ENDED JUNE 30, 1925, COMPARED WITH THE YEAR ENDED JUNE 30, 1924

Statistics	Year Ended June 30, 1925	Year Ended June 30, 1924
Railway revenue car-miles	48,300,107	50,401,902
Coach revenue coach-miles	1,218,307	85,492
Railway revenue car-hours	5,252,021	5,653,643
Railway revenue passengers	338,155,230	367,120,260
Railway transfer passengers	115,881,581	114,609,307
Railway total passengers	454,036,811	481,729,567
Coach revenue passengers	4,171,585	429,231
Total passengers	458,208,396	482,158,798
Railway operating revenue per car-mile, cents	44.02	44.75
Coach operating revenue per coach-mile, cents	24.44	27.36
Railway operating expenses per car-mile, cents	31.60	32.43
Coach operating expenses per coach-mile, cents	24.64	28.03
Railway operating revenue per car-hour	$4.05	$4.00
Railway operating expenses per car-hour	$2.90	$2.89
Ratio of transfer passengers to revenue passengers—Railway, per cent	34.27	31.21
Railway revenue passengers per car-mile operated	7.00	7.27
Railway transfer passengers per car-mile operated	2.40	2.27
Total railway passengers per car-mile operated	9.40	9.54
Coach revenue passengers per coach-mile operated	3.42	5.02
Ratio of railway operating expenses to railway operating revenue, per cent	71.77	72.46
Ratio of coach operating expenses to coach operating revenue, per cent	100.81	102.43

CONDENSED STATEMENT OF INCOME OF DETROIT MUNICIPAL LINES FOR THE PERIOD FROM JAN. 1, 1924, TO JUNE 30, 1925 (CENTS DISREGARDED)

Revenue	Half Year Ended June 30, 1924	Year Ended June 30, 1925	Together
From transportation	$11,256,127	$20,956,023	$32,212,150
From other railway operations	250,769	605,803	856,573
Total operating revenues	$11,506,897	$21,561,826	$33,068,724
Deduct—Operating expenses	7,941,992	15,590,261	23,530,254
Net revenue from operation	$3,564,904	$5,971,565	$9,536,469
Deduct—Taxes assignable to railway operations and miscellaneous rents paid	357,797	704,467	1,062,265
Balance, operating income	3,207,107	5,267,097	8,474,204
Add—Non-operating income	62,427	159,479	221,906
Gross income before interest charges, depreciation, etc	$3,269,534	$5,426,577	$8,696,111
Deduct—Interest and miscellaneous charges	1,051,407	1,995,081	3,046,488
Income before depreciation and loss in inventory value as at June 30, 1925	$2,218,127	$3,431,495	$5,649,623
Deduct—Provision for depreciation of property	498,890	1,056,293	1,555,183
Income after depreciation but before loss in inventory value as at June 30, 1925	$1,719,236	$2,375,202	$4,094,439
Deduct—Loss in value of material and supplies on hand at June 30, 1925, as developed by physical inventory	.....	.....	137,944
Net income for the period			$3,956,494

STATEMENT OF DISPOSITION OF INCOME OF DETROIT MUNICIPAL LINES

Revenue	Half Year Ended June 30, 1924	Year Ended June 30, 1925	Together
Income for the period after provision for depreciation but before deducting loss in inventory value at June 30, 1925, as above	$1,719,236	$2,375,202	$4,094,439
Deduct—Sinking fund and other appropriation in excess of provision for depreciation:			
Sinking fund provisions for payment of funded debt and purchase obligations—			
For construction bonds (exhibit IX)	$283,327	$571,351	$854,679
For purchase bonds (exhibit X)	65,953	133,000	198,953
For additions and betterments bonds (exhibit XI)	4,109	50,000	54,109
For purchase contract—			
On semi-annual installments (exhibit XII)	497,267	918,885	1,416,152
On final payment (exhibit XII)	392,143	786,441	1,178,584
Appropriation of income to equipment purchase fund reserve	.....	311,791	311,791
Together	$1,242,801	$2,771,469	$4,014,271
Deduct—Provision for depreciation of property	498,890	1,056,293	1,555,183
Excess of sinking fund and other appropriations from income over provision for depreciation	$743,911	$1,715,176	$2,459,087
Income for the period before deducting loss in inventory value, less sinking fund and other appropriations (in which is included provision for depreciation) as at June 30, 1925	$975,325	$660,026	$1,635,351
Deduct—Loss developed upon determination of value of physical inventory of material and supplies on hand as of June 30, 1925	.....	.....	137,944
Amount transferred to surplus (exhibit I)			$1,497,407

created by monthly charges against earnings of amounts equivalent to 3 per cent of the passenger revenue to provide for the settlement of claims against the department arising from accidents. On this point the report says:

> Larger percentages of income are being set aside for this purpose in most cities in which the operating conditions might be considered to be fairly comparable with the conditions in Detroit. However, it is the established practice of the department to charge against the reserve only the payments made in settlement of claims and to charge directly into operating expenses all expenses of conducting the claims division, including hospital and medical charges, workmen's compensation, payments, legal and court expenses, etc.

With reference to the adequacy of this reserve of $1,383,379, information obtained from the claims division indicates the reserve is more than 100 per cent in excess of the indicated requirements at that date.

While up to June 30, 1925, it was not the practice of the department to set aside funds for the specific purpose of liquidating claims for injuries and damages, the basis of accounting has now been changed in this respect and appropriations of cash are now being made for the purpose of liquidating liabilities of this nature.

The total insurance and surety coverage carried by the department on June 30, 1925, was $12,463,800.

PASSENGER REVENUE

During the period covered by this examination, the following rates of fare were effective:

Street Car Service.—Cash fare of 6 cents or nine tickets for 50 cents and 1 cent additional for transfers to other street car service.

Motor Coach Service.—"Belle Isle" Service—Cash fare of 5 cents without transfer privilege. "Lynch Road" Service—Cash fare of 6 cents or nine tickets for 50 cents and 1 cent additional for transfers to street car service.

(Note—This motor coach service was replaced by street car service during the period under review).

Other services.—Cash fare of 10 cents with free transfer privilege only on such street car lines as were fed directly by motor coach service. For the privilege of making an additional transfer on the street cars, a further charge of 1 cent was made. Upon presentation of a transfer from street car service, an additional charge of 4 cents was made for motor coach service, making a total fare of 10 cents for street cars and coach service.

The balance sheet as of June 30, 1925, records total assets of $50,722,915. This sum includes $42,586,337 as property account invested in road and equipment; total investments of $5,366,435; working assets of $1,478,531; total current assets of $1,149,493, and total deferred charges to future operations of $142,117. The liabilities include total funded debt and purchase money obligations of $34,131,000; total current liabilities of $5,006,804; reserve for injuries and damages amounting to $1,383,379, and reserve for depreciation of property of $3,087,484. The total surplus and reserves amounted to $7,114,246.

Personal Items

Changes in East St. Louis

Messrs. Welsh, Gregory and Rearden Advanced Before W. H. Sawyer's Departure for Australia

In line with the proposed departure of W. H. Sawyer, president of the East St. Louis & Suburban Railway, East St. Louis, Ill., to Australia for the purpose of making an electrical survey, personnel promotions have been announced which are at the same time a recognition of men's services and worth. G. W. Welsh has been elected vice-president of the East St. Louis Railway, the East St. Louis & Suburban Railway and the St. Louis & Belleville Electric Railway; T. W. Gregory has been elected vice-president and assistant secretary and Col. Frank L. Rearden has been elected assistant treasurer of the same lines.

G. W. Welsh

Before his recent promotion Mr. Welsh was assistant to the president of all the railway properties in the group. He was appointed to this position in August, 1924. Ten years before that he had become connected with the East St. Louis & Suburban group of properties in East St. Louis as superintendent of power. He continued in that position until 1919 when he was made chief engineer. Mr. Welsh received h's education at Lehigh University where he was graduated with the degree of electrical engineer in 1901. In that year he became identified with the General Electric Company in the testing department, specializing in electric railway work up to 1905. For the next four years he was employed with the New York Central Railroad in connection with the electrification of the Grand Central Terminal in New York City. This electrification job led to another and we next find him with the Southern Pacific Company, San Francisco, Cal., working on the electrification of its suburban lines on the eastern side of San Francisco Bay in Oakland and Berkeley. His title here was assistant electrical engineer. After four years of this work he went with the East St. Louis properties.

T. W. Gregory, the other new vice-president, entered the service of the East St. Louis properties as bookkeeper on July 1, 1902, and four months later was elected assistant secretary and assistant treasurer of the various companies then comprising the system and was elected to a similar office with other companies acquired after that date. Back in 1887 Mr. Gregory, a native of Pomona, Ill., entered the service of the Mobile & Ohio Railroad at Mill Creek, Ill., as telegraph operator. He was employed in that capacity and as station agent at various points on that line between East St. Louis and Cairo until he went to the East St. Louis freight office in 1890 and to the East St. Louis & Suburban Railway and affiliated companies in 1902. With the exception of a period of less than six months in 1892 with the Louisville, New Orleans & Texas at Greenville, Miss., now the Yazoo & Mississippi Valley, his employment for 38 years has been with two interests. On Dec. 22, 1925, Mr. Gregory was appointed receiver of the Alton, Granite & St. Louis Traction Company and on Dec. 31, 1925, was appointed receiver of the Alton Gas & Electric Company.

Col. F. L. Rearden, the new assistant treasurer, was formerly the auditor of the companies.

Mr. Sawyer, president of the railway companies in the East St. Louis group, expects to sail on Feb. 2 in company with H. W. Eales, St. Louis, to make a survey of electric power resources in the Antipodes. Reference was made to this proposed undertaking in the ELECTRIC RAILWAY JOURNAL, issue of Jan. 9, 1926, page 90.

E. C. Hathaway Resigns from Inspection Company

E. C. Hathaway, chairman of the board of directors of the Railway Audit & Inspection Compay, Inc., Philadelphia, has disposed of his interests in the company and will no longer be associated with it. Mr. Hathaway was formerly president of the company. He is well known among electric railway men. For some time prior to 1916 he was assistant general manager of the Virginia Railway & Power Company, Richmond, Va., in charge of the properties of the company in Norfolk. He served with that company more than fifteen years. Before that he was with the Railways & Light Company of America, with headquarters in Baltimore. This company controlled the public utility properties located in Norfolk, Knoxville, Lexington and other cities.

The Railway Audit & Inspection Company was organized by Mr. Hathaway about 1906, and grew steadily from that time until in 1916 he felt that its conduct demanded his undivided attention. He has a number of important interests other than this and it is understood that he will in the future devote his time largely to them.

A. L. Reynolds in Florida

Washington-Virginia Railway Receiver With Miami Road Under Electric Bond & Share

Arthur L. Reynolds has been made superintendent of railways and motor coach operation of the Miami Beach Railway, Miami, Fla., which also holds a management contract with the city for operation of its cars and buses. Mr. Reynolds is thus placed in charge of the entire transportation system of Miami and the line to Miami Beach. Twenty new cars and 24 buses have recently been added to these properties to care for its rapid growth due to the recent Florida popularity. The Miami Beach Railway is owned by the Florida Power & Light Company, controlled through stock ownership by the American Power & Light Company and is under the Electric Bond & Share Company supervision.

Mr. Reynolds was formerly general manager for the Washington-Virginia Railway and since its receivership has been receiver as well. He will continue as receiver of that property. Before he went to Washington Mr. Reynolds was manager of the Youngstown & Suburban Railway, Youngstown, Ohio, under the management of Day & Zimmermann, a position to which he was appointed in March, 1921.

A. L. Reynolds

Mr. Reynolds began his railway career in the operating department of the Northern Ohio Traction, Light & Power Company in 1907. The following year he took a position as a salesman with the B. F. Goodrich Company, and after remaining with that concern for a year again took up railway work with the operating department of the Twin City Rapid Transit Company as supervisor of transportation. Before the entrance of the United States into the war in 1917 Mr. Reynolds went to the Second Officers' Training Camp at Fort Snelling, Minn. He received a commission as first lieutenant in the infantry.

Upon his return to civil life in 1918 he re-entered the service of the Twin City Rapid Transit Company, Minneapolis. During the latter part of 1918 he conducted for the company many public meetings in connection with its campaign to explain to the people the cost-of-service franchise which the company was seeking to obtain from the city. This

measure was defeated at that time owing to the peculiar political situation, but the matter has since been settled along somewhat similar lines.

In 1919 Mr. Reynolds was again transferred to the St. Paul Division of the Twin City Rapid Transit Company, and while with that company he acted as supervisor of three of the heaviest interurban lines between St. Paul and Minneapolis and also in various other capacities.

Mr. Reynolds was born in 1886 in Ashland, Ohio. He received his education in the grade schools of Akron, Ohio, and later attended Kenyon Military Academy at Gambier, Ohio. He is a graduate of Kenyon College, also in Gambier.

J. W. Nicholson Succeeds Mr. Becht at Cincinnati

The resignation of A. J. Becht, secretary of the Cincinnati Street Railway, Cincinnati, Ohio, for more than fifteen years, has been accepted. Miss M. A. Cannon, assistant secretary, also has resigned. The action was in accordance with Mr. Becht's request at the time the railway took over its property from the Cincinnati Traction Company on Nov. 1 last year that he be permitted to retire as secretary on Jan. 1, 1926. He explained that he desired to devote all of his time to his other business and personal interests.

J. W. Nicholson

Following the acceptance of the resignations the board elected Joseph W. Nicholson secretary and Miss Caroline Hein as assistant secretary. Mr. Nicholson started with the Ohio Traction Company in 1911 as a stenographer. The Ohio Traction Company owned the Cincinnati Traction Company at that time. In 1920 Mr. Nicholson was made secretary of the Ohio Traction Company, succeeding Walter A. Draper, who then became vice-president. In 1922 he was elected secretary of the Cincinnati Traction Company in recognition of talent which he was quick to display and now succeeds Mr. Becht as secretary of the Cincinnati Street Railway.

Mr. Becht will devote himself to the interest of the Kilgour-Cunningham estate. He is an officer of the Toledo, Bowling Green & Southern Traction Company and of the Cincinnati & Hamilton Traction Company.

A. W. McClimont President

A. W. McClimont, for the past eight years vice-president and general manager of the Winnipeg Electric Company, Winnipeg, Man., has been elected president of the corporation, succeeding George W. Allen, K.C.

W. R. Bawlf of Winnipeg has been elected vice-president. W. H. Carter of Winnipeg and James B. Woodyat of Montreal have been elected directors.

Mr. McClimont, it is understood, will continue to hold the position of general manager.

Rumors About Mr. Dunbar Denied

Emphatic denial has been made by official circles in Philadelphia Rapid Transit Company affairs that W. C. Dunbar has resigned as president as stated in a signed article in a Philadelphia morning newspaper a few days ago. Furthermore it was officially stated the officers of the company resented the inference that President Dunbar welcomed the transfer to Detroit. It was made known at the time Mr. Dunbar went to Detroit he was loaned to Dillon, Read & Company, New York, to help straighten out the situation on the Detroit United Railway. In recent years Dillon, Read & Company have financed both the Philadelphia Rapid Transit and the Detroit United and Mr. Dunbar's selection to assist at Detroit was merely a reflection of the appreciation on the part of the bankers of his experience and abilities.

Frank W. Funk Succeeds C. I. Crippen at Youngstown

After an absence of several years Frank W. Funk has returned to the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, as assistant to General Manager MacCalla. In this capacity the former associate of C. I. Crippen on the Pennsylvania-Ohio System succeeds Mr. Crippen, who has left the organization to assume the executive supervision of a group of utilities that center in the Pennsylvania Gas & Electric Corporation. Mr. Crippen's new connection was referred to in the ELECTRIC RAILWAY JOURNAL issue of Dec. 12, 1925, page 1056.

Mr. Funk entered the service of the Pennsylvania-Ohio Electric System early in 1914 as electrical engineer in charge of operation and construction. After three years in that position he was appointed resident engineer of the Republic Engineers, Inc., and two years later, with the man whom he now succeeds, formed the consulting engineering firm of Crippen & Funk. He has continued in general industrial and consulting engineering work since that time.

Mr. Funk entered the Ohio State University, taking the course in electrical engineering. After he was graduated in 1908 he went direct to the West Penn Power Company on construction work at Connellsville, near Scotdale, Pa., the place of his birth. He remained there six months, when he joined the development staff of the Westinghouse Electric & Manufacturing Company. He continued with the Westinghouse for about four years, having a part in many important electrical development jobs. Among these was control work in connection with the electrification of the Pennsylvania Railroad terminal at New York, and electrification work on the New York, New Haven & Hartford Railroad.

In 1912 he turned to the public utility field to become assistant electrical engineer of the Northern Ohio Traction & Light Company at Akron. Here he took part in the work of designing and constructing the Gorge power station and other important projects. Later he was made assistant superintendent of motive power in charge of all electrical operation and maintenance and was assistant in steam operation.

H. M. Atkinson Most Valuable Citizen of Atlanta

Henry Morrell Atkinson, chairman of the board of directors of the Georgia Railway & Power Company, contributed in the past twelve months more of inspired, effective and unselfish work for the betterment of the community of Atlanta, Ga., than any other citizen. To him will be awarded the silver loving cup given annually by the *Georgian and Sunday American* for playing the rôle of Atlanta's most valuable citizen in 1925. The committee's selection, according to the announcement, was based on Mr. Atkinson's activities in industrial development of the North Georgia region, of which Atlanta is the center, through great water-power plans, two of which were completed in 1925 and another projected. His efforts to improve transportation facilities in and around Atlanta and his general record of service for the communities and region development were also cited by the committee.

H. M. Atkinson

Mr. Atkinson has been identified with nearly all the important electrical projects that have been put through at Atlanta for more than 25 years and has contributed much to the city's growth and prosperity. He was instrumental in consolidating the railways and lighting companies of Atlanta into the Georgia Railway & Electric Company. He also organized the Georgia Railway & Power Company, which began operating in 1912, and became chairman of the board of directors of that company at the time of its organization. This

position he has held up to the present time. In addition to electrical enterprises he organized, built and was the first president of the Atlanta, Birmingham & Atlantic Railroad, a steam property, which has contributed to the development and prosperity of those sections of Georgia and Alabama served by it. Mr. Atkinson has also found time to take an active interest in the cultural and social life of the community.

E. K. Miles Assistant Superintendent at Syracuse

F. R. Latta has resigned as assistant to the general superintendent of the Syracuse lines of the New York State Railways, Syracuse, N. Y. His resignation became effective on Jan. 1. E. K. Miles, division superintendent, will succeed to the post of assistant to the general superintendent, J. E. Duffy.

Owing to this change three appointments have been made necessary. John Flood, formerly an inspector at Warren and Fayette Streets, becomes division superintendent at the Tallman Street yards. E. F. Wombles, station master at Wolf Street, becomes inspector in place of Mr. Flood, and J. E. Whalen, formerly an outside man at Wolf Street, becomes station master.

Dr. W. A. Rigg Heads Interstate Railways

Dr. Walter A. Rigg has been elected president of the Interstate Railways, Camden, N. J., succeeding his father, John A. Rigg, who died on Jan. 2. Dr. Samuel B. Rigg, another son, became a member of the board of directors. Daniel Houseman, vice-president of the Real Estate Title Insurance & Trust Company, was elected vice-president of the Interstate Railways, succeeding Dr. Walter A. Rigg in that office.

The Interstate Railways is not an operating company. It is largely a disbursing agent for the moneys received under the terms of rentals of properties leased by it for operation by others.

H. M. Gould with Dodge Brothers

H. M. Gould, who resigned late last year as assistant general manager of the Department of Street Railways at Detroit, Mich., is now identified with Dodge Brothers, automobile manufacturers of Detroit, Mich. Mr. Gould was one of the first employees to join the Detroit Street Railway Department. He had been engaged on the municipal line since 1920, when he joined the operative personnel as electrical engineer to supervise electrical construction work. At that time the system was under the direction of former Mayor James Couzens. He was made assistant general manager in the fall of 1924, at which time his career was reviewed in the ELECTRIC RAILWAY JOURNAL, issue of Oct. 4, page 574. His promotion at that time was considered a tribute to his grasp of the electric railway problems, which went far beyond his technical training as an electrical engineer. Before going to Detroit he was with the Connecticut Company.

C. E. Newcomer Manager at Pheonix

Charles E. Newcomer, connected for several years with the Phoenix Railway, Phoenix, Ariz., will serve the city as chief clerk of the municipal transportation lines. The position of general manager, held for many years by Sam H. Mitchell, was abolished early in December when it became definitely known that the city would assume operation and control of the lines. City Manager Rieger stated that the City Commission was in full accord with the decision, made in the interest of economy, and that several of the members felt that the salary paid to Mr. Mitchell as general manager is exorbitant in the case of a concern which was sold "lock, stock and barrel" for $20,000.

Obituary

E. V. Goble

Ernest V. Goble, superintendent of the schedule department of the Grand Rapids Railway, Grand Rapids, Mich., died on Dec. 28 at St. Mary's hospital after an operation. Mr. Goble became connected with the Grand Rapids Railway in April, 1924, as head of its schedule department. He was well known throughout the Middle West in railway circles. His railway training was received in Minneapolis, where he had been employed by the Twin City Rapid Transit Company for many years. He had come up through the ranks from platform man. Mr. Goble was 37 years old last Christmas.

A. W. Jones

Arthur Winslow Jones, manager of the Far East department of the International General Electric Company since its formation in 1919 and a member of the advisory committee of the company, died at Schenectady, N. Y., on Dec. 26. Mr. Jones had general direction over activities of the company in Japan, China, Australia, South Africa, India, Philippine Islands and Dutch East Indies. Previous to the formation of the International General Electric Company in 1919, he was a director on the boards of different foreign selling companies. In 1888 he entered the employ of the Thomson-Houston Company in Lynn, Mass., and in 1891 was made chief engineer of the International Thomson-Houston Company.

Frank E. Chapin

Frank E. Chapin, general manager of the Peninsular Railway, San Jose, Cal., for the past twenty-two years, died on Jan. 5 at the Southern Pacific Hospital, San Francisco. He entered railway work in 1874 with the old Market Street Railway system in San Francisco. Removing to Stanislaus County he was employed by the La Grange Hydraulic Ditch Mining Company for four years and when he went back he joined the California Street Railroad in 1870 as a conductor and also as a gripman. Later he was made starter and then assistant superintendent. This office he held from 1882 to 1904. In 1904 he went to San Jose as general manager of the San Jose & Los Gatos Interurban Railroad. This road was merged with the Peninsular Railway and then the company purchased all the city lines of San Jose and incorporated them under the name of the San Jose Railroad.

Mr. Chapin's advice on railway operating and engineering problems was sought by railroad men not only within the limits of California but throughout the country. He was born in Tuolumne County, California, 69 years ago.

Joel Hurt, Sr.

Joel Hurt, Sr., pioneer electric railway operator, capitalist and business man at Atlanta, Ga., died at his home there on Jan. 10. He played a prominent part in the rebuilding of Atlanta after the civil war. In 1894-95 he was president of the American Electric Railway Association.

One of the first successfully operated electric railways in the world was built by Mr. Hurt in 1889, running from Inman Park to Atlanta. His planning and development of the suburban sections of Inman Park and Druid Hills were two of his many contributions to the improved living facilities of the Atlantans. He consolidated the city's street railways and in 1901 sold them to interests that later chartered the Georgia Railway & Electric Company.

His activities of the '90s were concerned with the organization of the Trust Company of Georgia, the presidency of which he held for eleven years. In 1892 he built the Equitable Building, the first fireproof office structure in the South.

Mr. Hurt was born at Olivet, Ala., July 31, 1850. After the war he worked his way through college, and took an engineering degree at the University of Georgia in 1871. For the next four years he was engaged in railroad construction and then entered real estate and insurance in Atlanta. His labors thereafter touched nearly every form of the development of the city of Atlanta.

Ralph D. Hood

Ralph D. Hood, vice-president and general manager of the Massachusetts Northeastern Street Railway and the Dover, Somersworth & Rochester Street Railway, died at the Hale Hospital in Haverhill, Mass., on Jan. 9, after an operation following pneumonia. He was one of the most widely-known electric railway men in the Northeast and was universally esteemed in New England traction circles.

Mr. Hood was president of the New England Street Railway Club for the year 1923-1924. He was a native of Massachusetts. He was educated in the public school and at Phillips-Andover Academy and was an engineer by profession. He served as rodman in the Haverhill City Engineer's office in 1891. Next he became transit man for the Haverhill & Amesbury Street Railway, serving that company in 1892 and 1893. He was engineer for the Haverhill, Georgetown & Danvers Street Railway in 1894-1895 and then in turn served in a similar capacity with the Exeter Street Railway, 1897; Ex-

ter, Hampton & Amesbury, 1899-1900; Massachusetts Construction Company and Lowell System, 1900-1903; Manchester & Haverhill Street Railway, 1904.

In 1905 he was office engineer for the El Paso & Durango Railroad and in 1906 engineer of the Rockingham race-track. He was with the Manchester & Derry Street Railway in 1907 and the Dover, Somersworth & Rochester Street Railway and allied companies from 1908 to 1911. On Jan. 1, 1911, Mr. Hood became superintendent of highways for the city of Haverhill and on Jan. 1, 1912, was elected a member of the Municipal Council of Haverhill and served as head of Department of Streets in 1913. He became engineer of maintenance of way of the Massachusetts Northeastern Street Railway and allied companies in 1914, continuing as such to 1917, when he was made vice-president and general manager of these companies.

In addition to his public service in 1911-1913, he has been chairman of the Haverhill Board of Survey from 1917 to date. He saw military service as an officer in the National and State Guards from 1904 to 1919, being promoted successively from Second Lieutenant to Major.

William G. Busby, former chairman of the Missouri Public Service Commission, died at his home in Kansas City, Mo., on Jan. 4. He had been ill for nine months. His death followed a third stroke of paralysis. When the Missouri Public Service Commission was created, in 1911, Gov. Elliott W. Major named Mr. Busby to the commission. Later he was elected chairman and held that post six years. Mr. Busby served as State Senator from 1908 until 1913. He was formerly Mayor of Carrollton, Mo.

William Brownlee Albright, a director of the Sherwin-Williams Company, Cleveland, Ohio, died suddenly on Dec. 28, while visiting in Cleveland. Mr. Albright had been closely associated in both a business and personal way with most of the railroad officials in New York City, and numbered among his friends many of the most prominent railroad men in the United States. He started with the Sherwin-Williams Company in January, 1885. Mr. Albright was born in Philadelphia on July 17, 1855. For the past twenty-five years he has made his home in New York.

Joshua B. Lascell, at one time superintendent of the Charlotte line at Rochester, N. Y., died recently. When the railroad was built from Charlotte to the Ridge Road in 1889 he was made assistant superintendent and later became superintendent, which position he held until the road was merged with the Rochester lines. Mr. Lascell continued with the line until last August, when he retired. He was born 70 years ago in Niagara County, New York.

Benjamin Hudson Ryder, electrical engineer of the American Steel & Wire Company for the past 24 years, died suddenly on Dec. 26. He was widely known in the electrical and railroad circles of the country. Mr. Ryder was born in Hudson, N. Y., on Dec. 3, 1877.

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

Brisk Foreign Interest in American Equipment

Representatives of National Pneumatic Company, Recently Returned from Abroad, Very Optimistic

Experience of the National Pneumatic Company in developing foreign business indicates a broadening opportunity for American car equipment manufacturers. In the various countries of the Far East, continental Europe and in England interest is growing in the improvement of electric railway cars and in the application of modern American devices.

T. W. Casey, vice-president, and P. R. Foreman, general manager and chief engineer of the National Pneumatic Company, have recently returned after an extended foreign trip. Mr. Foreman visited Japan and continued west from that point until he joined forces with Mr. Casey in Paris, after the latter had proceeded east to England and continental Europe.

Foreign railways were found very much interested in the improvement of car equipment and in the application of pneumatic door control.

In Japan Mr. Foreman completed arrangements under which National Pneumatic devices will be manufactured in that country by the Mitsubishi Denki K. K. under National Pneumatic patents. Negotiations are now under way with the Imperial Government Railways and other lines in Japan looking to the installation of pneumatic door control apparatus.

In France the Chemin de Paris-Orleans, which has begun the electrification of its lines, is putting into service a sample installation of pneumatic door equipment. The cars are equipped with folding doors and are arranged for the interchange of passengers at platforms of different levels. Consideration is being given to the matter of equipping 120 cars with pneumatic door control.

An order for 50 car sets of pneumatic engines and control has been received for Bucharest in Rumania. These are for street car service and the design arrangement closely follows American door control practice.

In Berlin the Nord Sud subway cars are initiating the installation of pneumatic doors by equipping eight cars. These doors will be of the sliding type. The decision was dictated by the desire to increase speed and safety while at the same time reducing train operating costs. The Hochbahngesellschaft is watching the Nord Sud installation carefully from the standpoint of its own operating conditions.

Installation of pneumatic door control has made considerable progress in Spain. On the surface lines in Barcelona 62 cars of the center-entrance type have been in service with pneumatic door equipment for a period of approximately two years. Experience with these cars has been so satisfactory that future equipment will probably be of this type. The question of remodeling some of the older cars is being considered in comparsion with the advantages of new equipment.

Preparations are being made to open the first section of the new Barcelona subway. Cars for this service are being completed. They closely follow modern American practice and incorporate full pneumatic door equipment for the operation of twelve sliding doors per car, six on each side.

Interest in rehabilitation and improved equipment is also reported in England and London. The London Underground has in service a large number of pneumatically equipped cars. The London United Tramways, Ltd., has three cars in service equipped with automatic rear exit treadles.

Ohio Brass Holds Annual Sales Meeting

Field forces of the Ohio Brass Company gathered at Mansfield, Ohio, on Jan. 11 for their annual sales conference, which extended through the week. A daily program of meetings was held at the Mansfield plant up to Thursday night. Friday and Saturday were spent at the insulator plant in Barberton.

A careful analysis of Ohio Brass products is one of the features of these meetings. In addition to the discussion of marketing problems, the field men are brought into contact with factory development and manufacturing plans. As the company has grown and its products have become more diversified these annual meetings have been the means of maintaining that close contact between factory and salesmen which is one of the features of Ohio Brass Service.

Charles Gordon, assistant vice-president of the McGraw-Hill Company, took part in the program by presenting a series of charts showing the application of modern industrial marketing principles to the sale of electric railway equipment.

American Bus and Truck Plans

R. D. Scott, vice-president of the Chemical National Bank, New York, has been named treasurer of the newly organized American Bus & Truck Company, which recently purchased the Kelly-Springfield Motor Truck Company, Springfield, Ohio. This announcement was made by H. W. Torney, New York engineer connected with the company, who was in Springfield with C. C. Jamieson, chairman of the company board, for an inspection of the plant. Philip Diehl, Springfield, has been named assistant treasurer. The other officers are yet to be chosen.

The board of directors of the new company is composed of Mr. Jamieson, New York manufacturer; H. E. Freeman, president of the American Trust & Savings Bank, Springfield; Mr. Scott; Walter Kutzleb of the banking firm of Morgan, Livermore & Company, New York, and Mr. Torney.

The same sales branches of the former Kelly-Springfield company will be used by the new concern, which plans, in addition to other lines, to manufacture a complete line of buses on foreign patents.

New Cable for Detroit City Service

The Public Service Production Company, a subsidiary of the Public Service Corporation of New Jersey, is installing about 360,000 ft. of underground cable for the Detroit municipal light and street railway services. The contract was let by the Habirshaw Cable & Wire Company.

Appointments Made by International G. E.

A. S. Durant, formerly manager of the department of the Americas, has been made a vice-president of the International General Electric Company, in charge of commercial relations and with headquarters in New York City.

James C. Ryan, formerly sales manager of the department of the Far East, has been appointed general sales manager with responsibility for all sales of apparatus and supplies.

E. A. Baldwin, formerly manager of the department of Europe, has been appointed manager of the Schenectady office, with general supervision of the Schenectady office and responsibility for engineering and contract relations.

W. J. Edmonds, comptroller of the company, with headquarters in New York, in addition to his former duties, now has executive direction of the activities, with the exception of sales effort, of the International foreign sales companies.

Car Building and Motor Merger

New Company Planned to Control Brill and American Car & Foundry Motors Company—Merger Plan Expected to Be Declared Operative Soon

THE J. G. Brill Company, Philadelphia, Pa., is one of the principal figures in a combination of transportation equipment builders announced on Jan. 13 by Samuel M. Curwen, president. It involves companies having total assets of $150,000,000 and outstanding capital stock issues of nearly $75,000,000, with the American Car & Foundry Company of New Jersey the dominating factor through its acquisition of more than a majority of the voting stock of the new Brill corporation.

Mr. Curwen was active with William H. Woodin, president of the American Car & Foundry Company of New Jersey, in arranging the deal. In a letter to stockholders of the Brill company Mr. Curwen says:

> The object of the plan and reorganization, so far as the stockholders of the J. G. Brill Company are concerned therein, is to afford them opportunity to share in the advantages of a large and growing bus business conducted in conjunction with their present car business under co-operative management.
>
> Based upon appraisals of properties and audit of accounts, and if there shall be acquired by it the entire capital stock of the J. G. Brill Company, the Brill Corporation upon completion of its organization, will be possessed of assets representing a value of approximately $20,000,000, and the Brill Corporation will have a source of earnings for its stock equal to its share as a stockholder of both American Car & Foundry Motors Company and the J. G. Brill Company, in the combined earnings of the above described engine and bus companies and the J. G. Brill Company, which share in such combined earnings, based on past experience of said companies and continuance of present conditions, is estimated to amount to more than $2,150,000 per annum.

Under the name of the Brill Corporation, or some similar designation preserving the name Brill, a new corporation will be organized in Delaware to take over a majority of the outstanding stocks of the Brill company and the American Car & Foundry Motors Company, a Delaware corporation organized in December, 1925.

The latter corporation owns all the capital stock of the Hall-Scott Motor Car Company, California, and more than 90 per cent of the capital stock of the Fageol Motors Company, Ohio. The American Car & Foundry Company of New Jersey will own a majority of the voting stock of the new corporation.

More than 60 per cent of the common and preferred stocks of the Brill company have already been deposited under the plan. The plan provides that the new organization shall have 7 per cent cumulative preferred stock of about $4,000,000, par $100; 225,000 shares of no par Class A stock and 400,000 shares of Class B stock.

There are outstanding 48,102 shares of Brill common stock, a majority of which is held by Brill estates, and 45,800 shares of preferred stock. Holders of these shares can exchange them on the following basis:

Preferred stock: One and one-tenth shares of 7 per cent cumulative preferred stock of the new corporation, or $110 in cash, for each share held.

Common stock: One share of the 7 per cent cumulative preferred stock and one share of the Class B stock of the new corporation, or two shares of the Class A and one share of the Class B stock of the new corporation, or $125 in cash for each share held.

Last recorded sales of Brill common were at $136 a share and the preferred at $105.50.

Under the plan, the new company will acquire more than 50 per cent of the preferred and approximately 67 per cent of the common stock outstanding of the American Car & Foundry Motors Company, including all the stock owned or controlled by the American Car & Foundry Company of New Jersey. The latter concern, by the purchase or underwriting of such amount of the Class A shares of the new corporation as may be necessary, will provide the funds required for the purposes of the merger plan and additional working capital.

The American Car & Foundry Company will receive $1,500,000 in cash and all of the Class B shares of the new corporation not required for the purposes of exchange for stock of the Brill company. Class B shares alone have voting rights.

New Foreign Representative for American Foreign Sales Corporation

Charles R. Cullen, formerly manager for the west coast of South America for the Baldwin Locomotive Works, has joined the American Foreign Sales Corporation, 150 Broadway, New York City. Announcement of the formation of this organization appeared in the ELECTRIC RAILWAY JOURNAL for Oct. 24. Mr. Cullen will represent the company's interests in Peru, Bolivia, Chile and the Argentine, with offices in Lima, La Paz, Santiago and Buenos Aires.

In 1917 Mr. Cullen had charge of construction work in Brazil for E. J. Lavino Company, manganese shippers, later returning to this company and accepting a position with the Baldwin Locomotive Works. This resulted in his returning to South America in the latter part of 1919 to open offices for the Baldwin company in Peru and Chile.

Mr. Cullen was graduated from Cornell University, class of 1908, with the degree of mechanical engineer. After graduation, he joined the American Locomotive Company as a special apprentice, employed at both the Schenectady and Dunkirk plants until 1911, when he went with R. W. Hunt & Company, inspecting engineers, for a year. He then returned to the American Locomotive Company as a traveling engineer and commercial representative for the foreign sales department. While employed in this capacity, Mr. Cullen's field was very widespread, in Brazil, Colombia, Central America, Serbia, Bulgaria and Greece. He is a member of the American Society of Mechanical Engineers and is highly regarded in both foreign and domestic engineering circles.

Legislative Safeguards for Stability of Metal Prices Sought

Legislation will be sought during the present session of Congress to make it possible for American consumers of tin and other mineral commodities to pool their buying. It seems certain that the sub-committee of the interstate and foreign committee of the House of Representatives that will have charge of an investigation in this field will be urged to recommend such action on the part of the government.

In the case of tin, it is believed by some of the non-ferrous specialists in the government service, who expect to be called before the committee, that this step would constitute an important safeguard for the industry. Should the largest two American consumers—the United States Steel Corporation and the National Lead Company—have legal authority to join in their purchases of tin, they alone could do much

) insure against price inflation, it is aid.

While the production of Brazilian tin under American control, Nigerian n, under British control, is necessary) its efficaceous smelting. It will not e contended that there has been any agrant manipulation of tin by the ritish, but it will doubtless be pointed ut that they are in a position to bring bout price advances if they should de- ide to do so. This is an ever-present ossibility, with the success of rubber ontrol dangling before British eyes.

$6,000,000 Proposed for Extensions in San Francisco

Mayor James Rolph of San Francisco, al., recommended to the new Board f Supervisors the expenditure of $6,- 00,000 for 25 miles of new street car ines and 8 miles of bus lines during he year. If this work is carried for- ward it will mean a considerable exten- ion of present operations, for the unicipal railway system as now con- tituted comprises 69 miles of track and .4 miles of bus routes.

More Business Booked by General Electric

Orders received by the General Elec- ric Company for the year ended Dec. 31, 1925, amounted to $302,513,380. Compared with $282,107,697 for the year 1924, this was an increase of 7 per ent. For the three months ended Dec. 31, 1925, orders totaled $78,636,669, compared with $80,009,978 for the same quarter of 1924, a decrease of 2 per cent.

Tool Steel Company Is Optimistic

From the standpoint of orders re- ceived, 1925 was a record breaker for the Tool Steel Gear & Pinion Com- pany, Cincinnati, Ohio. A considerable amount of heavy traction electrification business came to the company from abroad, practically all of these orders hailing from electrifications where the manufacturer supplied the gears in 1914-1916. Incidentally, the foreign shipments are pretty well spread about the face of the globe, as shown by the following orders:

	Equipments
New South Wales Government Railway	150
Netherlands State Railway, Utrecht, Holland	100
London, Midland & Scottish Railway	96
Havana Central Railroad Company, Havana, Cuba	32
São Paulo Tramway, Light & Power Company, São Paulo Brazil	80

In the first three cases the gears weighed from 500 to 700 lb. each.

During the year two steel gears were specified on a total of 588 new motors which were bought for the street rail- way lines at Altoona, Atlanta, Scran- ton, Gary, Denver, Rochester, and Toledo. Basing their predictions on the trend of conditions during the past few months, the Tool Steel officials are con- vinced that the current year holds ex- cellent prospects for the industry.

Many Reports of Impending Car Purchases

Reports that persist in trade circles indicate that many important car pur- chases impend. The JOURNAL has not heard all of the reports by any means, but when in a single week rumors are on tap of the probable purchase of about 400 cars the matter deserves more attention than would be accorded to it if the purchases that are said to be impending were listed as separate items of news. Here are some of the rumors arranged on an ascending scale: Five cars for Chattanooga, ten for Nashville, ten for Evansville, 30 for Little Rock, 30 for Memphis, 75 for New Orleans, 100 for Philadelphia and 100 for Detroit. This is an imposing total, both in number of cars and in the amount of $3,600,000 estimated to be involved in their purchase.

The Chattanooga, Nashville and Evansville properties are controlled by the Hodenpyl-Hardy interests. So far as it was possible to learn, no direct ap- propriation has been authorized cover- ing these expenditures. The other Southern properties reported about ready to consider the purchase of cars are all under Electric Bond & Share su- pervision. Confirmation of this report could not be obtained, but judging from the progress that is being made indus- trially and in a civic way in each of these places it would appear likely that additions to equipment would follow. A somewhat similar situation appears to exist with respect to Detroit. No cars to the extent of the impending indicated order have been purchased and no bids have been asked recently. There is an equipment purchase pro- gram under way, but H. U. Wallace, general manager of the Department of Street Railways, says the program has not been definitely decided. No order has been placed by the Philadelphia Rapid Transit Company for 100 new cars. That is definite. However, the company has before it the problem of caring for the crowds expected to at- tend the Sesqui-Centennial and it has already worked out its plans for track extensions into the grounds and details of similar traffic arrangements. It may be that these plans as finally concluded will embrace a program that will in- clude among its items a provision for the addition of new rolling stock to the extent of the requirement previously indicated.

Prospects ahead in electric locomo- tive construction appear to be particu- larly good. Not only do inquiries for equipment indicate this, but it is con- firmed by the electrification projects for 1926 actually outlined. One of the large manufacturing companies han- dling this type of equipment now has inquiries for 75 or 80 electric locomo- tives. This may or may not represent the total of such inquiries from all sources, but it does represent a probable expenditure of $50,000,000. If all this work materializes the total will be in striking contrast with 1925, when 47 locomotives were reported to have been ordered at a cost of about $20,000,000.

$900,000 to Be Spent in Akron

Nearly $2,500,000 will be spent dur- ing 1926 for improvements in territory served by the Northern Ohio Traction & Light Company, Akron, Ohio. The tentative 1926 budget provides for the expenditure of approximately $900,000 in the street railway and interurban department, including the purchase of twenty new buses, ten of which will be

ELECTRIC RAILWAY MATERIAL PRICES—Jan. 12, 1926

Metals—New York

Copper, electrolytic, cents per lb.	14.15
Lead, cents per lb.	9.25
Nickel, cents per lb.	35.00
Zinc, cents per lb.	8.85
Tin, Straits, cents per lb.	63.00
Aluminum, 98 to 99 per cent, cents per lb.	27.00
Babbitt metal, warehouse, cents per lb.:	
Commercial grade	56 00
General service	31.50

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	$4.875
Somerset mine run, Boston	2.075
Pittsburgh mine run, Pittsburgh	2.05
Franklin, Ill., screenings, Chicago	1.875
Central, Ill., screenings, Chicago	1.425
Kansas screenings, Kansas City	2.375

Track Materials—Pittsburgh

Standard steel rails, gross ton	$43.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	2.95
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.	2.00
Ties, white oak, Chicago, 6 in. x 8 in. x 8 ft.	$1.35

Hardware—Pittsburgh

Wire nails, base per keg	2.65
Sheet iron (28 gage), cents per lb.	3.35
Sheet iron, galvanized (28 gage), cents per lb.	4.60
Galvanized barbed wire, cents per lb.	3.35
Galvanized wire, ordinary, cents per lb.	2.50

Waste—New York

Waste, wool, cents per lb.	12–18
Waste, cotton (100 lb. bale), cents per lb.:	
White	13–17.50
Colored	10–14

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), cents per lb.*	11.9
White lead in oil (100 lb. keg), cents per lb.	15.5
Turpentine (bbl. lots), per gal.	$1.115
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.	16.00
Rubber-covered wire, No. 14, per 1,000 ft.	$7.00
Weatherproof wire base, cents per lb.	18.25

Paving Materials

Paving stone, granite, 5 in. New York—Grade 1, per thousand	$147
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd.	$2.70
Paving brick 3½x8½x4, N. Y., per 1,000 in carload lots	51.00
Paving brick 3x8½x4 N.Y., per 1,000 in carload lots	45.00
Crushed stone, ¾-in., carload lots, N. Y., per cu.yd.	1.85
Cement, Chicago consumers' net prices, without bags	2.10
Gravel, ¾-in., cu.yd., f.o.b. N. Y.	1.75
Sand, cu.yd., f.o.b. N. Y.	1.00

Old Metals—New York and Chicago

Heavy copper, cents per lb.	11.75
Light copper, cents per lb.	9.75
Heavy brass, cents per lb.	7.25
Zinc, old scrap, cents per lb.	5 125
Lead, cents per lb. (heavy)	8 00
Steel car axles, Chicago, net ton	$17 75
Cast iron car wheels, Chicago, gross ton	18. 25
Rails (short), Chicago, gross ton	18 75
Rails, (relaying), Chicago, gross ton	25.50
Machine turnings, Chicago, gross ton	9.50

*The method of selling linseed oil on a gallon basis has been changed and all sellers now quote on a pound basis.

double-deck carriers. A new freight depot will be built in North Howard Street and cars purchased for the freight traffic. An addition will be built to the South Akron substation at a cost of $350,000.

What Is the Life of a Paving Brick?

An important investigation is being conducted by the United States Bureau of Public Roads to ascertain the durability of a vitrified paving brick wearing surface. On a circular track located at the bureau's experimental farm at Arlington, Va., ten sections of vitrified brick paving have been laid out, the only variable being found in the depth (or thickness) of the brick. This ranges from 2 in. to 4 in., being graded in increases of ½ in.

The object is to determine the intensity and weight of traffic that can be withstood by the various depths of the vitrified brick wearing surface. To this end artificial impact is being introduced and every attention given to subjecting the brick wearing surface by means of intensified traffic to the same sort of punishment and in the same or greater degree that it would get under normal use in a public street or highway. The need for this test became apparent through the increasingly greater use of thinner brick by highway engineers throughout the country. It was considered advisable to ascertain as definitely as possible through such a test just what traffic the various thicknesses of brick can be expected to withstand.

Electric Train for the Erie

A gasoline-electric train intended for the Erie Railroad is now under construction by the J. G. Brill Company, Philadelphia. It consists of a combination motor and baggage car and three day coaches. The new equipment will be placed in service around the middle of January on the Jefferson branch, near Carbondale, Pa. This will be the first gas-electric train to be commercialized in that section.

Rolling Stock

Montreal Tramways, Montreal, (Que.) Canada, has awarded a contract to the Canadian Car & Foundry Company, Ltd., for the construction of 50 new cars. The value of the contract is approximately $900,000. It is said that delivery will commence in the spring.

Tampa Electric Company, Tampa, Fla., received on Dec. 28, 1925, seven new cars which were referred to in the ELECTRIC RAILWAY JOURNAL, issue of Dec. 12, 1925, page 1060. The details follow:

Builder of car body	American Car Company
Type of car	Semi-convertible motor passenger
Seating capacity	52
Total weight	32,500
Bolster centers, length	23 ft. 9 in.
Length over all	45 ft. 4 in.
Truck wheelbase	5 ft. 4 in.
Width over all	8 ft. 3 in.
Body	Steel
Interior trim	Light mahogany
Roof	Arch
Air brakes	Westinghouse variable load
Armature bearings	Plain
Axles	A. E. R. E. A. standard
Bumpers	3-in. channel
Car signal system	Faraday high voltage
Car trimmings	Bronze
Center and side bearings	Brill
Compressors	Westinghouse DH-16
Control	K-35-KK
Couplers	None
Curtain fixtures	Curtain Supply Company
Curtain material	Pantasote
Destination signs	Hunter
Door-operating mechanism	Westinghouse
Exterior finish	Enamel
Fare boxes	Johnson
Fenders or wheelguards	H-B
Gears and pinions	Nuttall
Hand brakes	American Car Company
Headlights	Golden Glow SM-95
Journal bearings	Plain
Journal boxes	Brill
Lightning arresters	Westinghouse K-3
Motors	Westinghouse No. 510, inside hung
Registers	International R-10
Sanders	American Car Company
Sash fixtures	O. M. Edwards
Seats	Waylo
Seating material	Pantasote
Slack adjuster	American
Springs	Brill
Step treads	Feralun
Trolley catchers	Ideal
Trolley base	Ohio Brass
Trucks	Brill 77-E
Ventilators	Utility
Wheels	26-in. cast iron
Special devices, etc.	Nichols-Lintern traffic light

Indianapolis Street Railway, Indianapolis, Ind., overhauled and remodeled 75 cars in the company's shops during 1925. The program for the new year calls for remodeling 100 street cars so that they can be operated by one man when desired.

Track and Line

Sioux City Service Company, Sioux, City, Ia., will spend about $150,000 on the construction of four major improvements during 1926. Financing for this work was made possible by the recent granting of a 25-year franchise to the company. The work planned is: A turnout will be constructed on upper Jackson Street between Thirty-fourth Street and Thirty-fifth Street. Elimination of the traffic menace at the Peters Park intersection will be accomplished by a curve and cross-over which will be constructed near the intersection of Transit Avenue and Morningside Avenue. The waiting room at this intersection will be abandoned, which will open Transit Avenue to vehicular traffic. A new line, probably double track, will be constructed on Sixth Street from Pierce Street to Jones Street, thus forming a new loop for the downtown district. New track will be laid on Eleventh Street from Court Street to Wall Street.

British Columbia Electric Railway, Vancouver, B. C., it is reported will spend $200,000 in double-tracking in 1926. Most of the money will be expended in Point Grey.

Portland Electric Power Company, Portland, Ore., in its budget for 1926 calls for an expenditure of approximately $3,200,070. In the railway department the city lines' estimate is $550,000 and the interurban lines' estimate $320,000.

Indianapolis Street Railway, Indianapolis, Ind., included in its track projects of 1925 an additional track of approximately 3,700 ft. and 4,500 ft. of track in East Tenth Street. In Central Avenue 4,030 ft. of single track was replaced and in Pennsylvania Street, 4,000 ft. of single track was replace and an additional 1,000 ft. laid to pr vide double-track facilities. Renewal were made at practically every one c the downtown intersections. The com pany used 1,500 tons of steel, 38,00 ties, 670,000 paving bricks and 60,00 paving stones. In connection with thi work, 5,600 rail joints were welded b the thermit process.

Trade Notes

E. C. Folsom has been appointed receiver for the Railway Materials Company, Toledo, Ohio, by an order of the United States District Court at Toledo Notice has been mailed to creditors of the company requesting them to file claims promptly in order that the assets may be quickly and economically liquidated.

J. G. Brill Company, Philadelphia, Pa., announces the appointment of F. O. Paul as service manager of its automotive car division. For several years Mr. Paul was connected with the sales and service departments of the Timken Roller Bearing Company, Canton, Ohio. He was previously affiliated with the International Motor Company as chief inspector at its New Brunswick, N. J., plant. His experience in automotive affairs covers a period of more than fifteen years.

Morton Manufacturing Company, Chicago, Ill., has purchased property adjacent to its present Chicago plant, on which it is planning the construction of an addition which will provide 50,000 sq.ft. of extra shop space.

L. S. Belding has joined the Electric Service Supplies Company, Philadelphia. He is a graduate of Pratt Institute, Department of Science and Technology, later attending the H. L. Doherty School at Toledo. After leaving the army Mr. Belding was connected with the Albany Felt Company as factory engineer, and as factory and service engineer for the Consolidated Car Heating Company. Later he acted as sales engineer for the latter company. Mr. Belding will cover Ohio and part of Michigan for Electric Service Supplies Company.

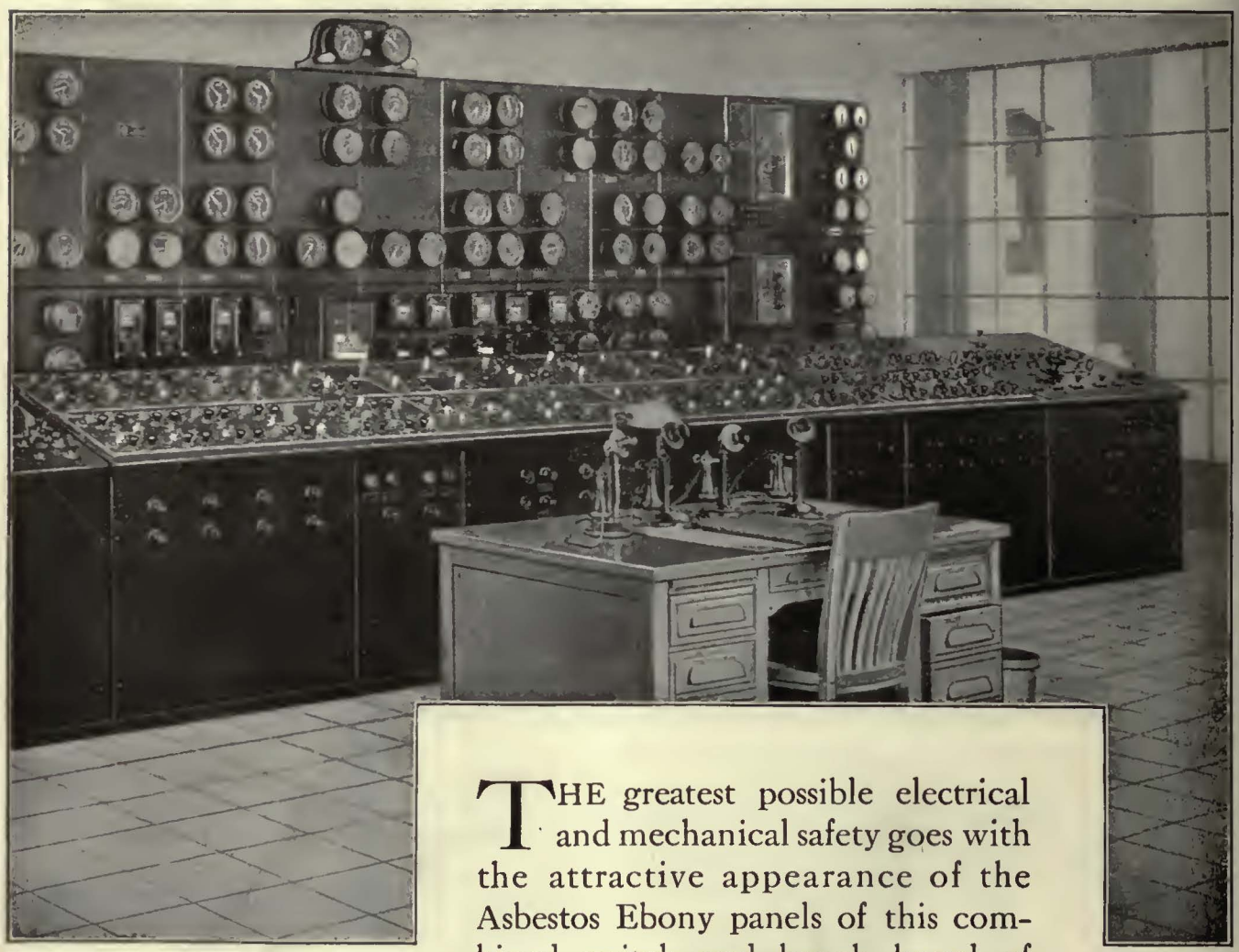
New Advertising Literature

General Electric Company, Schenectady, N. Y., has issued Bulletin GEA-295, entitled "Automatic Switching Equipment." It is well illustrated and describes the application of this equipment to railway service, hydro-electric generators, mining and industrial service, central station service, etc.

Topping Brothers, New York, distributors for Bearium Bearings, Inc., Buffalo, N. Y., have issued a leaflet setting forth the outstanding advantages of these bearing metals for all types of industrial requirements. Five grades of metal are specified, each adapted for certain types of work. Among the merits claimed for Bearium products are the overcoming of porosity, ease of machining, non-scoring of shafts or journals under faulty lubrication conditions, longer service and greater strength.

Bankers and Engineers

Asbestos Ebony Panels



Installation by the Bureau of Power and Light, Los Angeles, Calif.

THE greatest possible electrical and mechanical safety goes with the attractive appearance of the Asbestos Ebony panels of this combined switch and bench board of the Bureau of Power and Light, Los Angeles, Cal.

Asbestos Ebony surpasses all other switchboard materials in dielectric strength, physical resistance, and workability.

JOHNS-MANVILLE Inc.
292 Madison Avenue, at 41st Street, New York City
Branches in 64 Large Cities
For CANADA: CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

Through—
Electrical Materials
FOR
Utilities
Jobber
Contractor
AND
Dealer

JOHNS-MANVILLE

The Canadian Pacific Railway Chooses the Fageol Safety Coach

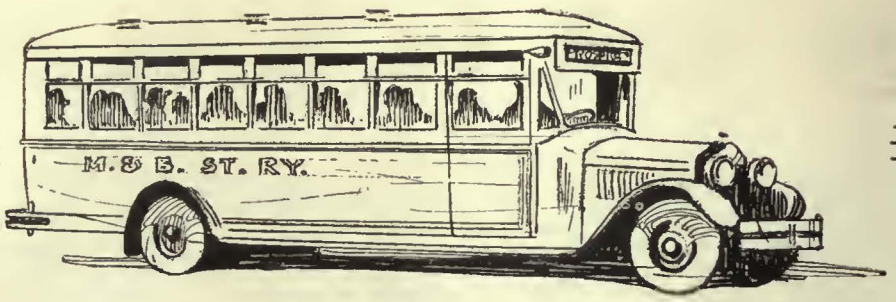
After a minute and careful engineering investigation of the entire motor bus field, the Canadian Pacific Railway Company chose Fageol Safety Coaches to equip its new bus operating subsidiary, the Canadian Pacific Transport Company, Ltd.

They bought on the basis of established and demonstrated facts—superior earning power, through greater passenger appeal, and lower "last costs."

FAGEOL SAFETY COACH

Territory West of the Rocky Mountains served by
Fageol Motors Company
Hollywood Blvd. at 107th Ave.,
Oakland, California

Territory East of the Rocky Mountains served by
The Fageol Company
(In the Akron District)
Kent, Ohio



In the service of the Middlesex & Boston St. Ry., White Buses

LEECE-NEVILLE EQUIPPED

Passengers riding home from work appreciate a good steady reading light in the buses. Operation on a regular schedule, with cost per bus-mile shaved down to a profitable minimum, demands the use of thoroughly reliable electrical equipment.

These two basic requirements of an electrical system for bus service are fully met by LEECE-NEVILLE Voltage Regulation,—standard on the White Buses operated by the Middlesex and Boston Street Railway.

Other advantages of this up-to-date system are listed to the right. If you are interested we will gladly send you an interesting booklet discussing the question in full detail. *Write us.*

Note these demonstrated advantages

The battery cannot be over-charged.

The battery is charged only at the correct rate for its condition.

The battery will go longer without refilling with water.

The life of the battery is greatly prolonged.

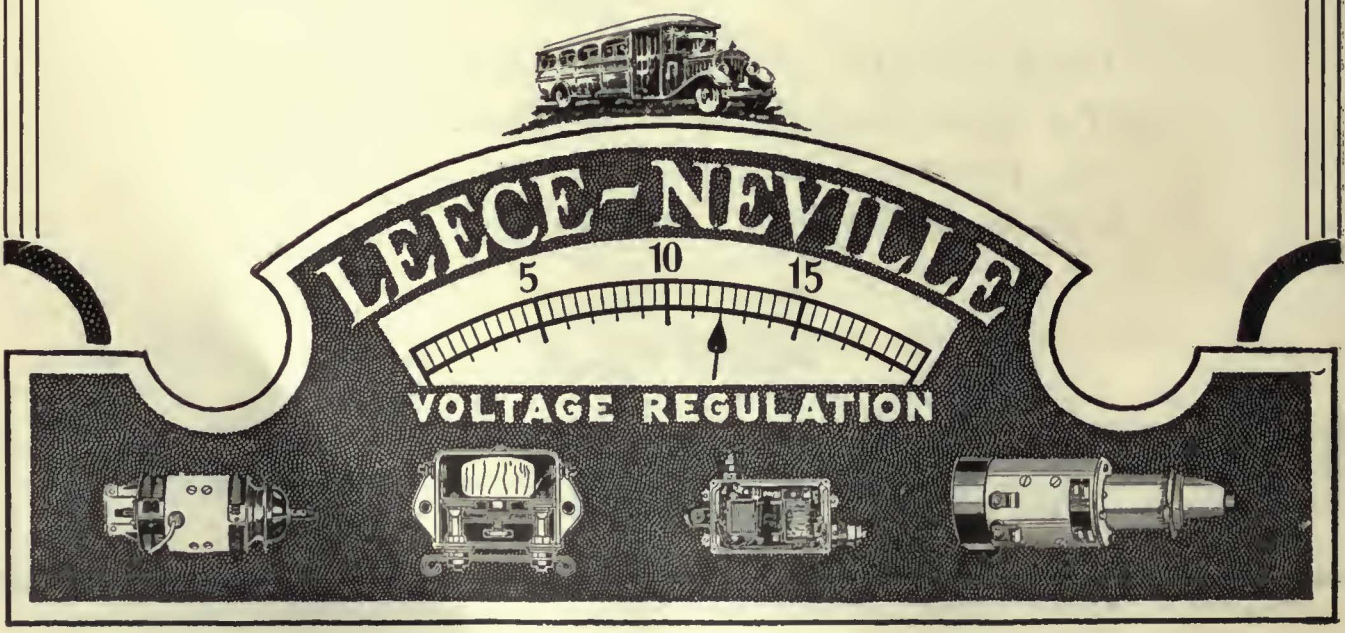
The lights can be operated direct from the generator when the engine is running.

Loose or corroded battery connections will not cause the lamp bulbs to burn out due to a rise in voltage.

It is the most economically operated generating system for motor bus use.

Write for descriptive booklets

THE LEECE-NEVILLE COMPANY
CLEVELAND, OHIO

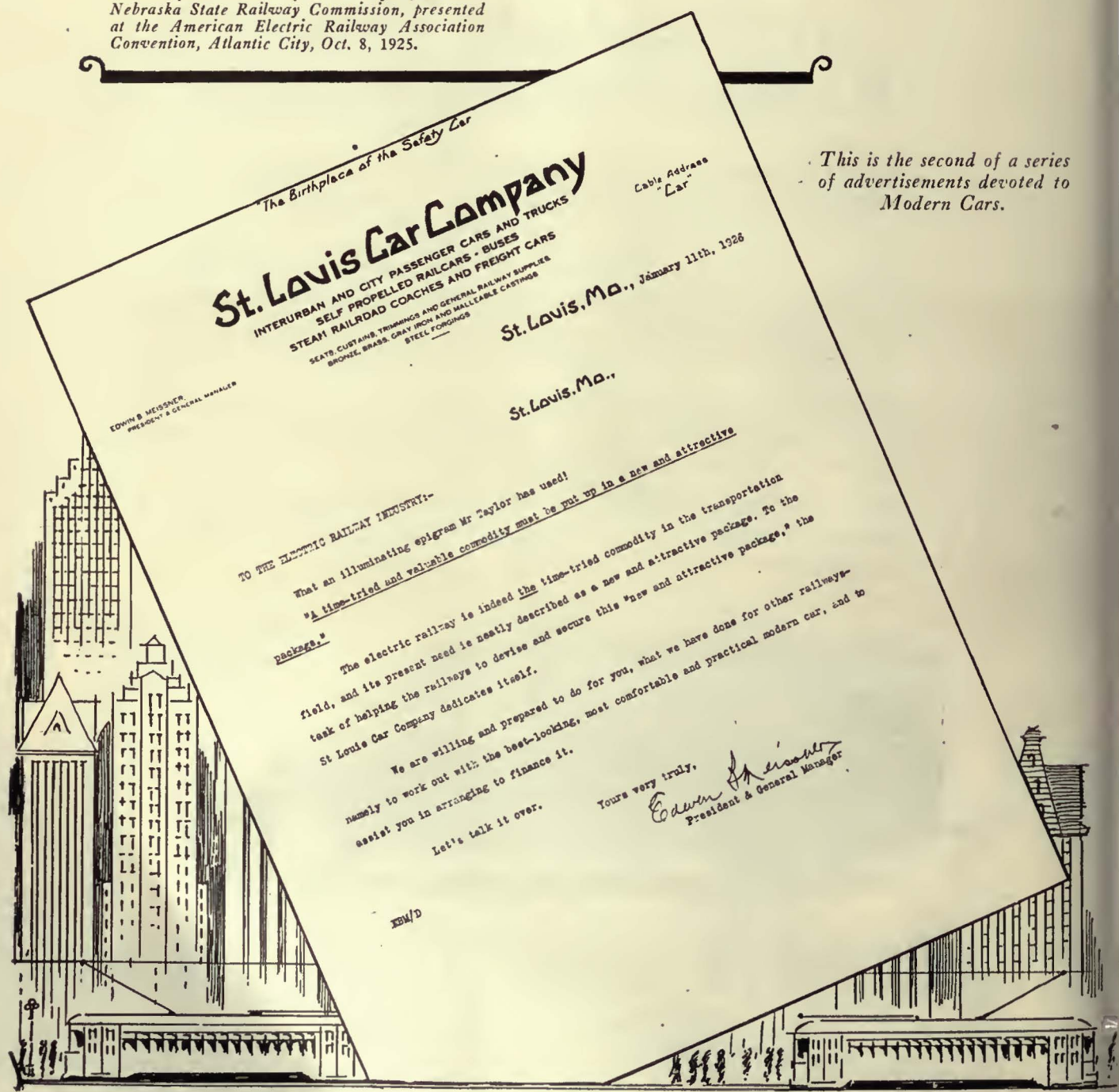


MODERN CARS for

H. G. Taylor said—

"The rider who in the old days enjoyed his trip on the street car because he knew no better method of transportation has become independent and critical..... Old methods, therefore, will necessarily have to be discarded with old conditions..... A time-tried and valuable commodity must be put up in a new and attractive package."

Extracts from address of H. G. Taylor, Member Nebraska State Railway Commission, presented at the American Electric Railway Association Convention, Atlantic City, Oct. 8, 1925.



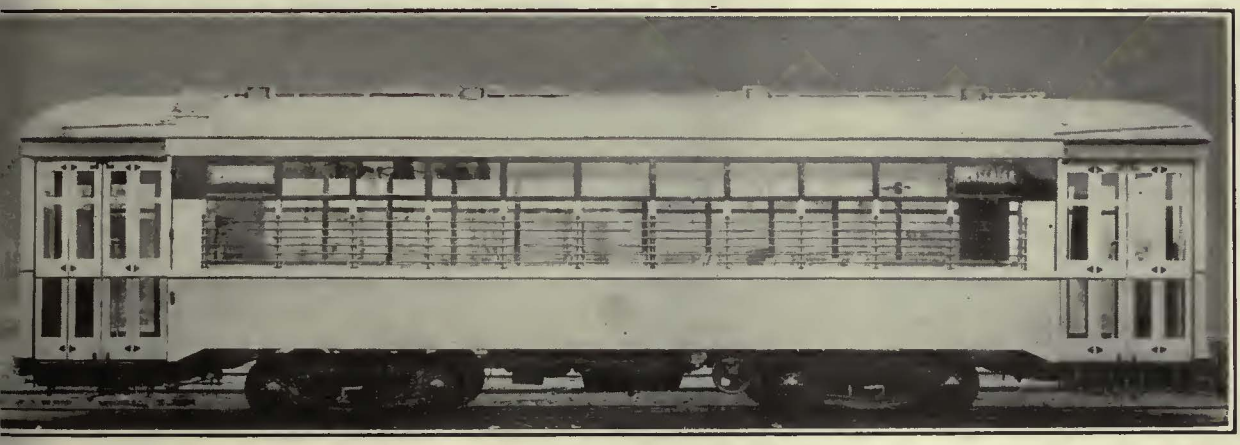
This is the second of a series of advertisements devoted to Modern Cars.

Modern Conditions—

Johnstown Traction Co., Johnstown, Penna.

started the New Year by placing in service 10 attractive looking city cars built at the QUALITY SHOP of the St. Louis Car Company. The officials of the traction company justify their belief in a "new and attractive package" by having the exterior of these cars painted blue and white with red upper sash frame; the interior is finished in bright mahogany and the cars are brilliantly lighted, resulting in increased patronage on the part of the traveling public. The St. Louis trucks under the car illustrated are equipped with SKF roller bearings.

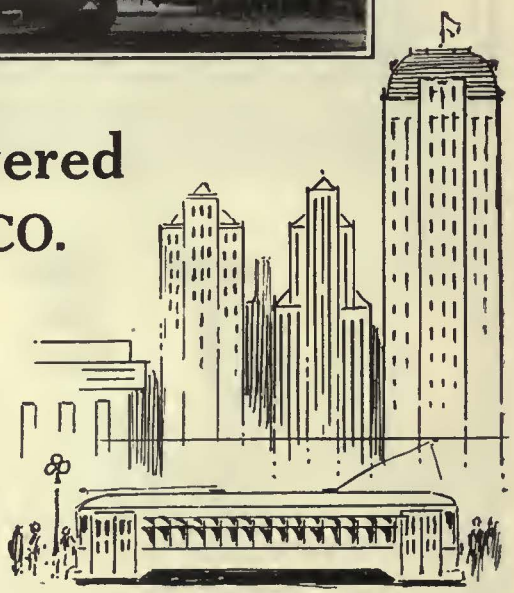
Quality Cars



Ten New Cars Recently Delivered
TO JOHNSTOWN TRACTION CO.
JOHNSTOWN, PENNA.

by

St. Louis Car Company
St. Louis, Mo.
"The Birthplace of the Safety Car"



. . and for the Los Angeles Railway Safety Coaches

General Cords, of Course!

Sixty-five busses—safety coaches like the one pictured and big, heavy double-deckers—that's the fleet of the Los Angeles Railway, one of the finest in the West.

Naturally, the tires used are the finest and most economical money can buy—husky, long-lived General Cords.

So many large fleet operators are swinging over to Generals! . . . to make sure of the lowest possible tire cost per mile.

Riding on less inflation — *and with less internal wear* — Generals absorb the jolts and jars of the road, providing real protection for the mechanism of the bus.

Thanks to their lower rolling-resistance, Generals bring a substantial yearly saving in power and gasoline consumption, assuring the lowest possible cost of operation.

And *that's* what every fleet operator wants.

The Mark of Leading Tire Stores Everywhere

The GENERAL

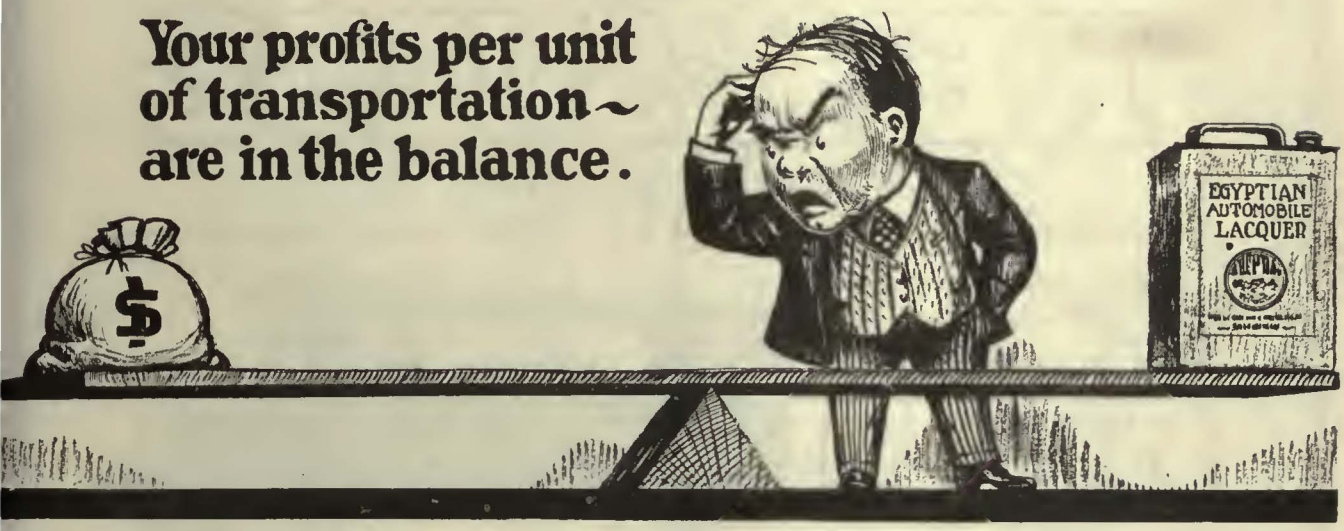
CORD

—goes a long way to make friends

BUILT IN AKRON, OHIO, BY THE GENERAL TIRE AND RUBBER CO.

Finish or Refinish

Your profits per unit of transportation ~ are in the balance.



FINISHING new railway cars or refinishing old ones, your profits per unit of transportation are in the balance. It's the attractively finished cars that bring in the business.

But, why use Egyptian Lacquer?

—because its permanent finish keeps your cars out of the shop and "in service."

—because the ease and speed of application make finishing and refinishing cheaper, not only from labor standpoint but from the shop time standpoint. Successive coats of Egyptian Lacquer may be applied with spray gun in one-hour periods.

—because for fifty years this company has manufactured lacquers exclusively, offering a product based on practical manufacturing experience and research.

Consult us before specifying your next finishing or refinishing job.

The EGYPTIAN LACQUER MFG. CO.
90 West Street, New York

EGYPTIAN LACQUERS

TIMKEN

Tapered

ROLLER BEARINGS

In Trolley Bases

It can be done. A trolley base that will swing free and true forever, without risk of wobble or binding, is made possible by the use of Timken Tapered Roller Bearings.

In the O-B Trolley Base, produced by The Ohio Brass Co., Mansfield, Ohio, Timken Bearings maintain alignment despite weight, shock, and the constantly shifting thrust reaction of the pole. With their greater bearing area per unit of required space, Timkens carry maximum loads most compactly, which fits this trolley base for heavy duty on electric freight, as well as for smaller passenger cars.

Eliminating excess friction, and permitting perfect enclosure, Timken Bearings in trolley bases make this inaccessible point independent of constant lubrication or other attention.

There are always new examples of the many betterments Timken Bearings produce in any mechanism.

THE TIMKEN ROLLER BEARING COMPANY, *CANTON, OHIO*

"Today's winners in the endurance contest are—"

Whenever the results of the "wear-and-tear" contest are posted, Boyerized Parts get the first places.

Made to stand the gaff of hard usage, they outlast the average contestant by three to four times.

On your next job pick your railway supplies from the winners shown at the left.

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

We'll gladly quote on your requirements

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, 722 Pacific Electric Bldg., Los Angeles, Cal.

"It's Boyerized"

"Boyerize to economize"

Six Years

Troy Pike, Dayton, Ohio, when Dayton Ties were being put in under the southbound track of the Dayton & Troy Electric Railway.

# of Traffic

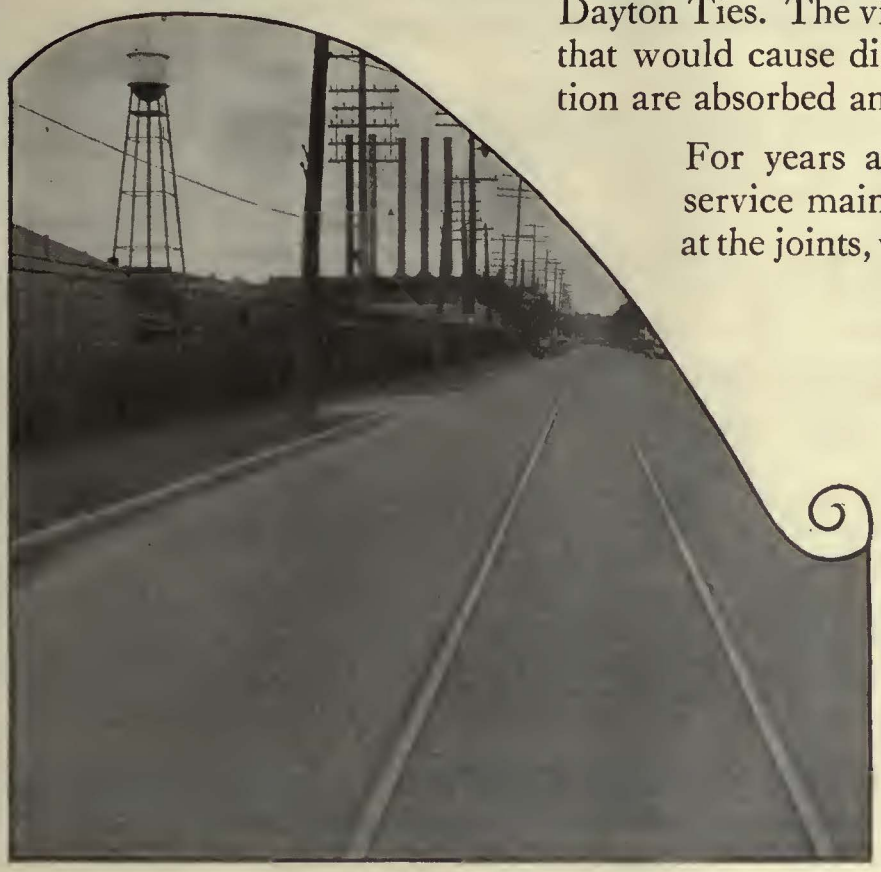
And the track looks like this

The best testimonial is performance. The condition of Dayton Tie track after years of heavy service under traffic is its best recommendation.

In it can be read the value of the RESILIENT wood block and asphalt cushion construction of Dayton Ties. The vibration and blows of traffic that would cause disintegration of the foundation are absorbed and deadened.

For years and years of smooth, quiet service maintenance is negligible, even at the joints, where trouble usually starts.

Dayton Resilient Ties will save you more money in both installation and maintenance costs than you probably think possible. You owe it to your job to KNOW what they will do.



The same track in 1924. Heavy interurban traffic has left no mark upon it. McCook Field, the Army Air Base, is on the left.

Write to us for details of construction and cost data.

Special-ization

THE operating engineer who takes charge of your machinery is undoubtedly a highly skilled man, and fully competent for the work he is expected to do. But why ask him to do something that has not entered into his training?

An operating engineer is not a lubricating engineer. He should not be expected to choose the proper grades of oils and greases for the machinery in his charge.

Lubrication is not a side-line—it is an extensive and very exacting branch of the engineering profession. Many of the lubricating specialists in our employ have been studying lubricating problems for more than ten years, and are still learning. For new problems arise to be solved every day.

We offer you the services of these engineers without charge. They will make a survey of your plant, and will recommend the correct grades of oils and greases for use on each piece of machinery.

Standard Oils and Greases

will, when correctly used, save power, reduce friction and lower depreciation costs. But every piece of machinery has its individual lubrication requirements. An oil or grease that is exactly suited to the requirements of one bearing may cause another to burn out in a few days.

If you want to be sure that the correct grades of lubricants are being used on your equipment, phone or write our nearest branch office and arrange for a survey by our engineers.

STANDARD OIL COMPANY

(Indiana)

General Offices: 910 S. Michigan Avenue Chicago, Illinois

Over 70 per cent placed repeat orders which proves that "Tool Steel" gear & pinions are best by test

read the story

10 years ago our company gave free of charge 58 "Tool Steel" pinions to 58 different electric railway companies, who had not before used our product. They agreed to keep track of the pinions and report to us at intervals as to how they were performing.

After a lapse of 10 years we have checked up and find of the 58 companies, 41 have placed repeat orders with us and have bought a total of 607 gears and 1814 pinions as the result of the test they ran. 17 companies either failed to follow their records or did not place repeat orders. Of these 17—eight are not operating at the present time.

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

The Tool Steel Gear and Pinion Co.
Cincinnati, Ohio

Humboldt County
Van Duzen River Bridge
View looking North.

Construction Work—Bridge across Truckee River and S.P.R.R. tracks located in Nevada County, near Polaris.

Bridge over North Fork Pacheco Creek. Located in Santa Clara County

News from California about Concrete

Field control of concrete quality is now standard practice of the California State Highway Department.

During the last year and a half fifty bridges in various parts of the state have been built strictly in accordance with this practice.

Recognition has been given the principle that the most important factor in obtaining concrete of uniform strength is *control of the water ratio.*

In designing the proper mix for this control, aggregates have been graded by sieve analysis; proportions have been accurately determined by fineness modulus.

Then as a check on the consistency of the concrete, slump tests were made at regular intervals.

Finally, strengths on all jobs were verified by testing field cylinders made of concrete as it came from the mixer.

Results of these tests prove—as similar tests have proved on many other jobs throughout the country—that field control insures uniformly better concrete.

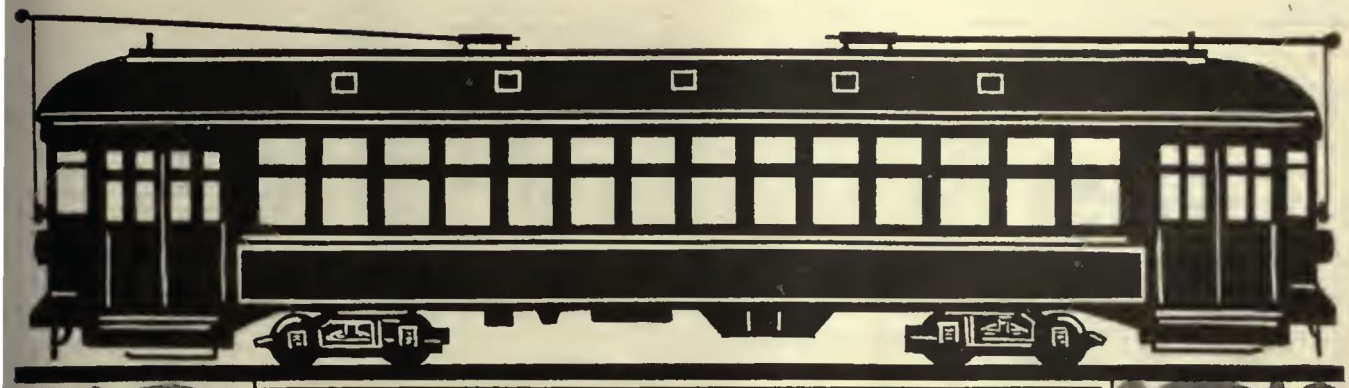
Write today for a copy of "Design and Control of Concrete Mixtures." Address the nearest office listed below. There is no obligation.

PORTLAND CEMENT ASSOCIATION

A National Organization to Improve and Extend the Uses of Concrete

ATLANTA	DALLAS	KANSAS CITY	NEW YORK	SALT LAKE CITY
BIRMINGHAM	DENVER	LOS ANGELES	OKLAHOMA CITY	SAN FRANCISCO
BOSTON	DES MOINES	MILWAUKEE	PARKERSBURG	SEATTLE
CHARLOTTE, N.C.	DETROIT	MINNEAPOLIS	PHILADELPHIA	ST. LOUIS
CHICAGO	INDIANAPOLIS	NASHVILLE	PITTSBURGH	VANCOUVER, B. C.
COLUMBUS	JACKSONVILLE	NEW ORLEANS	PORTLAND, ORE.	WASHINGTON, D. C.

Our Booklets are sent free in the United States, Canada and Cuba only



THE ILLINOIS STEEL COMPANY makes no extravagant claims for Gary Wrought Rolled Steel Wheels in electric railway service. It merely submits that for years and years it has been a world-leader in quality steel manufacture; that all the skill, metallurgical knowledge and engineering experience gained in this long period has been incorporated into the design and manufacture of Gary Wrought Steel Wheels; and that wherever these wheels have been used, notable performance has been recorded.

If, therefore, you are not entirely satisfied with your present wheels; if perhaps they need replacing too frequently or regrinding too often; if, in a word, they don't give you the service that you think perfect wheels should give—we suggest that you investigate the records being made regularly by the Gary Wrought Steel Wheel in service similar to your own.

Illinois Steel Company

General Offices • 208 South La Salle Street
Chicago, Illinois

GARY WROUGHT STEEL WHEELS

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..... 4.30 an inch
8 to 14 inches..... 4.10 an inch

Rates for larger spaces, or yearly rates, on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

POSITIONS WANTED

ELECTRIC railway engineer, 25 years' experience, desires new connection, as general manager or assistant in operating field. Previous experience has been with two of the largest electric railways in U. S. One combined city and interurban, other in very large city. PW-877, Electric Railway Journal, Tenth Ave. at 36th St., New York.

SUPERINTENDENT transportation, qualified by a wide experience and successful record on large city and interurban properties; successful in handling labor. Public relations, safety campaigns, etc., recognized as an efficient, progressive official fully capable of getting results. At present engaged. Personal reasons for desiring change. High-class references from leading executives. Correspondence invited. PW-858, Electric Railway Journal, 401 Guardian Bldg., Cleveland, Ohio.

BUSINESS OPPORTUNITY

Man Wanted

to take hold of the promotion end of the Houston, Beaumont and Orange Interurban Line, capital stock $400,000.00. Will allow $250.00 per month for helping and assembling the work and 5 per cent commission on land that the holding company is taking over along the line. Must be interested $2,500.00 in land along the line. Report for duty at once with a good chance of promotion within four months, provided he can comply with the above. Reference Bradstreet and Dunn. Write to Ed Kennedy, 911 Chronicle Bldg., Houston, Tex.

Attention—Buyers

FOR SALE APPROXIMATELY

4000 tons of 70 lb. ASCE first class Steel Rail and Angle Bars, 30-ft. lengths.

Approximately 1000 tons of same class of Rails, 60-ft. lengths.

ROTARY CONVERTERS

300 K.W. Westinghouse, 600 v. D.C., 6 ph., 60 cy., 1200 R.P.M. with 33,000 v. step down transformers complete with panel boards and instruments.

Bronze trolley ears, steel pole brackets, etc.

Thousands of poles and ties.

Immediate Shipments
Get in touch with us now

HYMAN-MICHAELS CO.

Peoples Gas Bldg., Chicago

When Writing Your Ad

Provide an indexing or subject word.

Write it as the first word of your ad.

If it is a Position Wanted or Position Vacant ad, make the first word the kind of position sought or offered.

This will assure proper classification in the column. The right is reserved to reject, revise or properly classify all Want Advertisements.

Proper Classification
increases the possibility of
Prompt Returns

0301

BOILERS

FOR SALE

6—Aultman & Taylor Boilers, 500 hp., 12 tubes high and 18 tubes wide with stokers; used about 25 years, in original location at power plant.

Kansas City Railways Company
Kansas City, Missouri

Rotary Converters
BARGAINS

4—300 Kw. 60 Cycle.
2—500 Kw. 60 Cycle.

Above are complete units ready for operation.

Transit Equipment Company
Cars—Motors
501 Fifth Avenue, New York

FOR SALE

30 Birney Safety Cars

Brill Built

West. 508 or G. E. 264 Motors. Cars Complete—Low Price—Fine Condition.

ELECTRIC EQUIPMENT CO.
Commonwealth Bldg., Philadelphia, Pa.

TO HELP YOU

FIND A NEW OR BETTER JOB

"Searchlight" Advertising

G-5

4 High Grade, High Speed, 56 PASSENGER COMBINATION (Smoking and Baggage) CARS

Exceptionally Good for Interburban Service

All in excellent condition. Built by Kuhlman. Length over all, 57 ft. Height over trolley board, 12 ft. 5 in. Height over all, 13 ft. 10 in. Number of seats, 26. Type of motors, four G. E. 205. Make of trucks, Brill. Wheel base, 7 ft. Controller, G.E.—MC—74. Toilets, 34x36-in. Air Compressor, WH-D-2.

For illustration of these cars, see our advertisement in the January 2nd issue of this publication. Watch for advertisement in January 30th issue, offering other types of cars.

J. W. GERKE, *Railway Equipment*
303 Fifth Ave., New York City

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.

Air Brakes
Christensen Air Brake Co.

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

Armature Shop Tools
Elec. Service Supplies Co.

Asphalt Paint
American Asphalt Paint 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.
Illinois Steel Co.
Johnson & Co., J. R.
St. Louis Car Co.
Standard Steel Works

Axles, Carbon Vanadium
Johnson & Co., J. R.

Axles, Steel
Carnegie Steel Co.

Babbitt Metal
Ajax Metal Co.
Johnson & Co., J. R.

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

Barges, Steel
American Bridge Co.

Bearings and Bearing Metals
Ajax Metal Co.
Bemis Car Truck Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse E. & M. Co.

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

Bearings, Roller and Ball
Timken Roller Bearing Co.

Bells and Gongs
Brill Co., The J. G.
Elec. Service Supplies Co.
St. Louis Car Co.

Body Material—Haskelite & Plymetl
Haskelite Mfg. Corp.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bolts & Nuts, Track
Illinois Steel Co.

Bond Testers
Amer. Steel & Wire Co.
Elec. Service Supplies Co.

Bonding Apparatus
Amer. Steel & Wire Co.
Elec. Service Supplies Co.
Ohio Brass Co.
Railway Track-work Co.
Una Welding & Bonding Co.

Bonds, Rail
American Steel & Wire Co.
Elec. Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Railway Track-work Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

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

Brake Adjusters
National Ry. Appliance Co.
Westinghouse Tr. Br. Co.

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

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
General Electric Co.
National Brake Co.
Safety Car Devices Co.
St. Louis Car Co.

Brake Lining, Asbestos
Johns-Manville, Inc.

Bridges, Steel
American Bridge Co.

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

Brush Holders
Flower, D. B.

Buildings
American Bridge Co.

Building Materials, Fire Proof
Johns-Manville, Inc.

Bulkheads
Haskelite Mfg. Corp.

Buses, Motor
Brill Co., The J. G.
Cummings Car & Coach Co.
Fageol Motor Co.
Garford Motor Truck Co.
Graham Bros.
Mack Trucks
St. Louis Car Co.
Yellow Coach Co.

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

Cables (See Wires and Cables)

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

Carbon Brushes (See Brushes, Carbon)

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

Car Lighting Fixtures
Elec. Service Supplies Co.

Cars, Dump
Differential Steel Car Co.
St. Louis Car Co.

Cars, Gas Rail
St. Louis Car Co.

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

Cars, Self-Propelled
General Electric Co.

Car Wheels, Rolled Steel
Bethlehem Steel Co.

Castings, Brass, Composition or Copper
Ajax Metal Co.
More Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries.
Bemis Car Truck Co.
St. Louis Car Co.
Standard Steel Works
Wm. Wharton, Jr. & Co., Inc.

Castings, Malleable & Brass
Amer. Br. Shoe & Fdy. Co.
Bemis Car Truck Co.
St. Louis Car Co.

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

Catenary Construction
Archbold-Brady Co.

Ceiling Car
Haskelite Mfg. Corp.
Pantasote Co., Inc.

Cement Products
Portland Cement Assn.

Cements, High Temperature
Johns-Manville, Inc.

Change Carriers
Cleveland Fare Box Co.
Electric Service Supplies Co.

Circuit-Breakers
General Electric Co.
Westinghouse E. & M. Co.

Clamps and Connectors for Wires and Cables
Dossert & Co.
Elec. Ry. Equipment 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.
Root Spring Scraper Co.
St. Louis Car Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Elec. Service Supplies Co.

Coils, Armature and Field
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.
General Electric Co.
Mica Insulator Co.
Westinghouse E. & M. Co.

Compounds, Insulating
Johns-Manville, Inc.

Compressors, Air
General Electric Co.
Westinghouse Tr. Br. Co.

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

Condenser Papers
Irvington Varnish & Ins. Co.

Conduit Duct, Underfloor
Johns-Manville, Inc.

Conduit, Fibre
Johns-Manville, Inc.

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

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

Controllers or Parts
Amer. Brown Boveri Elec. Corp.
General Electric Co.
Westinghouse E. & M. Co.

Controller Regulators
Elec. Service Supplies Co.

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

Converters, Rotary
Amer. Brown Boveri Elec. Corp.
General Electric Co.
Westinghouse E. & M. Co.

Conveying & Hoisting Machinery
American Bridge Co.

Copper Wire
Anaconda Copper Mining Co.

Copper Wire Instruments Measuring Testing and Recording
American Steel & Wire Co.

Cord, Bell, Trolley, Register
Brill Co., The J. G.
Elec. Service Supplies Co.
Internat'l Register Co., The
Roebling's Sons Co., J. A.
Samson Cordage Works
St. Louis Car Co.
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.
St. Louis Car Co.
Westinghouse Tr. Br. Co.

Cross Arms (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossings
Ramapo Ajax Corp.
Wm. Wharton Jr. & Co., Inc.

Crossing Signals (See Signals, Crossing)

Crossing, Frog and Switch
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Crossing Manganese
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton Jr. & Co., Inc.

Crossings, Track (See Track, Special Work)

Crossings, Trolley
Anderson Mfg. Co., A.&J. M.
Ohio Brass Co.
Westinghouse E. & M. Co.

Curtains & Curtain Fixtures
Brill Co., The J. G.
Morton Mfg. Co.
Pantasote Co., Inc.
St. Louis Car Co.

Dealer's Machinery
Elec. Equipment Co.
Gerke, J. W.
Hyman-Michaels
Transit Equip. Co.

Derailing Devices (See also Track Work)
Wharton, Jr. & Co., Wm.

Derailing Switches, Tee Rail
Ramapo Ajax Corp.

Detective Service
Wish-Service, P. Edward

Doors and Door Fixtures
Hale-Kilburn Co.
St. Louis Car Co.

Door Operating Devices
Brill Co., The J. G.
General Electric Co.
Nat'l Pneumatic Co., Inc.
Safety Car Devices Co.

Doors, Folding Vestibule
Nat'l Pneumatic Co., Inc.

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

Dryers, Sand
Elec. Service Supplies Co.

Ears
Anderson Mfg. Co., A.&J.M.
Electric Service Supplies
Ohio Brass Co.
Westinghouse E. & M. Co.

Electrical Wires and Cables
Amer. Electrical Works
American Steel & Wire Co.

Electric Grinders
Railway Track-work Co.

Electric Locomotives
St. Louis Car Co

Electrodes, Carbon
Railway Track-work Co.
Una Welding & Bonding Co.

Electrodes, Steel
Railway Track-work Co.
Una Welding & Bonding Co.

Enamel
Duco, E. I. Du Pont De Nemours & Co.

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

Engines, Gas, Oil or Steam
Westinghouse E. & M. Co.

Exterior Side Panels
Haskelite Mfg. Corp.

Fare Boxes
Cleveland Fare Box Co.
Johnson Fare Box Co.
Nat'l Ry. Appliance Co.
Ohmer Fare Register Co.
Perey Mfg. Co., Inc.

Fare Registers
Electric Service Sup. Co.

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

Feeders and Wheel Guards
Brill Co., The J. G.
Consolidated Car Fender Co.
Root Spring Scraper Co.
St. Louis Car Co.
Star Brass Works

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

Field Coils (See Coils)

Finishing Materials
Egyptian Lacquer Mfg. Co.

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

Flaxlinum Insulation
Nat'l Ry. Appliance Co.

Floodlights
Elec. Service Supplies Co.

Floor, Sub.
Haskelite Mfg. Corp.

Floor Covering
Wolf Waterproof Fabric Co., L. L.

Flooring, Monolithic
Johns-Manville, Inc.

Floors
Haskelite Mfg. Corp.

Forgings
Standard Steel Works

Frogs & Crossings, Tee Rail
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton Jr. & Co., Inc.

Frogs, Track (See Track Work)

Frogs, Trolley
Anderson Mfg. Co., A.&J.M.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Funnell Castings
Wm. Wharton, Jr. & Co., Inc.

Furnaces, Electric
Amer. Brown Boveri Elec. Corp.
American Bridge Co.

Fuses and Fuse Boxes
General Electric Co.
Westinghouse E. & M. Co.

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

Gaskets, Asbestos
Johns-Manville, Inc.
Westinghouse Tr. Br. Co.

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse E. &. M. Co.

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

Gear Blanks
Bethlehem Steel Co.
Standard Steel Works

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

Gears and Pinions
Bemis Car Truck Co.
Bethlehem Steel 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
Amer. Brown Boveri Elec. Corp.
General Electric Co.
Lecce-Neville Co.
Westinghouse E. & M. Co.

Girder Rails
Bethlehem Steel Co.
Lorain Steel Co.

Gong (See Bells and Gongs)

Greases (See Lubricants)

Grinders and Grind. Supplies
Metal & Thermit Corp.
Railway Track-work Co.

Grinders, Portable
Buda Company
Railway Track-work Co.

Grinders, Portable Electric
Railway Track-work Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guard Rail Clamps
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Guard Rails, Tee Rail and Manganese
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

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

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

Headlights
Elec. Service Supplies Co.
General Electric Co.
Ohio Brass Co
St. Louis Car Co.

Headlining
Haskelite Mfg. Corp.
Pantasote Co., Inc.

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

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

Helmets—Welding
Railway Track-work Co.
Una Welding & Bonding Co.

Hoists and Lifts
Ford Chain Block Co.

Horns, Car
American Strombos Co.

Ignition Units
Lecce Neville Co.

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

Insulating Cloth, Paper and Tape
General Electric Co.
Johns-Manville, Inc.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Okonite Co.
Okonite-Callender Cable Co., Inc.
Staud. Underground Cable Co.
Westinghouse E. & M. Co.

Insulating Silk
Irvington Varnish & Ins. Co.

Insulating Varnishes
Irvington Varnish & Ins. Co.

Insulation (See also Paints)
Electric Ry. Equipment Co.
Electric Service Sup. Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
Okonite Co.
Okonite-Callender Cable Co., Inc.
Westinghouse E. & M. Co.

Insulating, Pipe & Boiler
Johns-Manville, Inc.

Insulation Slot
Irvington Varnish & Ins. Co.

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

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

Interior Side Linings
Haskelite Mfg. Corp.

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

Joints, Rail (See Rail Joints)

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

Junction Boxes
Std. Underground Cable Co.

Lacquer
Duco E. I. Du Pont De Nemours & Co.

Lacquer Finishes
Egyptian Lacquer Mfg. Co.

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

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

Lamps, Signal and Marker
Elec. Service Supplies Co.
Nichols-Lintern Co.

Laterns, Classification
Nichols-Lintern Co.

Leather
Wolf Waterproof Fabric Co., L. L.

Letter Boards
Haskelite Mfg. Corp.

Lighting Systems
Leece Neville Co.

Lightning Protection
Electric Service Sup. Co.
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

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

Locking Spring Boxes
Wm. Wharton, Jr. & Co., Inc.

Locomotives, Electric
Amer. Brown Boveri Elec. Corp.
Cummings Car & Coach Co.
General Electric Co.
Westinghouse E. & M. Co.

Lubricating Engineers
Standard Oil Co. of Indiana
Texas Company
Universal Lubricating Co.

Lubricants, Oil and Grease
Standard Oil Co. of Indiana
Texas Company
Universal Lubricating Co.

Machinery, Insulating
Amer. Insulating Mach. Co.

Manganese Steel Castings
Wm. Wharton, Jr. & Co., Inc.

Manganese Steel Guard Rails
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Manganese Steel Switches, Frogs and Crossings
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Manganese Steel, Special Track Work
Bethlehem Steel Co.
Wm. Wharton Jr. & Co., Inc.

Meters (See Instruments)

Mica
Mica Insulator Co.

Molding, Metal
Allis-Chalmers Mfg. Co.

Motor Buses (See Buses, Motor)

Motor Generators
Amer. Brown Boveri Elec. Corp.

Motor Leads
Dossert & Co.

Motors, Electric
Amer. Brown Boveri Elec. Corp.
Westinghouse E. & M. Co.

Motors and Generator Sets
General Electric Co.

Motormen's Seats
Allis-Chalmers Mfg. Co.
Brill Co., J. G.
Electric Service Sup. Co.
Hale-Kilburn Co.
St. Louis Car Co.
Wood Co., Chas. N.

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

Oils (See Lubricants)

Omnibuses (See Buses, Motor)

Oxy-Acetylene (See Cutting Apparatus Oxy-Acetylene)

Oxygen
International Oxygen

Packing, Asbestos
Johns-Manville, Inc.

Paint
American Asphalt Paint Co.
Duco E. I. Du Pont De Nemours & Co.

Paint, Iron Preservative
Johns-Manville, Inc.

Paints and Varnishes (Insulating)
Mica Insulator Co.
National Ry. Appliance Co.

Paints and Varnishes, Preservative
Aluminum Co.
Electric Service Sup. Co.

Panels, Outside, Inside
Haskelite Mfg. Corp.

Paving Bricks, Filler and Stretcher
Nelsonville Brick Co.

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

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

Pickups, 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.
Ohio Brass Co.
Westinghouse Tr. Brake Co.

Pipe
National Tube Co

Pipe Fittings
Standard Steel Works
Westinghouse Tr. Brake Co.

Planers (See Machine Tools)

Plates for Tee Rail Switches
Ramapo Ajax Corp.

Pliers, Rubber Insulated
Electric Service Sup. Co.

Plywood, Roofs, headlining, Floors, Interior Panels, Bulkheads, Truss Planks
Haskelite Mfg. Corp.

Pole Line Hardware
Bethlehem Steel Co.
Electric Service Sup. Co.
Ohio Brass Co.

Poles, Metal Street
Elec. Ry. Equipment Co.
Hubbard & Co.

Pole Reinforcing
Hubbard & Co.

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

Poles, Ties, Posts, Piling and Lumber
Bell Lumber Co.
International Creosoting & Construction Co.
Naugle Pole & Tie Co.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Electric Service Sup. Co.
National Tube Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Elec. Ry. Equipment Co.
National Tube Co.

Portable Grinders
Buda Company

Potheads
Okonite Co.
Okonite-Callender Cable Co., Inc.

Power Houses
American Bridge Co.

Power Saving Devices
National Ry. Appliance Co.

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

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

Pyroxylin
Duco E. I. Du Pont De Nemours & Co.

Rail Braces and Fastenings
Ramapo Ajax Corp.

Rail, Brick
Nelsonville Brick Co.

Rail Grinders (See Grinders)

Rail Joints
Carnegie Steel Co.
Illinois Steel Co.
Rail Joint Co.

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

Rail Welding
Una Welding & Bonding Co.

Rails, Relaying
Hyman-Michaels

Rails, Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Co.

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

Railway Safety Switches
Westinghouse E. & M. Co.

Rail Welding
Metal & Thermit Corp.
Railway Track-work Co.

Rattan
Brill Co., The J. G.
Cummings Car & Coach Co.
Electric Service Sup. Co.
Hale-Kilburn Co.
St. Louis Car Co.

Rectifiers, Mercury
Amer. Brown Boveri Elec. Corp.

Registers and Fittings
Brill Co., The J. G.
Electric Service Sup. Co.
Intern'l Register Co., The
Ohmer Fare Register Co.
Rooke Automatic Register Co.
St. Louis Car 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
Electric Service Sup. Co.

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

Retrievers, Trolley (See Catchers and Retrievers, Trolley)

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

Roof Coverings
Wolf Waterproof Fabric Co., L. L.

Roofing Asbestos (Corrugated and Flat
Johns-Manville, Inc.

Roofs, Car & Bus
Haskelite Mfg. Corp.

Roofing, Car
Pantasote Co., Inc.

Roofing & Shingles, Asbestos
Johns-Manville, Inc.

Sanders, Track
Brill Co., The J. G.
Electric Service Sup. Co.
Nichols-Lintern Co.
Ohio Brass Co.
St. Louis Car Co.

Sash Fixtures, Car
Brill Co., The J. G.
Edwards Co., Inc., O. M.
St. Louis Car Co.

Sash, Metal, Car Window
Edwards Co., Inc., O. M.
Hale-Kilburn Co.

Scrapers, Track (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Electric Service Sup. Co.

Seats, Bus
Hale-Kilburn Co.
Haywood-Wakefield Co.
St. Louis Car Co.

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

Seating Materials
Brill Co., J. G.
Hale-Kilburn Co.
Haskelite Mfg. Corp.
Pantasote Co., Inc.
St. Louis Car Co.

Second Hand Equipment
Electric Equipment Co.
Gerke, J. W.
Hyman-Michaels
Transit Equip. 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
Electric Service Sup. Co.
Nat'l Pneumatic Co., Inc.

Signal Systems, Block
Electric Service Sup. Co.
Nachod Signal Co., Inc.
U. S. Electric Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod Signal Co., Inc.
U. S. Electric Signal Co.

Signals, Indicating
Nichols-Lintern Co.

Slack Adjusters (See Brake Adjusters)

Sleet Wheels and Cutters
Elec. Ry. Equipment Co.
Electric Service Sup. 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.
Consolidated Car Fender Co.
Cummings Car & Coach Co.
Root Spring Scraper Co
St. Louis Car Co.

Snow Sweeper, Rattan
Johns-Manville, Inc.

Soldering and Brazing Apparatus (See Welding Processes and Apparatus)

Special Adhesive Papers
Irvington Varnish & Ins. Co.

Special Trackwork
Bethlehem Steel Co.
Buda Company
Lorain Steel Co.
Wm. Wharton, Jr. & Co., Inc.

Spikes
Amer. Steel & Wire Co.
Illinois Steel 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.
Standard Steel Works
St. Louis Car Co.

Sprinklers, Track and Road
Brill Co., The J. G.
Cummings Car & Coach Co.
St. Louis Car Co.

Steel Castings
Wm. Wharton, Jr. & Co., Inc.

Steel and Steel Products
Illinois Steel Co.
Morton Mfg. Co.

Steps, Car
Morton Mfg. Co.

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

Storage Batteries (See Batteries, Storage)

Strain, Insulators
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Strand
American Steel & Wire Co.
Roebling's Sons Co., J. A.

Superheaters
Babcock & Wilcox Co.

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

Switchboards, Asbestos
Johns-Manville, Inc.

Switch Stands and Fixtures
Ramapo Ajax Corp.

Switches, Selector
Nichols-Lintern Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track (See Track Special Work)

Switches and Switchboards
Amer. Brown Boveri Elec. Corp.
Electric Service Sup. Co.
General Electric Co.
Westinghouse E. & M. Co.

Tampers, Tie
Railway Track-work Co.

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

Tee Rail Special Track Work
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Telephones and Parts
Electric Service Sup. Co.

Terminals, Cable
Std. Underground Cable Co.

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

Thermostats
Gold Car Heating & Lighting Co.
Railway Utility Co.
Smith Heater Co., Peter

Ticket Trippers & Destroyers
Electric Service Sup. Co.

Tie Plates
Illinois Steel 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.)

Ties, Mechanical
Dayton Mechanical Tie Co.

Tires
General Tire & Rubber Co.
India Tire & Rubber Co.

Tongue Switches
Wm. Wharton, Jr. & Co., Inc.

Tool Steel
Bethlehem Steel Co.

Tools, Track & Miscellaneous
Amer. Steel & Wire Co.
Electric Service Sup. Co.
Hubbard & Co.
Railway Track-work Co.

Torches, Acetylene (See Cutting Apparatus)

Tower Wagons & Auto Trucks
McCardell & Co., J. R.

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

Track Expansion Joints
Wm. Wharton, Jr. & Co., Inc.

Track Grinders
Metal & Thermit Corp.
Railway Track-work Co.
Rail Welding & Bonding Co.
Una Welding & Bonding Co.

Trackless Trolleys
St. Louis Car Co.

Track, Special Work
Bethlehem Steel Co.
Buda Company
Ramapo Ajax Corp.
Wharton, Jr. & Co., Inc., W.

Transfer (See Tickets)

Transfer Issuing Machines
Ohmer Fare Register Co.

Transformers
Amer. Brown Boveri Elec. Corp.
General Electric Co.
Allis-Chalmers Mfg. Co.
Westinghouse E. & M. Co.

Treads, Safety, Stair Car Step
Irving Iron Works
Morton Mfg. Co.

Trolley Bases
Anderson Mfg. Co., A. J. & J. M.
General Electric Co.
More Jones Brass & Metal Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
Anderson Mfg. Co., A. & J. M.
Nuttall Co., R. D.
Ohio Brass Co.

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

Trolley Material (Overhead)
Bates Expanded Steel Truss
Electric Service Sup. Co.
More Jones Brass & Metal Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Trolley & Trolley Systems
Ford Chain Block Co.

Trolley Wheels (See Wheels, Trolley)

Trolley Wheel Bushings
More Jones Brass & Metal Co.

Trolley Wheels and Harps
Electric Service Supplies Co.
More Jones Brass & Metal Co.
Thornton Trolley Wheel Co.

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

Trucks, Car
Bemis Car Truck Co.
Brill Co., The J. G.
Cummings Car & Coach Co.
St. Louis Car Co.

Truss Planks
Haskelite Mfg. Corp.

Tubing, Steel
National Tube Co.

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

ALPHABETICAL INDEX TO ADVERTISEMENTS

WHAT AND WHERE TO BUY

(Continued from Page 62)

Turbines, Steam
General Electric Co.
Westinghouse E. & M. Co.

Turnstiles
Electric Service Sup. Co.
Perey Mfg. Co., Inc.

Turntables
American Bridge Co.

Upholstering
Wolf Waterproof Fabric Co., L. L.

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

Varnished Papers
Irvington Varnish & Ins. Co.

Varnished 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.

Vestibule Linings
Haskelite Mfg. Corp.

Waterproofing
Johns-Manville, Inc.

Welded Rail Joints
Metal & Thermit Corp.
Ohio Brass Co.
Railway Track-work Co.
Una Welding & Bonding Co.

Welders, Portable Electric
Metal & Thermit Corp.
Ohio Brass Co.
Railway Track-work Co.
Westinghouse E. & M. Co.

Welding Processes and Apparatus
General Electric Co.
International Oxygen Co.
Metal & Thermit Corp.
Ohio Brass Co.
Railway Track-work Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Welding & Cutting Tools
International Oxygen Co.

Welding Steel
Railway Track-work Co.
Una Welding & Bonding Co.

Welding Wire
American Steel & Wire Co.
General Electric Co.
Railway Track-work Co.
Roeblings Sons Co., J. A.

Welding Wire and Rods
Railway Track-work Co.

Wheel Guards (See Fenders and Wheel Guards)

Wheel Presses (See Machine Tools)

Wheels, Car Steel & Steel Tire
Carnegie Steel Co.
Illinois Steel Co.
Standard Steel Works

Wheels, Trolley
American Steel Foundries
Elec. Ry. Equipment Co.
More Jones Brass & Metal Co.

Wheels, Trolley, Wrought Steel
Electric Service Sup. Co.
General Electric Co.
Illinois Steel Co.
Nuttall Co., R. D.

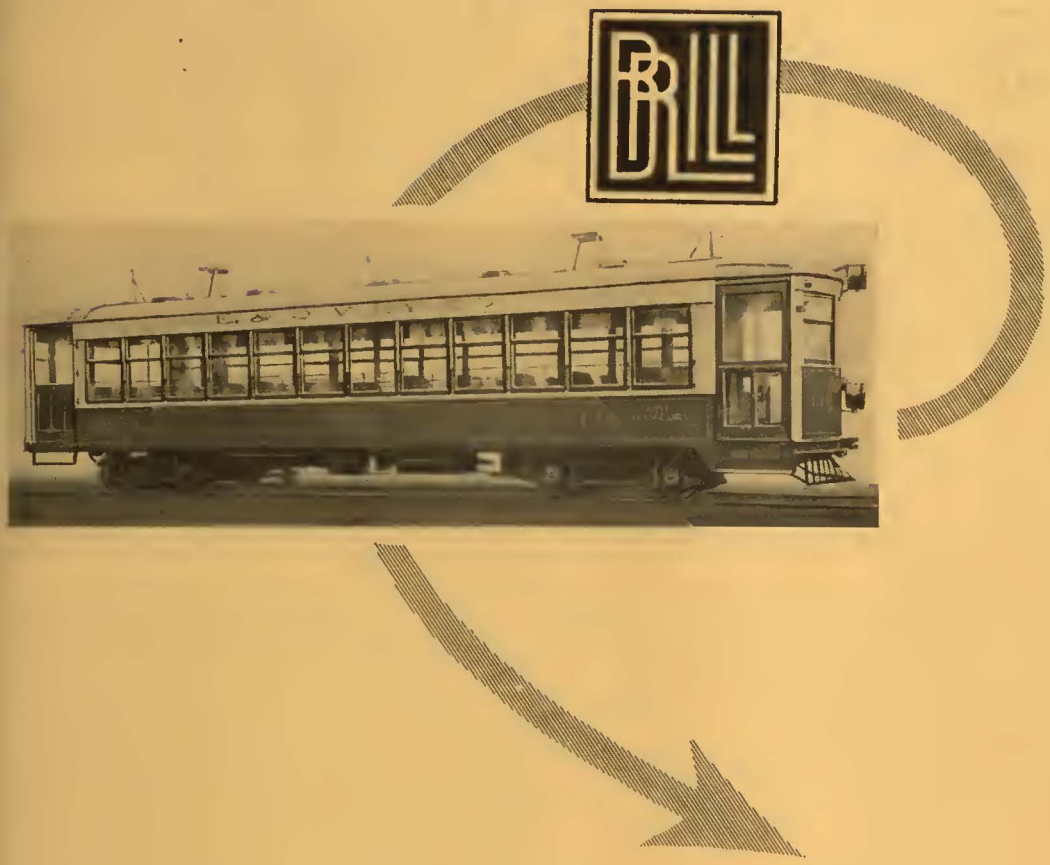
Wheels, Wrought Steel
Carnegie Steel Co.
Illinois Steel Co.

Whistles, Air
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Window Packing
Wolf Waterproof Fabric Co., L. L.

Wire Rope
Amer. Steel & Wire Co.
Roebling's Sons Co., J. A.

Wires and Cables
American Steel Foundries
Amer. Electrical Works
Amer. Steel & Wire Co.
Anaconda Copper Min. Co.
General Electric Co.
Okonite Co.
Okonite-Callender Cable Co., Inc.
Roebling's Sons Co., J. A.
Std. Underground Cable Co.
Westinghouse E. & M. Co.



Another Electric Railway Achieves Success with
MODERN CARS

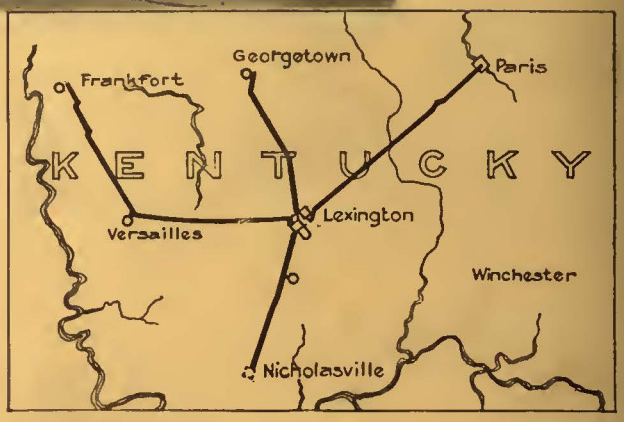
The Evansville & Ohio Valley Railway, in Indiana, placed in service six new modern light-weight cars built by the American Car Company and mounted on Brill low-level 77-E Trucks equipped with Brill Twin Links for the higher speed service. These cars weighed only 17 tons while those displaced varied in weight from 32 to 37 tons.

In the short space of a few months the economy in power and maintenance and increased riding due to the modern type cars has made the investment a most profitable one.

Public Patronage can be attracted by attractive cars, substantially built, and modernly equipped.

THE J. G. BRILL COMPANY
PHILADELPHIA, PA.
AMERICAN CAR CO. ST. LOUIS MO. — G.C. KUHLMAN CAR CO. CLEVELAND, OHIO. — WASON MANF'G CO. SPRINGFIELD, MASS.

The old cars were good enough in their time; but times have changed. More attractive transportation is demanded and a lower operating cost is necessary, both afforded by modern light-weight cars.



Modern one-man cars have increased net receipts 102% for the Kentucky Traction & Terminal Company

For three years' operation, operating costs per car-mile:

Maintenance of way and structure	3.5 cts.
Maintenance of equipment	1.5 cts.
Power	3.4 cts.
Conducting transportation	8.1 cts.
Traffic	0.5 cts.
General and miscellaneous	3.6 cts.
Total	20.6 cts.

Modern Interurban Equipment:

Total weight of cars	25,180 lb.
Motors 4-25 h.p.	GE-264A
Control single-end	G-E type K-35
Air brakes	G-E with safety car control
Compressors	G-E type CP-27B

Reliability, so vital a factor in railway operation, has not been sacrificed in the equipment produced by General Electric to effect reductions in car weights. Be sure to retain this reliability by maintaining original equipment quality with the use of duplicate G-E parts.

11-71

GENERAL ELECTRIC