

ELECTRIC RAILWAY JOURNAL

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PRINCIPAL CITIES OF THE UNITED STATES

Numerically Arranged with 1920 Census Population

CITY	POPULATION	CITY	POPULATION
✓ New York, N. Y.....	5,620,048	✓ Minneapolis, Minn.....	380,582
✓ Chicago, Ill.....	2,701,705	✓ Kansas City, Mo.....	324,410
✓ Philadelphia, Pa.....	1,823,779	Seattle, Wash.....	315,652
✓ Detroit, Mich.....	993,739	Indianapolis, Ind.....	314,194
✓ Cleveland, Ohio.....	796,836	Jersey City, N. J.....	298,079
✓ St. Louis, Mo.....	772,897	Rochester, N. Y.....	295,750
✓ Boston, Mass.....	748,060	✓ Portland, Ore.....	258,288
✓ Baltimore, Md.....	733,826	✓ Denver, Colo.....	256,491
✓ Pittsburgh, Pa.....	588,193	✓ Toledo, Ohio.....	243,164
Los Angeles, Calif.....	576,673	✓ Providence, R. I.....	237,595
Buffalo, N. Y.....	506,775	Columbus, Ohio.....	237,031
San Francisco, Calif.....	506,676	✓ Louisville, Ky.....	234,891
✓ Milwaukee, Wis.....	457,147	St. Paul, Minn.....	234,680
✓ Washington, D. C.....	437,571	Oakland, Calif.....	216,261
✓ Newark, N. J.....	414,216	✓ Akron, Ohio.....	208,435
✓ Cincinnati, Ohio.....	401,247	Atlanta, Ga.....	200,616
✓ New Orleans, La.....	387,408		

The Principal Tie in the Principal Cities

60%
have
Twin Tie Installations

In the first 33 cities of the United States (those over 200,000 in the 1920 census), 20 of them have Steel Twin Tie installations, or plan to install Twin Ties in the present Season.

30%
are making
Twin Tie Installations
this season

Of the first 33 cities in the United States 10 are now installing Twin Ties or have scheduled installations for the Season.

15%
have standardized on
Twin Tie Track
for all work

5 have standardized on Steel Twin Tie Construction for all work.

The International Steel Tie Company
Cleveland, Ohio

Steel Twin Tie Track

Renewable Track . . . Permanent Foundation

Burned Fingers Can be Prevented

NO more burned controller fingers! The Westinghouse TA handle in conjunction with a line switch will prevent all drum arcing in backing off. It is quick, positive and safe in action, and can be quickly applied to K type controllers.

The TA Handle Switch

offers these important advantages:

1. The line switch opens **BEFORE** the drum begins to move.
2. Applied without change to the controller except to drill and tap the top plate for mounting.
3. Standard handles can be used.
4. All working parts of the handle switch are accessible by removing the cover plate.

The Westinghouse office nearest you will gladly supply full information, or write to

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

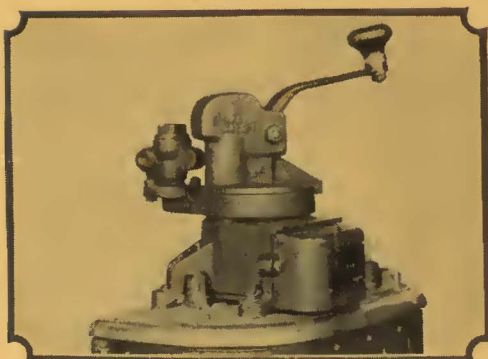


1926

Westinghouse

X88797

Renewal Parts Reduce
Maintenance Cost



TA Handle Applied to
Safety Device

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It Lives to Serve

FROM numerous sources have come words of commendation for the survey of car and bus purchases which was made by the JOURNAL in the issue for July 3. The comprehensive nature of the survey, the unequivocal statement of the pernicious condition existing within the industry in the matter of indifference to the needs for modern cars—these factors rendered it valuable to operating companies and car builders alike.

Undertakings such as this are among the varied services constantly being rendered to the industry by the staff of ELECTRIC RAILWAY JOURNAL. In order to arrive at the facts embodied on the latest survey, all of the car builders in the United States were called on for information concerning car orders received during the first six months of the year; the files of the JOURNAL for this period were thoroughly searched for all material which had been published on this subject, and confidential information was obtained by telegraph on proposed expenditures by railways for car and bus equipment during the balance of the year.

In spite of the critical situation existing this year in the matter of diminished car purchases, the survey was published to give the industry an opportunity to take stock of itself and to set about the correcting of its unsound condition.

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SAVING THE RAIL SAVES THE RAILWAY

Are you a good merchant?

Clean cars, smooth track and uninterrupted service are equivalent to an attractive store, reliable delivery and worthy merchandise. Good merchants know their value.

Your cars may be modern and clean, your schedules may be ideal—yet your sales will fall off if your track does not provide safe, smooth, silent and satisfactory rides. It's up to your track maintenance.

Grind out all corrugations, weld and grind cupped joints and battered special work. It's good business, it's an economy—and it's easily done with the modern equipment we offer.

Bulletins by return mail.

Also quotations.

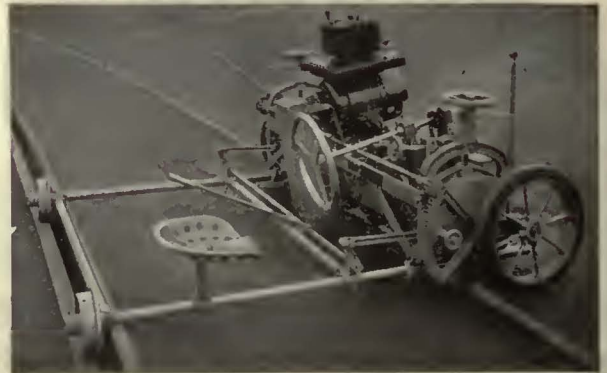
Railway Trackwork Co.

3132-48 East Thompson Street, Philadelphia

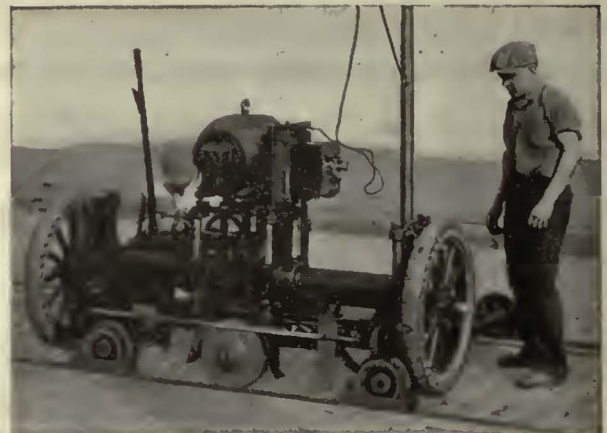
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 Electrical Engineering & Mfg. Co., Pittsburgh
 H. F. McDermott, 208 S. La Salle St., Chicago
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 Frazar & Co., Japan.

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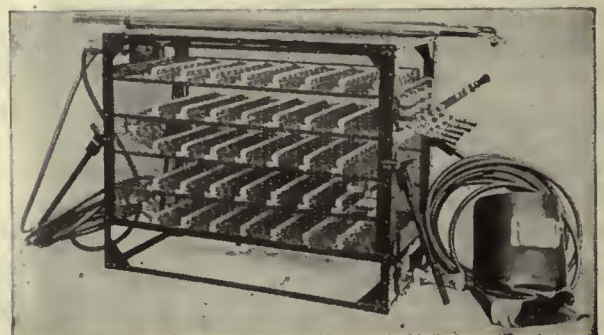
"Improved Atlas" Rail Grinder



"Imperial" Track Grinder

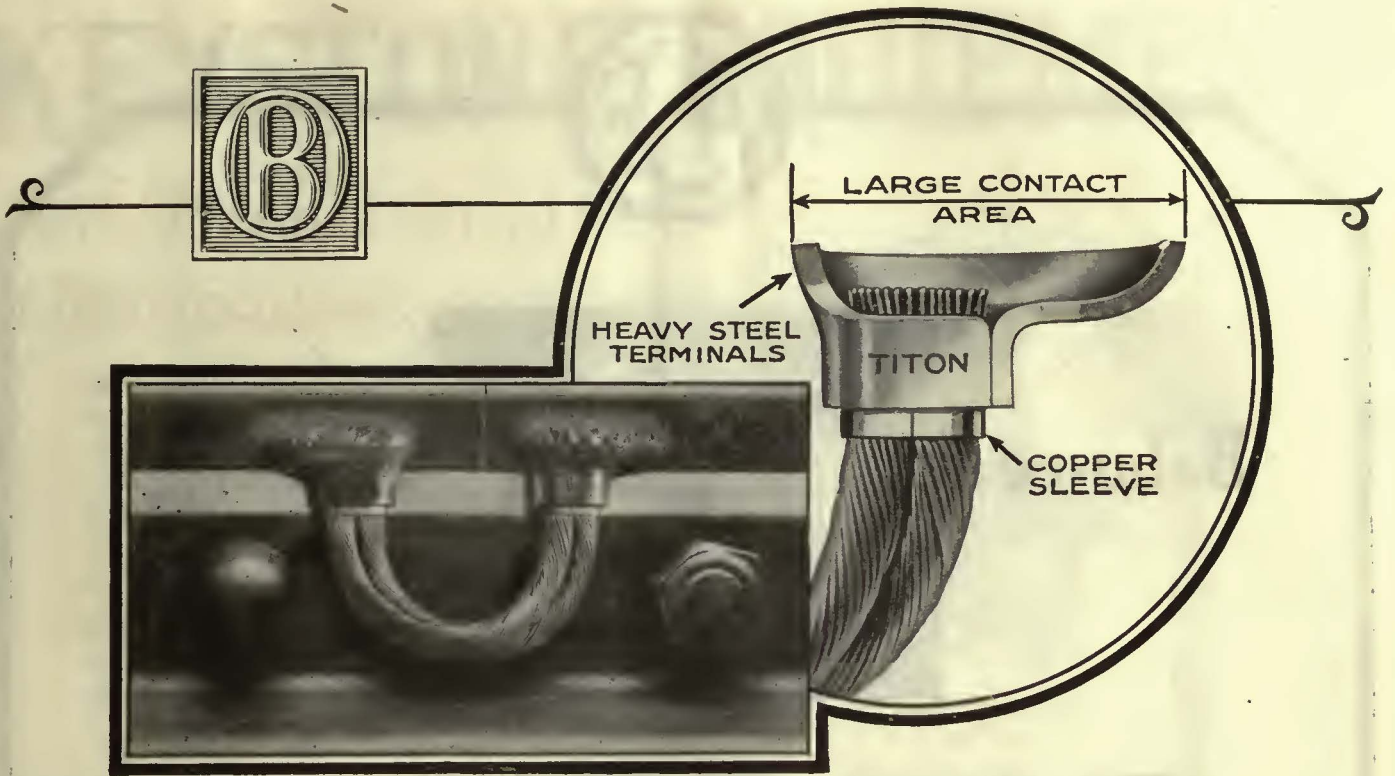


Reciprocating Track Grinder



"Ajax" Electric Arc Welder

SAVING THE RAIL SAVES THE RAILWAY



Checkmate Bonding Problems With the New O-B Titon Bond

HOLD a Titon Bond in your hand—examine it critically in every detail of its clean cut design and long life construction. Watch your welders put one on the rail head, and put it on to stay, in about a minute and a half. Then test it thoroughly for electrical and mechanical efficiency.

That is all you need do to assure yourself, as others have done, that the O-B Titon Copper Arc Weld Bond is the one you will want to use for *all* your ball-of-rail bonding.

Large, heavy steel, offset terminals make it easy to secure a good, strong weld—to apply the bond properly so it has a permanently low electrical resistance. The terminals support the molten metal as deposited, provide a mechanical protection for the finished weld, and help insure a thorough union of the copper cable to the rail head through the medium of the deposited metal.

Another feature, the interior copper sleeve between terminals and cable strands, cushions and damps vibrations. It materially increases the life of the bond in service.

To make it convenient for you to send for a sample Titon Bond—to submit it to your welders for test and approval—a coupon is printed below.

Ohio Brass Company,
Mansfield Ohio

1378

Gentlemen: Without cost or obligation please send me a sample of the new O-B Titon Bond. Also complete information about its application by the copper arc weld process.

Company

Your Name

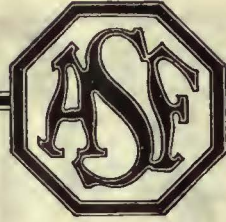
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City and State

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LINE MATERIALS
RAIL BONDS
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Balanced



Braking

Double the Braking Area—

Double it—and you decrease over 50% the required energy absorption per brake shoe.

Double the braking area and you greatly increase the friction coefficient.

Double it and you can attain a higher rate of retardation.

Double it and you decrease the frequency of brake shoe replacements.

The "SIMPLEX AND AMERICAN MULTIPLE UNIT" clasp brakes with two brake shoes per wheel instead of one, doubles the braking area and accomplishes these results.

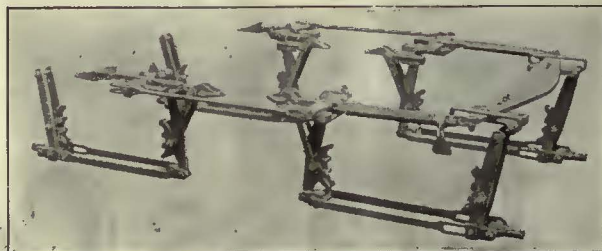
AMERICAN STEEL FOUNDRIES

NEW YORK

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American Multiple Unit Clasp Brake



KEYSTONE EQUIPMENT

On the Illinois Central R.R. Electrification

Here is one of the outstanding electric railway equipment jobs of the year 1926—a heavy electrification project which has been under construction for several years. The first of the 215 new cars are just being delivered—and electric operation will soon be commenced.

Among the many distinguishing features of these fine new cars, not the least noteworthy are the applications of Keystone Car Equipment as indicated herewith.



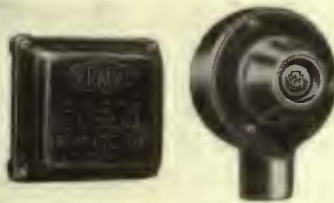
GOLDEN GLOW Headlights

Type RA-128, a special design for heavy electric railway multiple unit trains, shaped to conform to the curve of the car roof. But the familiar standard Golden Glow glass reflector is there—to provide a powerful penetrating beam of non-dazzling light along the right-of-way.

PARK ROW

HUNTER-KEYSTONE Destination Signs

Now accepted almost universally as the standard sign for indicating routes and destinations, this choice is in line with the best current practice.



FARADAY Signals

Installed to afford convenient and reliable means of communication between trainmen and motormen, Faraday Buzzers and Push Buttons put the finishing touches of perfection on this high-grade rolling stock.

ELECTRIC SERVICE SUPPLIES Co.

PHILADELPHIA
17th and Cambria Sts.

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1123 Bessemer Building

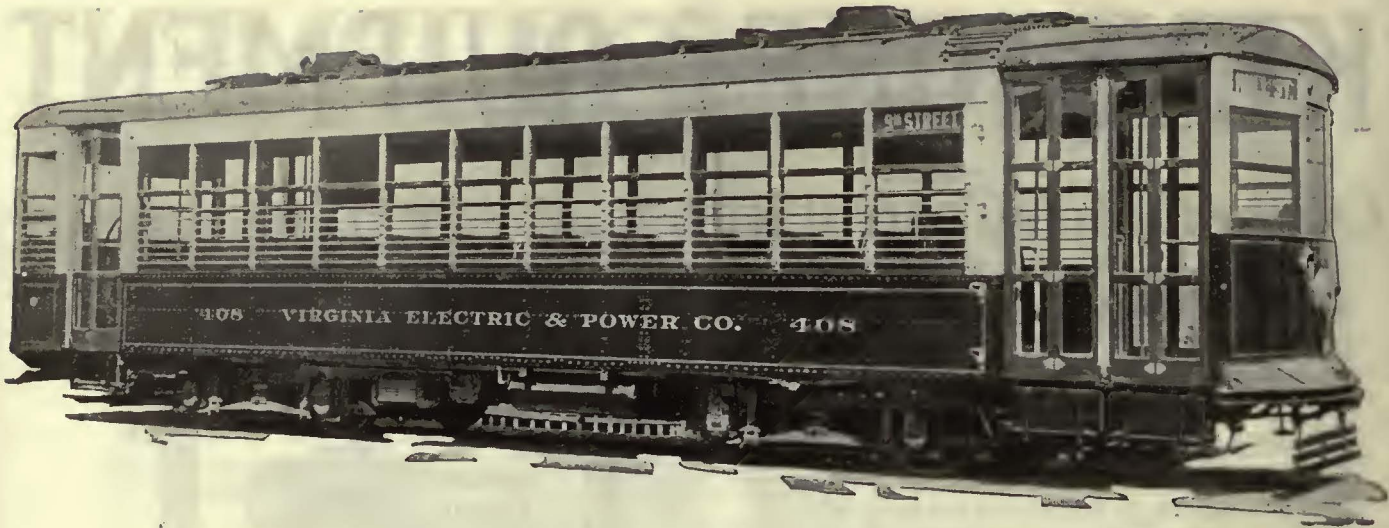
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General Motors Building



The Safety Car

—is an exemplification of modern safety and economy in street railway equipment. It bridges the gap between ordinary precaution and positive safety, stimulating public appreciation through the medium of safe, adequate, accelerated service that follows with the obvious economic advantages of Safety Car installation.

Safety Car Control Equipment interlocks the power, brake and door control functions to combine ease and convenience of operation with positive safety. Greater convenience is realized because both brakes and doors are controlled by the manipulation of a single operating handle, and because selective door control is possible. Greater safety is assured because careless or promiscuous door opening is prevented, the car must be stopped before the doors can be operated, the doors must be closed before the car can be started, and release of the controller handle, through motorman's negligence or disability, cuts off the power and applies the brakes automatically.

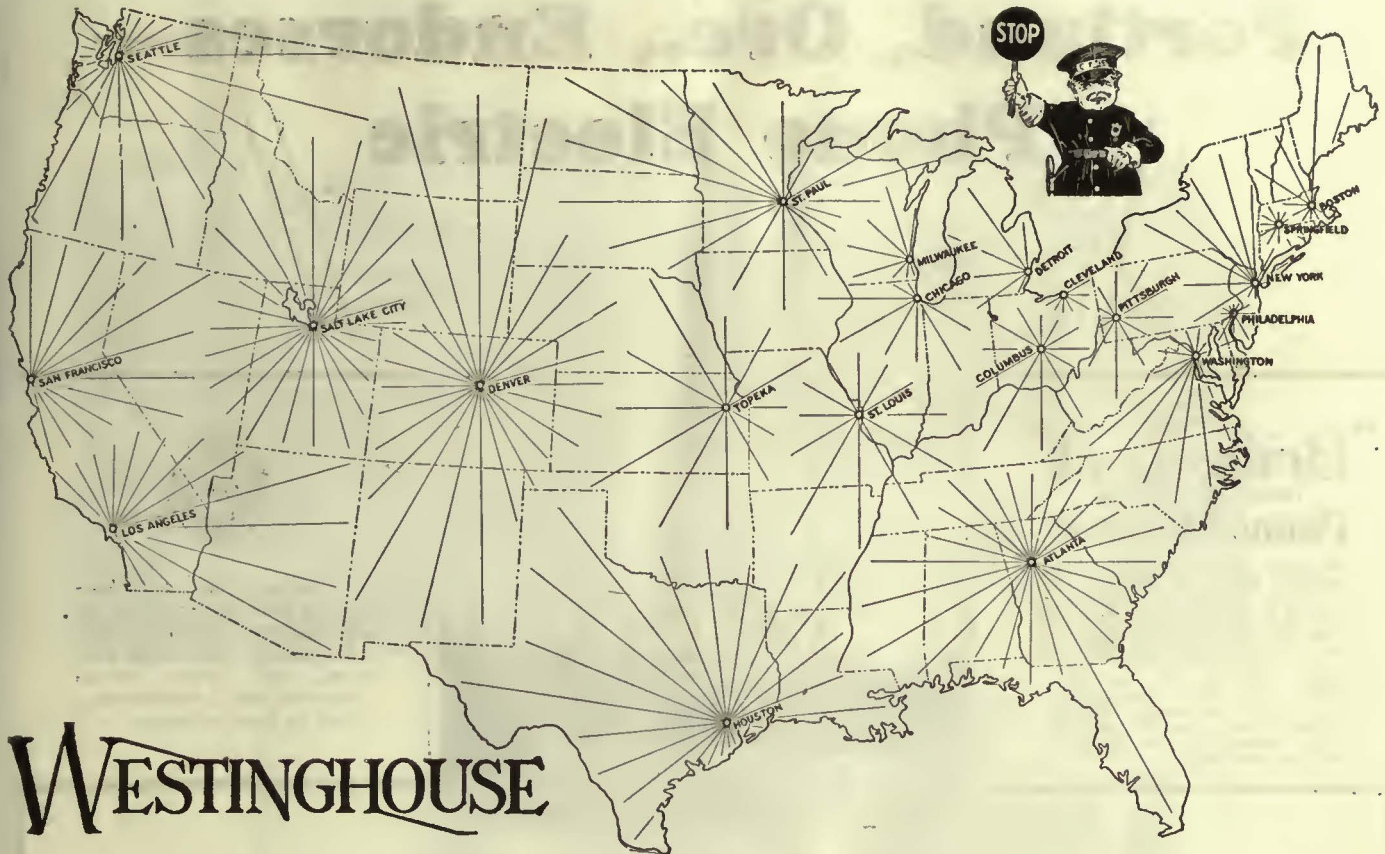


SAFETY CAR DEVICES CO.
OF ST. LOUIS, MO.

Postal and Telegraphic Address:

WILMERDING, PA.

CHICAGO SAN FRANCISCO NEW YORK WASHINGTON PITTSBURGH



WESTINGHOUSE

*Automotive Air Brake Service
Covers the Map*

Branch offices of the Westinghouse Air Brake Company—located in the principal cities of the United States—are “service stations” for Westinghouse Automotive Air Brakes.

Here are men especially trained in this branch of our business; men able to demonstrate the advantages of Westinghouse Air Brakes for modern automotive vehicles; men skilled in the application and maintenance of Westinghouse Air Brakes; men available for consultation and assistance to users of Westinghouse Air Brakes.

These men are at your service.

Westinghouse Air Brakes

- develop a retarding force sufficiently powerful for stopping even the heaviest car quickly, to increase safety and permit faster schedules.
- to provide automatic equalization, to minimize skidding and lengthen life of brake linings.
- relieve the driver of braking fatigue, to increase safety and utility.
- and permit the use of metal brake linings, to provide still greater safety and economy.

WESTINGHOUSE AIR BRAKE CO.
Automotive Division, Wilmerding, Pa.



Portland, Ore., Endorses— Phono Electric

“Bridgeport”
TRADE MARK
CO.
Phono-Electric

We made a point of asking the Portland Electric Power Company for their opinion on the question of conductivity. They stated that feeders, on which there is no wear, offset the slightly lower conductivity on their lines. This is the usual condition. But where conductivity is of vital importance, PHONO III-CON now can be supplied with conductivity of 60% or 80% as specified.



An interesting booklet of Phono facts is now being mailed. It deals with the subjects of tensile strength, conductivity, wire wear, and "fatigue" in an interesting and exhaustive way. Have we your address?

This photograph shows part of the Phono-Electric installation on the Portland Electric Power Company's Council Crest line. Phono's exceptional wear resistance and high tensile strength make it especially valuable on sharp curves such as this.

Bridgeport
Brass Company
BRIDGEPORT - CONNECTICUT

Thirteen years does not seem like much in cold figures, but the World has been made over in that time, and the original Phono-Electric Trolley Wire installation in Portland, Oregon, has chalked up a total of more than 1,284,000 car passes. This on curves and main traveled arteries.

Much of it is still in place,—still giving good service, and a standing tribute to Phono as a solution to problems of wire-wear and overhead cost.

Such a record, backed as it is by authentic data proving similar and even greater records of service under widely varying conditions, furnishes one sound reason why leading roads in all parts of the country are using more and more Phono-Electric Trolley Wire.

We would particularly call your attention to the booklet mentioned above; and also to the detail of Portland's experience in relation to conductivity.

Phono-Electric



Carrying crowds
to the beaches



They



fight to get on!



Asbury Park, Ocean Grove, Bradley Beach, Belmar and Long Branch, New Jersey—names which mean pleasure to thousands during the vacation season and which mean revenue to the Coast Cities Railway, operators of Yellow Coaches.

Along the North Jersey coast Yellow Coaches are furnishing coordinated service with the high peak spread over three months and complete coach equipment thrown in during this period.

Feeder bus lines, centering in Asbury Park, serve sections beyond the trolley zone and sightseeing lines operate along the famous Ocean Boulevard.

During the summer season the entire fleet of Yellow Coaches is kept running: 12 single decks and 13 double deckers—*Yellow Coaches exclusively*. And they fight to get on! Three hundred people milling around at the loading point. Even on a 10-minute headway of double deckers they can't carry them away. It's all they can do to keep the crowd in line.

During 1925 the fleet of Yellow Coaches piled up 564,574 miles at a total cost of .2325 cents per mile for operation and maintenance. This in the face of the fact that the coaches stop nearly every block during

the peak season. And from January 1 to October 31, 1925, Yellow Coaches carried 1,572,000 passengers.

A recent cost analysis of this operation disclosed the following figures:

	Single Deck Cents per Bus-Mile	Double Deck Cents per Bus-Mile
Maintenance of plant and equipment.....	0.006	0.011
Maintenance of buses and cars.....	1.804	1.413
Maintenance of carhouses and garage.....	0.017
Power.....	2.931	3.178
Lubricants for buses.....	0.623	0.443
Tires and tubes.....	1.599	1.633
Carhouse and garage expenses.....	1.456	1.139
Bus and car operators.....	5.834	12.001
Other transportation expense.....	0.119	0.048
Rent of equipment.....	0.464	1.409
Superintendence.....	1.614	2.432
General office supplies and expenses.....	0.291	0.345
Advertising.....	0.103	0.404
Legal expenses.....	0.169	0.049
Stationery and printing.....	0.140	0.023
Injuries and damages.....	0.025
Insurance.....	1.492	0.909
Licenses and taxes.....	0.312	4.195
Miscellaneous expenses.....	0.202	0.181
Total expenses per mile before depreciation	19.201	29.813
Depreciation.....	3.000	3.000
Total expenses per mile including depreciation	22.201	32.813

It will be noticed that in these figures are included some overlapping car expenses, but even with these added the total costs for operating Yellow Coaches tell their own story.

This is the third season down there for Yellow Coaches and again the fleet will write its record of successful and economical performance. Mechanically the coaches are free from trouble and keep moving in a type of service that taxes equipment to the limit.

The peculiarities of *your service* will yield to a Yellow Coach survey, whether seasonable or year-round.



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



“YOU PUSH THE BUTTON—”

PHYSICAL labor has no place in modern operation. In cars equipped with National Pneumatic Door and Step Controlling Mechanisms, the car man does not have to reach for or to struggle with door handles and door operating levers. He simply pushes a button and the National Pneumatic Engine does the rest.

NATIONAL PNEUMATIC COMPANY

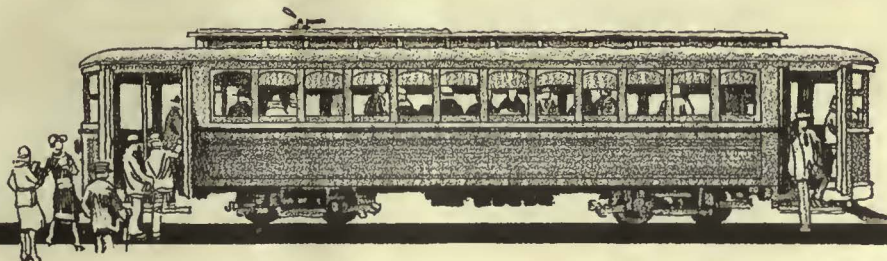
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General Works, Rahway, New Jersey

CHICAGO
518 McCormick Building

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TORONTO, CANADA BY
Railway & Power Engineering Corp., Ltd.

PHILADELPHIA
1010 Colonial Trust Building



Operator's Check

- Illinois Power & Light Corp., Chicago, Ill.
 The Connecticut Co., New Haven, Conn.
 Chicago, West Towns & Northern R.R., Chicago, Ill.
 Lehigh Traction Co., Hazleton, Pa.
 United Electric Railway Co., Providence, R. I.
 Columbus Ry., Power & Lt. Co., Columbus, Ga.
 Boston Elevated Ry. Boston, Mass.
 Waterloo, Cedar Falls & North. R. R., Waterloo, Iowa
 Illinois Power Co., Springfield, Ill.
 Boston & Worcester St. Ry. Co., Framingham, Mass.
 Mississippi Valley Electric Co., Iowa City, Iowa
 New Orleans Public Service Co., New Orleans, La.
 Tampa Electric Co., Tampa, Fla.
 Chicago, South Bend & Northern Ry., Chicago, Ill.
 Chicago & Joliet Electric Ry. Co., Chicago
 Key West Electric Co., Key West, Fla.
 Oklahoma Union Ry. Co., Tulsa, Okla.
 Municipal Tramways Trust, Adelaide, S. Australia
 Iowa Southern Utilities Co., Inc., Des Moines, Iowa
 Holyoke Street Ry. Co., Holyoke, Mass.
 Durham Public Service Co., Durham, N. C.
 Coast Counties Gas & Elect. Co., San Francisco, Cal.
 Hartford & Springfield St. Ry., Co. Hartford, Conn.
 Worcester Consol. Street Ry., Worcester, Mass.
 Binghamton Ry. Co., Binghamton, N. Y.
 Wisconsin Power & Light Co., Madison, Wis.
 Kansas City Rys., Kansas City, Mo.
 Iowa Railway & Light Co., Des Moines, Iowa
 Omaha & Lincoln Ry. & Lt. Co., Omaha, Neb.
 Arkansas Central Power Co., Little Rock, Ark.
 Twin City Rapid Transit Co., St. Paul, Minn.
- Wilkes-Barre Ry. Co., Wilkes-Barre, Pa.
 Phillipsburg Traction Co., Phillipsburg, N. J.
 Wilmington & Philadelphia Traction Co.
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 Union Street Ry. Co., New Bedford, Mass.
 Baton Rouge Electric Co., Baton Rouge, La.
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 Newburgh Public Service Corp., Newburgh, N. Y.
 Pittsburgh Ry. Co., Pittsburgh, Pa.
 Savannah Electric & Power Co., Savannah, Ga.
 Tacoma Ry. & Power Co., Tacoma, Wash.
 Westside Electric St. Ry. Co., Charleroi, Pa.
 Lehigh Valley Transit Co., Allentown, Pa.
 Wellington City Council, Wellington, N. Z.
 Florida Motor Lines, Inc., Tampa.
 Cincinnati St. Ry. Co., Cincinnati, O.
 Mississippi Power & Light Co., Jackson, Miss.
 Detroit United Ry., Detroit, Mich.
- ✓ Des Moines & Central Iowa Ry. Co., Des Moines, Ia.
 Penn Public Motor Trans. Co., Erie, Pa.
 Maumee Valley Trans. Co., Perrysburg, O.
 Lackawanna & Wyoming Valley Ry. Co., Scranton, Pa.
 Capital District Trans. Co., Albany, N. Y.
 Winnipeg Electric Co., Winnipeg, Can.



Mack-Made Buses

25-Passenger City Type

29-Passenger City Type

25-Passenger Parlor Car

25-Passenger Suburban Type

29-Passenger Suburban Type

25-Passenger Gas-Electric

29-Passenger Gas-Electric

Five 74 Mile round trips a day— and never missed a run for the Des Moines & Central Iowa Motor Transportation Company

That's the performance of three Mack parlor car buses, operating since last September on this company's Des Moines—Newton inter-urban line.

The schedule calls for five round trips a day, and *the buses haven't missed a trip* since the line was inaugurated. Only four times have they been late in leaving the terminals, and then only a few minutes.

Mack performance wins again.

The distance from Des Moines to Newton is 37 miles, about half of which is pavement. The balance of the highway is in poor condition—dirt and gravel surfacing. There are several bad grades which test the power of the Mack-built engine. Each bus averages seven stops a

trip and running time one way is one hour and a half. Each bus has covered to date better than 40,000 miles while repairs have consisted only of minor adjustments.

Tires, due to correct distribution of weight and perfect alignment, are averaging between 20,000 and 23,000 miles, fuel consumption is slightly better than seven miles to a gallon while a gallon of lubricating oil is sufficient for 400 miles. Complete operating costs, including depreciation, is normal; that is, equal to the original estimate. Mack performance, shown in marked economy of operation and maintenance, is producing constantly growing revenue, "with which we are distinctly pleased."

The nearest Mack factory branch is ready to indicate tangible and profitable operation for you.



MACK TRUCKS, INC.
INTERNATIONAL MOTOR COMPANY
25 Broadway, New York City

One hundred and seven direct MACK factory branches operate under the titles of "MACK INTERNATIONAL MOTOR TRUCK CORPORATION," "MACK MOTOR TRUCK COMPANY," or "MACK TRUCKS OF CANADA, LTD."

American BROWN BOVERI

The World's largest steam



PRINCIPAL PRODUCTS

Mercury-Arc Power Rectifiers (steel enclosed)

Electric Locomotives—for any system of current, high or low tensions

Complete equipment for railway electrification

Rotary Converters

Motor Generators

Diesel-Electric Locomotives

Mining Locomotives

Switches, Controllers and all Auxiliary Equipment

Steam Turbo Generators for normal or high pressures and superheats

Automatic Regulators

Oil Switches

Condensers and Auxiliaries

Relays

Turbo Compressors and Blowers

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THE largest unit yet constructed for the generation of electric power was recently ordered for the Hell Gate Station of the New York Edison-United Company System. This turbo-generator will be built by the American Brown Boveri Electric Corporation at its main plant in Camden, New Jersey.

The size and character of this unit presents for the consideration of American Utilities engineers an entirely new ratio between equipment costs and land and building costs, in the Kw. price of generating stations.

The New York Edison-United Company System has always been recognized to be among the most progressive of America's electrical companies. Its management has faced and met electrical problems created through the growth of New York City, by the use of engineering talent of resource and vision.

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Electrical and Mechanical Characteristics

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Superheat — 200 deg. (present conditions at Hell Gate Station).

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Total weight — 2,810,000 lb.

American Brown Boveri Electric Corporation

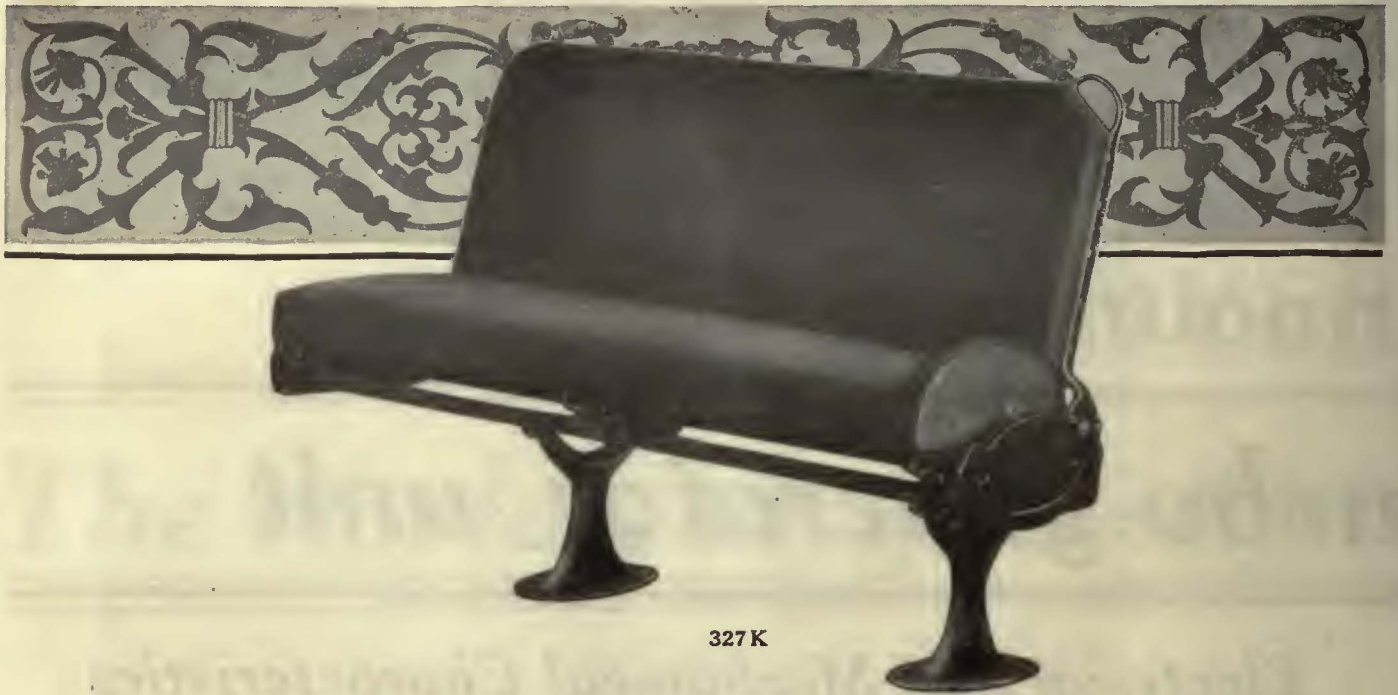
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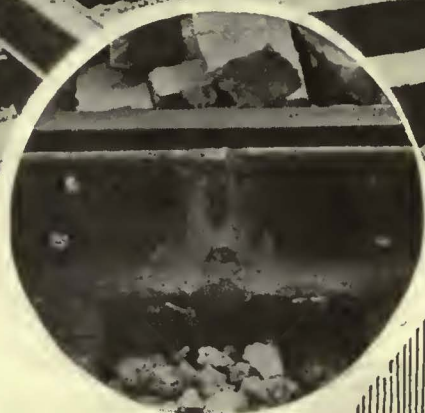
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**Making
Trouble-Free Track for
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Sesqui-Centennial
Traffic**

The Philadelphia Rapid Transit Company, planning to carry 100,000 people an hour at the peak of the Sesqui-Centennial traffic, is building permanent track. This track is being built not only for this immediate traffic necessity, but for years of future service in a newly developing section of the city.



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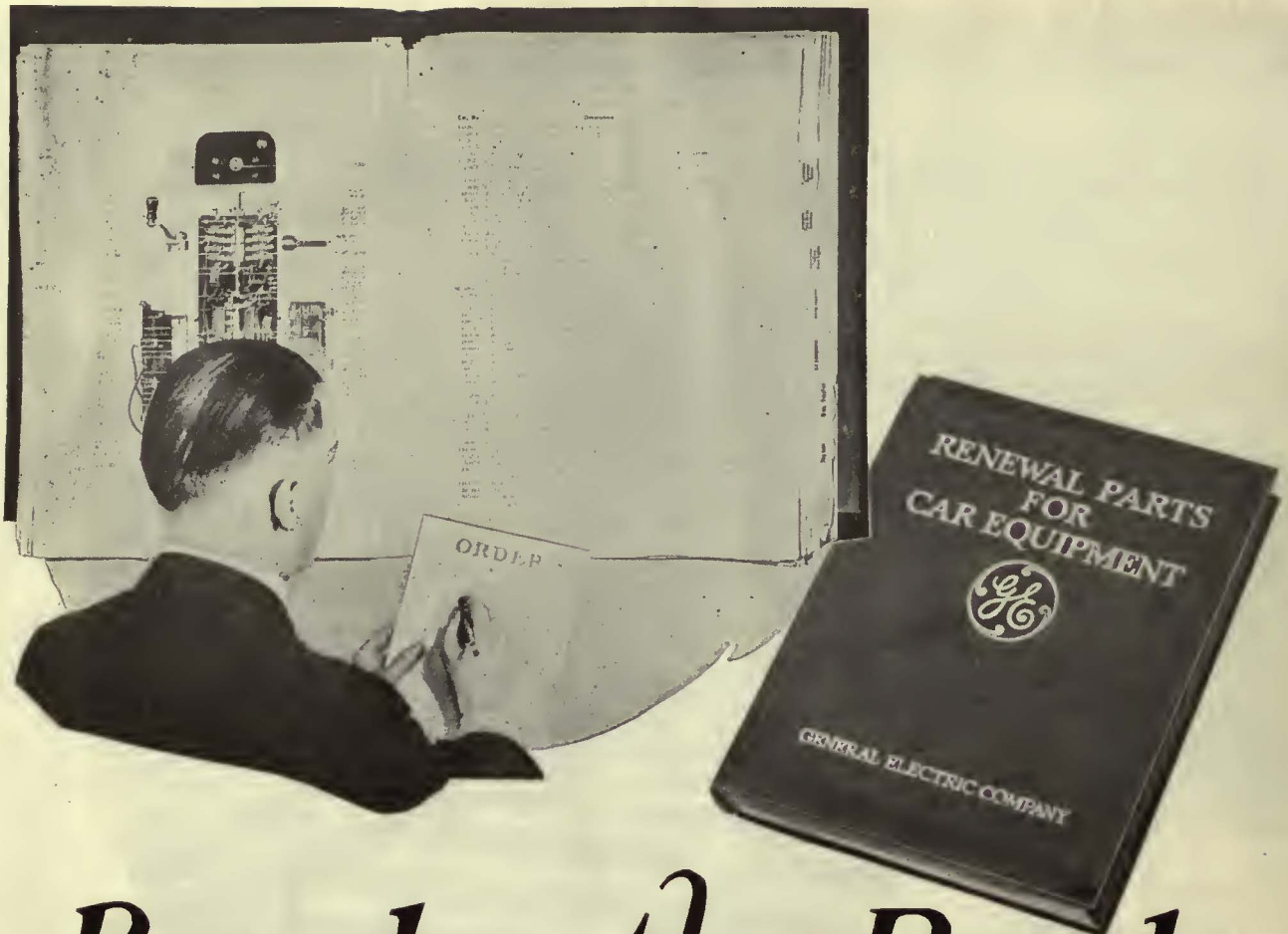
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GENERAL ELECTRIC

Electric Railway Journal

Consolidation of *Street Railway Journal* and *Electric Railway Review*

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CHARLES GORDON, *Editor*

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Magnetic Brakes Together with Air Give Short, Positive Stop

HIGH schedule speeds are essential if electric railways are to attract the additional riders to which electric cars are entitled. Along with high speed goes the necessity for the most effective braking equipment possible. The International Utilities Corporation, which owns and operates the Buffalo & Erie Railway and the Kentucky Traction & Terminal Company, has developed a form of magnetic track brake for use in addition to the air brakes already on the cars. The installation of these brakes is nearly completed on all cars operated by these two properties. Details of the equipment together with some test results are given in this issue of the JOURNAL.

This form of magnetic track brake was developed primarily to meet emergency conditions that arise continually on any rail system and which require cars to be stopped in the shortest distance possible regardless of rail conditions. Therefore the magnetic brake equipment is hooked up so as to function automatically whenever the air brake handle is thrown to the emergency position. The retarding force developed by the magnetic track brakes is thus added directly to the maximum that can be obtained by the air brakes. Observations on the Buffalo & Erie Railway show that from ten to twelve emergency stops are made daily. Several very bad accidents have already been avoided by cars equipped with the new features.

Results of tests given in the article show that a reduction of the distance required to bring a car to a stop of from 30 to 35 per cent can reasonably be expected. The reduction in time to make stops is sometimes also of vital importance. One case occurred where an automobile came out of a blind driveway and crossed directly in front of an approaching car. The distance was so short that even with the additional braking force of the magnetic brakes the car could not be stopped before reaching the crossing. The increased time element, however, enabled the automobile to get across, so that a collision was avoided.

An interesting feature of the magnetic equipment is the use of air pressure to force the magnetic shoes down in contact with the rail. This provision enables the magnetic shoes to be carried at a distance of 2½ in. above the running rail. The necessity for a small air gap is thus done away with and there is no need for particular attention to the maintenance of tracks and adjustment of the shoes in order to get maximum braking results.

The framework which supports the magnetic shoes is spring hung, so that it is not a dead weight overhanging the truck structure. The attachment of the magnetic

shoes to the trucks of the double-truck cars is back of the trailing wheels and is of link form. The additional retarding force is thus a pull through these links. Results from the trial equipments, which have now been in service more than six months, show that the addition of the magnetic brakes has had no unfavorable results on the truck structure. The wearing parts of the magnetic shoes are replaceable and adjustments for wear can be made easily.

At this time, when electric railways are using all possible means to make cars safer and better and to provide more attractive service, this innovation in braking equipment is of particular value and results will be watched with interest.

Axle Bearings Should Receive More Careful Inspection

EXCESSIVELY worn axle bearings are causing much trouble in electric railway equipments. They are allowed to become loose and are not given the careful attention they demand. The minimum air gap between armature and pole faces determines when armature bearings must be renewed. If armature bearings are allowed to continue in service with the small air gap the inspector knows that the armature will soon rub the pole faces and probably be damaged beyond repair. He may lose his job as a result and so he will not take chances. The equipment inspector has no such definite gage for axle bearings and does not check them closely.

Axle bearings should be given the same careful attention as armature bearings. It is a mistake to assume that by keeping them in service longer reduced cost will result. The cost of maintaining axle bearings may be lower, but other maintenance costs will mount rapidly instead. Loose axle bearings are disastrous to gears and pinions. From one-half to two-thirds of the mileage that could be obtained with accurately meshed gearing is lost by axles and shafts being out of adjustment and by too great spread between centers.

Maintenance practices that have improved axle bearing conditions in Kansas City are described in the paper by R. W. Bailey presented at the Midwest Electric Railway Association, abstracted elsewhere in this issue. The Kansas City Railways uses die-cast axle bearings. The cost of these is but one-half that of bronze bearings, so they can be replaced at frequent intervals and close limits for bearing wear can be used. With a die-cast type of axle bearing old material can be melted and used for the new bearings, and as the bearings are cast with all windows, keyways, oil grooves, etc., no finishing or machining is necessary.

Particular care is also used in fitting each bearing to

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

the axle about which it is to operate. Whenever a pair of wheels is changed the axle bearings are returned to the shop and new ones are fitted.

Car trucks cause more rattling and disturbing noises than any other part of the equipment. The most important parts of the truck are the bearings. Axle bearings, particularly, should be given more careful inspection and should be renewed more frequently.

Why Do Operators Often Design and Build Their Own Cars?

NOT long ago a new face appeared in the executive office of a large railway property. It developed that this man was employed to design cars to be built either in outside establishments or in the well-equipped shops of the company. The same company is using many buses, it also uses substation equipment and many standard and sometimes easily constructed maintenance units.

Why the complex on cars? What was the psychology back of this desire to design only this one physical thing used in the conduct of the property? Does this company have a peculiar bias or perhaps a hobby on this particular part of its equipment, while taking a normal attitude toward other parts of its property? Or is this caused by lack of originality and initiative on the part of long-established car building companies, resulting in failure to anticipate the needs of this operator?

It is not alone this one incident that raises these questions, but that this tendency has appeared over and over again in many parts of the country. Many cases of car designing complexes on the part of operating companies could be cited. But it is unfortunate that such a condition continues in the face of the magnificent effort now being made to pull this essential industry out of the mire of despondency.

Just as one trained soldier is worth many untrained civilians when in battle, so should one corps of car designers with vision and experience, backed by a management with a desire to lead, be able to outdistance the entire operating group in the question of design. Certainly, since the operating companies have had the spirit to weather the distress and difficulty of recent years and still aspire to seek something better, the car building companies should be able and willing to assume the leadership in design and manufacture.

Wrong Impressions Are Worse than No Consciousness at All

THIS thought is suggested by a recent track-renewal job that was being done in conjunction with the widening and repaving of a business street in a city which is an important transportation center. The work was so extensive as to necessitate temporary suspension of the electric railway service on this street. In the early stages it looked as if the electric railway line was being abandoned. This was the impression gained even by some electric railway men who were passing through the city and were among the large numbers of out-of-town people to see the work in progress. Perhaps this conclusion was justified, as there was nothing to indicate otherwise, but it illustrates the great tendency of the public mind to believe that the electric railway has reached the peak of its usefulness.

The local business man who has his store remodeled seldom fails to make known, at least to the passers-by, that it is "being enlarged in order better to accommodate our growing patronage" or "still further to improve service to our customers." But the merchants of transportation have not learned equally well the value of pointing out to their patrons the better-service significance of new improvements and investments, although the improvements made by the electric railway, which is established to serve the whole community, are of much more general interest. True, it may not always be practicable to point out the better service represented in ordinary track reconstruction, yet posters telling, for instance, something of the cost per mile would add to the common knowledge and, in the case cited, could have prevented some misinformation of a kind which just now is altogether too plentiful.

People see the motor bus being introduced both as an addition and as an adjunct to their present transportation. Some have seen it replace as well as extend electric railway service. Not being in a position to know its limitations, many overestimate its possibilities and so expect less from the electric railway of the future. This is a state of mind which makes it essential, more than ever before, that the people, all potential railway customers, be correctly informed. It must be remembered that the average individual comprehends very little of the activities, the problems and the plans of his local electric railway. Strangely enough, even the indispensability of this public servant is not always obvious, much less appreciated. No panacea can be offered for this condition. Each company must be alert to take advantage of every opportunity to achieve and maintain in the public mind a proper conception of its purpose and its importance. A sympathetic public must have the facts.

Mr. Coffin's Life Story Is an Inspiration

FEW men have the ability and genius to organize and control capital and labor as did Charles A. Coffin, who passed away this week after a long and useful career. Without his courage, his vision and his perseverance the General Electric Company, which he founded, would probably never have developed into the world-wide organization it became under his direction.

His active connection with that company and its predecessors has covered the entire history of electrical development as it is known today. He was a successful business man in Lynn, Mass., during the early eighties when Elihu Thomson was a struggling inventor, trying to interest people in his newly developed arc light generator and lamp. Finally some of Mr. Thomson's friends appealed to Mr. Coffin to give them the benefit of his commercial experience in the manufacture and sale of this new machinery. For a number of years the company over whose affairs Mr. Coffin presided, the Thomson-Houston Electric Company, devoted itself primarily to Professor Thomson's series lighting system, while its principal competitor, the Edison Electric Manufacturing and associated companies, developed the low-voltage direct-current incandescent lighting system. When the two organizations were brought together the choice of the man to lead the destiny of the combined company fell on Mr. Coffin.

While not specially trained in science or electricity,

he was not slow to grasp the possibilities of the new power. Furthermore, he saw that much could be accomplished by investigation and research, not only toward improvement in methods but even more in looking far afield to find possible new applications of the mighty force. No one was more ready to expend large sums of money to encourage research in pure and applied science, even though its connection with the business might seem remote.

It was characteristic of Mr. Coffin that the men about him were far better known to the general public than he was himself. While he was most approachable and willing to talk about the industry, he was always ready to attribute to others credit for achievements for which all recognized he was largely responsible.

Conditions such as those that brought Mr. Coffin into the electrical industry in its early days will never be repeated. Nevertheless, there is even more opportunity for the young man in the business today, in no small part due to his work. The story of his life should be an inspiration to men in the field, just as are the awards given in his name an inspiration to better and yet better work by the companies.

Interborough Sues Strikers for Injury to Its Business

SUIT for \$239,000 damages has been brought by the Interborough Rapid Transit Company against 62 of its striking employees. It is based on a very fundamental principle of law. This is that if A and B have entered into a valid contract by which A employs B and C seeks maliciously to procure a breach of this contract, C can be enjoined and sued for damages. The word "maliciously" in this connection does not mean necessarily with malice or ill will, but with intention to interfere with the business of A.

This principle has been fully adjudicated by the United States Supreme Court, most notably perhaps in *Hitchman Coal & Coke Company vs. Mitchell et al.* (245 U. S., 229), where the defendants directly and through agents attempted to call out on strike the employees of a non-union coal mining company and thereby injuriously affected the company's business. In this opinion, which was delivered by Justice Pitney on Dec. 10, 1917, a number of very definite principles of law were laid down. One of these is that an employer is entirely free to make non-membership in a particular union a condition of employment. Another is that the right of men to strike did not give the defendants in the case the right to instigate a strike. In other words, the purpose entertained by the defendants to bring about a strike in the mine so as to compel the owner to consent to the unionization of the mine was an unlawful purpose. Hence the court approved the grant of an injunction against the defendants to prevent them from interfering or attempting to interfere with the employees of the mine for the purpose of unionizing it, of wilfully trying to induce them to break their contracts of service or leave their service without their employer's consent, or intimidating them.

The New York courts are also very clear on this subject, notably in *Calvin A. Lamb vs. S. Cheney & Son* (227 New York, 418), where the court said:

Where a man employs a laborer, and another man, knowing of such contract of employment, entices, hires or persuades the laborer to leave the service of the first employer during the time for which he was so employed, the law

gives the party injured a right of action to recover damages.

While the Interborough is asking for injunction and damages, it has not applied for a temporary injunction to prevent its striking employees from committing unlawful acts, such as endeavoring to persuade present employees to abandon their duties. Should this temporary injunction be requested, precedents in the New York courts indicate that it would be granted. Thus it is only seven years ago that the New York Supreme Court granted such an injunction in the case of *Third Avenue Railway vs. Patrick J. Shea, Amalgamated Association of Street & Electric Railway Employees, W. D. Mahon, et al.* This injunction required the defendants to refrain from interfering with the performance of the contract of employment between the railway company and its employees, from approaching or conferring with said employees as a part of any attempt to induce them to break their contracts with the railway company, from enrolling or attempting to enroll said employees in said Amalgamated Association without the consent of their employer, from enticing said employees, present and future, under like contract, to leave the service of their employer, etc. The New York courts have also shown themselves ready to act under the Penal Code in case of unlawful acts by strikers, as shown in the case of the 1916 Interborough strike, where some 720 strikers received sentences, some for imprisonment and others for fines.

In other words the courts, both federal and state, at least so far as New York State is concerned, have very definitely declared they will penalize all persons who do not mind their own business but unlawfully interfere with the business of others. Labor organizations should realize this fact. Individual strikers should also understand the peril which they run in trying unlawfully to injure the business of a former employer. It was for this very offense that less than ten years ago, in the *Danbury Hatters' case*, a judgment was obtained against some 186 former employees for about \$80,000, for injuring the business of D. C. Lowe & Company, hat makers. Under the Sherman anti-trust law this amount was tripled, making it about \$240,000, and interest brought it up to about \$300,000. Writs of attachment were levied on the bank accounts and homes of the defendants, who finally raised about \$80,000. The efforts of labor organizations to raise the rest of the money are well known, and \$150,000 was secured through voluntary contributions, making a total of about \$230,000, which was finally accepted in settlement by the plaintiffs.

In brief, the law says that a man is free to leave work which is unsatisfactory at the end of his term of contract, just as the employer is free to discharge him at such time, but he is not free to incite others to break their contracts with his former employer or otherwise injure his business unlawfully.

It would be especially desirable if this principle should be realized and enforced in public utility cases. In them the public has a vital interest. Discontinuance of the manufacture of hats by a single maker for a longer or shorter period does not seriously affect the people at large. They can buy their hats from another maker. But with the public utility the situation is different. It is to be hoped that the legal principles on which the Interborough suit is based will be again laid down by the courts. It will be a good thing for all concerned.



Car on Buffalo & Erie
Railway Equipped with
Magnetic Track Brakes

Emergency Stopping Distance Decreased 22.5 to 46 per Cent

By Using Magnetic Track Brakes to Supplement Air Brakes on Its Interurban Cars the Buffalo & Erie Railway Increases Retardation Materially—Makes Brake Effective Regardless of Rail Conditions—Permits Higher Maximum Speed and Reduces Front-End Accidents

FOLLOWING careful tests with magnetic track brakes to supplement the air brakes, the Buffalo & Erie Railway, Fredonia, N. Y., and the Kentucky Traction & Terminal Company, Lexington, Ky., are proceeding to equip all of their cars with the equipment developed. Tests on two sample equipments were made on the Buffalo & Erie line late last year and further developments and improvements were made this year while the two cars were continued in regular service. Officers of the International Utilities Corporation, which owns the two railway properties, feel that this development is of tremendous value. The tests conducted have shown that regardless of rail conditions the supplementary magnetic brake equipment gives a positive form of braking; that the braking distance is decreased from 22.5 per cent to 46 per cent over what would be obtained with air brakes alone, and that a further decrease can be made to any reasonable amount desired. With the installation of this type of supplementary braking schedule speed can be improved. Careful checking of results obtained has led the management to believe that a very large proportion of front-end accidents can be eliminated with the additional braking equipment and catastrophe hazards, such as runaways,

car collisions and inability of motormen to control cars, are prevented. Checks on the number of emergency stops show that there are from ten to twelve daily.

As an example of the prevention of accidents with this improved braking equipment, one case occurred where an automobile came from behind a truck and stalled on the railway track. The motorman barely had time to apply the brakes. Thanks to the high rate of retardation obtained through the addition of the magnetic brakes the car stopped within 2 ft. of the automobile. Without this high rate of retardation a very bad accident would have resulted.

NEW TYPE OF BRAKE DEVELOPED

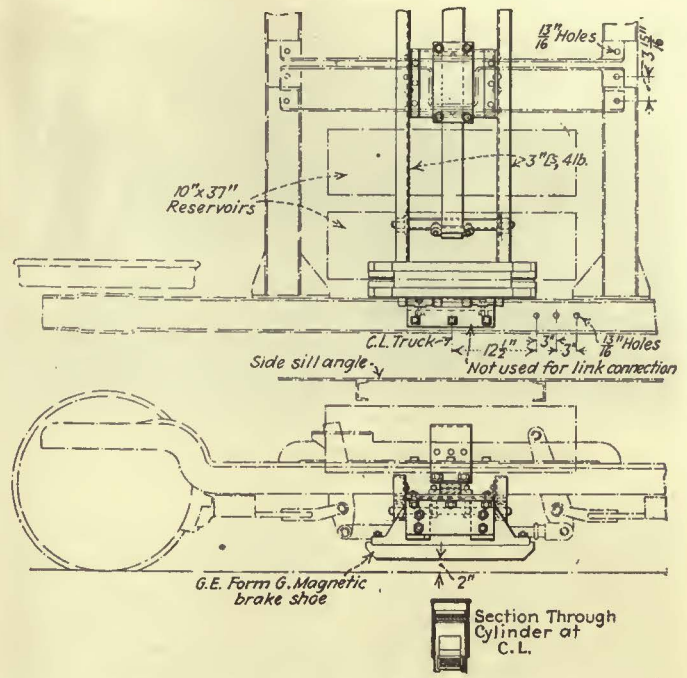
The type of magnetic brakes used is quite different from the usual forms such as have been used in this country, as on cars of the West Penn Railway and very extensively abroad, particularly in England. In its regular running position the bottom of the magnetic shoe is maintained 2 in. above the top of the running rail. When the brakes are applied air pressure first brings the magnet shoes into contact with the running rail and then through the energizing of the electromagnets magnetic braking results. By this means the

very small air gap required with other forms of magnetic track brake is not used. In England the magnetic brake shoes are maintained from $\frac{1}{16}$ to $\frac{1}{8}$ in. above the surface of the rail. It will be appreciated by electric railway operators that such a small clearance must require close attention to the maintenance of tracks as well as to the braking equipment itself.

The additional electrical equipment used in this installation on the lines of the Buffalo & Erie Railway and the Kentucky Traction & Terminal Company's cars is being furnished by the General Electric Company. The mechanical parts and suspensions are furnished by the Cincinnati Car Company. On double-truck cars four magnetic shoes are used and on single-truck cars but two shoes. Accompanying line drawings show the method of supporting the equipment on the two types of trucks. On single-truck cars the magnetic brake shoes are attached to the trucks so that the shoes come in contact with the rail midway between the two wheels on each side. On cars which use the Cincinnati Car Company's RS-60-D double trucks a pair of brake shoes is attached to the outside framing of each truck.

A rigid supporting framework of two 3-in. x 2-in. x $\frac{3}{8}$ -in angles is carried across the end of the truck. These are anchored at each end to bars 4 in. x 1 in., which extend back to the truck-pedestal castings. There are also additional supporting bars to the upper part of the truck framework at each end. The two angles are connected at the center by a plate which serves as the saddle for a semi-elliptic spring. The air cylinder for pushing the shoes down in contact with the rail also forms a part of this center saddle. The cylinder is 5 in. in diameter and 8 in. long. The piston of the air cylinder is attached to a similar circular section, which fits closely inside the air cylinder and extends down to the movable support for the magnetic shoes.

The movable framework which supports the shoes consists of two 3-in., 4-lb. channels, which extend across the ends of the truck. The magnetic shoes are mounted at the ends of these. These channels are connected together at the center by a built-up structure of angles and plates. The movable part of the air cylinder is attached to this. At the ends of the movable framework two adjustable screws form the connection to saddles which hook into the ends of the semi-elliptic spring. The shoes are guided by the permanent structure extending down outside of the shoes so as to prevent excessive sidewise motion. They are also held



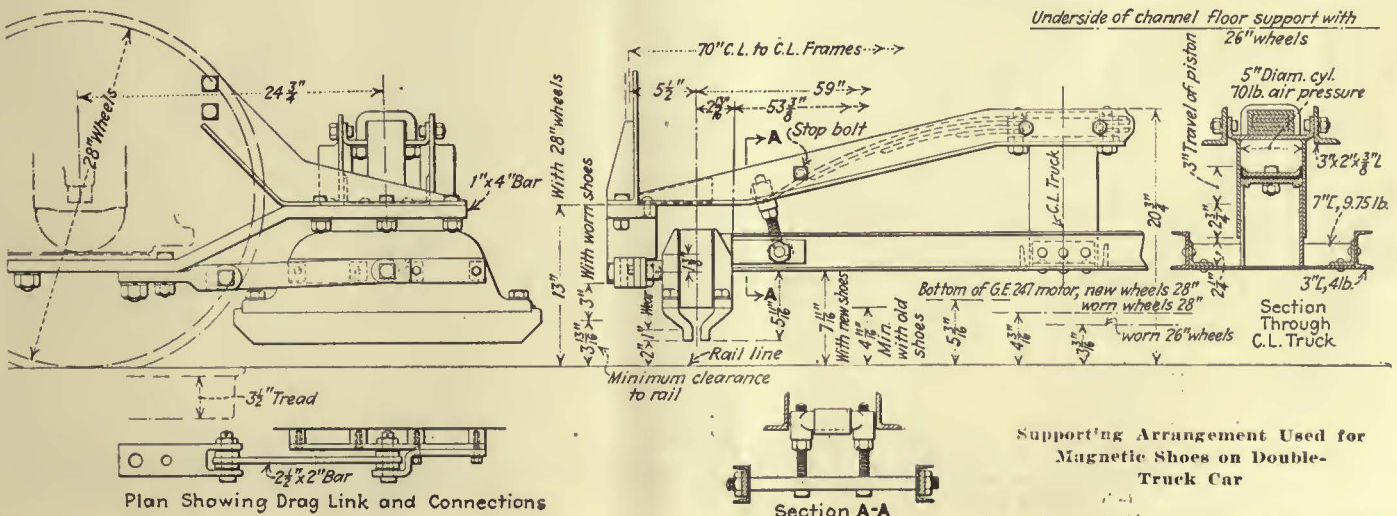
Method of Supporting Magnetic Brake Shoes on Single-Truck Car

longitudinally by links which connect to a clevis attached to the lower part of the pedestal casting. The two stationary angles which extend across the end of the truck also serve as guides for the saddles which are attached to the ends of the springs. When the shoes are down the retarding force is transmitted through the link connection.

The bottom of the stationary framework immediately above the shoes is 13 in. above the rail line with new 28-in. diameter wheels, and the outside construction which serves as a guide for the shoes extends down to within 6 $\frac{1}{8}$ in. of the rail line. The adjustable screws which form the connection from the ends of the spring to the movable beam provide an adjustment of the magnetic shoes for wheel wear, so that uniform height of the shoes above the rail line can be maintained up to the scrapping diameter of the wheels.

STANDARD METHOD OF BRAKE OPERATION USED

For operating the brakes a standard M-28 brake valve is used without change. The sander connection is used to supply air for operating an electro-magnetic switch.



Supporting Arrangement Used for Magnetic Shoes on Double-Truck Car

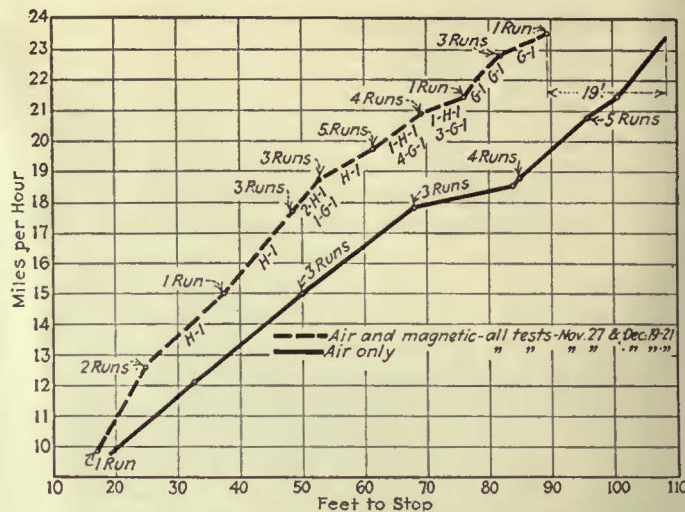


Magnetic Track Brake Shoes at Trailing End of Front Truck on Double-Track Car

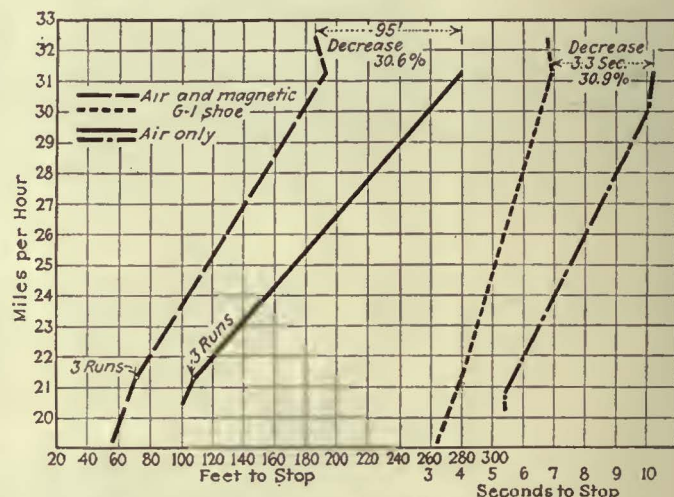
This closes the electric circuit to operate a contactor, which in turn energizes the coils of the magnetic brake shoes. Two shoe coils are connected in series with a resistor and trolley voltage is used. With this arrangement the magnetic brakes must be used every time the brake valve is thrown to the emergency position, and they can be operated independently if desired. In addition to this equipment, a relay valve is used to control the time that the magnetic coils are energized. In the service operated by the test equipment this was arranged to keep the coils energized for 24 seconds. Two fuses mounted in an MA-13 fuse box serve to protect the line breaker and the auxiliary operating circuits. Air connections to the magnetic brake operating cylinder are made through two 3/4-in. hose. A union with a choke is used to govern the leakage of air for cutting out the contactor.

DECREASED TIME AND DISTANCE

The accompanying graphs show average results of a number of tests made to determine the decreased time and distance that would result by the use of the magnetic brakes, together with the air brakes as compared



Decreased Distance to Stop at Various Speeds When Using Air and Magnetic Brakes as Compared with Air Alone. Two Types of Magnetic Brake Shoes Were Used During the Test Made on a Single-Track Car

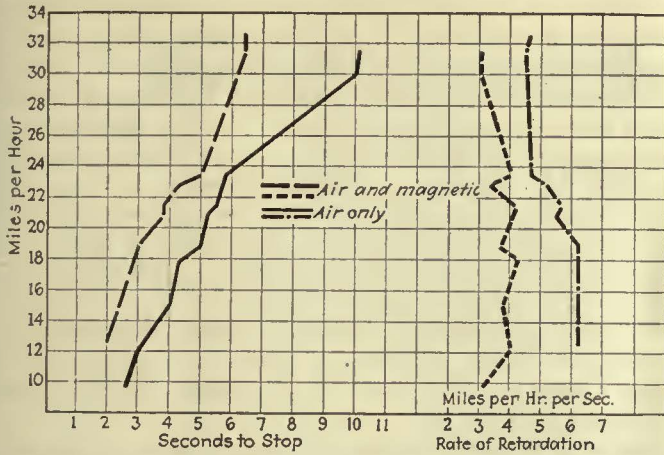


Comparison of Stopping Distances and Stopping Time Using the Type of Magnetic Shoes Finally Adopted as Compared with Air Alone on Single-Track Car

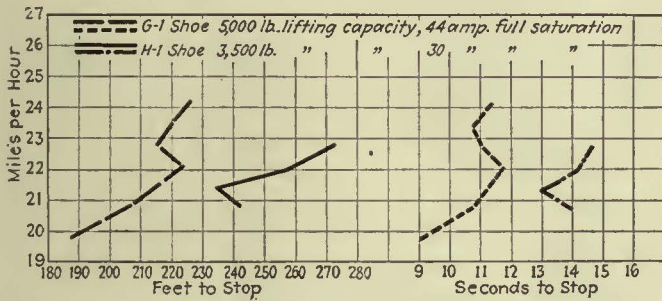
Table I—Braking Tests on Single-Track Car Weighing 17,000 Lb. Light

Kind of Stop	Air Pressure, I. b.	Braking Current, Amp.	Speed When Brakes Were Applied, M.P.H.	Time to Stop, Sec.	Distance to Stop, Ft.	—Decrease of Air-Magnetic Over Air Alone—				Rate of Retardation, Average	Increased Rate of Retardation, With Air-Magnetic	Per Cent Increase in Rate of Retardation
						In Stopping Distance, Ft.	In Stopping Distance, Per Cent	In Time to Stop, Sec.	In Stopping Time, Per Cent			
Air.....	70		21.4	5.1	95.05					4.22		
Air-Magnetic.....	70	43.3	21.4	3.8	73.17	21.88	23.0	1.27	25.0	5.63	1.41	33.4
Air.....	70		21.4	5.2	114.83					4.11		
Air-Magnetic.....	70	43.0	21.4	4.0	81.17	23.66	22.5	1.20	23.0	5.35	1.24	30.1
Air.....	65		21.4	6.0	110.25					3.56		
Air-Magnetic.....	60	40.0	21.4	4.2	77.00	33.25	30.1	1.80	30.0	5.09	1.53	43.0
Air.....	60		21.4	6.8	128.00					3.14		
Air-Magnetic.....	70		20.8	5.3	97.27					3.95		
Air.....	70		20.8	3.8	69.14	28.13	28.9	1.46	27.7	5.47	1.52	38.4
Air-Magnetic.....	70	42.7	20.8	5.0	85.33					3.76		
Air.....	70		18.8	3.0	57.66	27.67	32.4	2.00	40.0	6.26	2.50	66.5
Air-Magnetic.....	70	43.0	18.8	3.0	32.50					4.03		
Air.....	70		12.1	3.0	29.50	8.00	24.6	1.00	33.3	6.25	2.22	55.0
Air-Magnetic.....	70	43.0	12.5	2.0	132.17					3.35		
Air.....	60		22.8	6.8	132.17					4.56		
Air-Magnetic.....	60	43.0	22.8	5.0	90.75	41.42	31.3	1.80	26.4	5.18	1.21	36.0
Air.....	70		22.8	4.4	82.00					5.24		
Air-Magnetic.....	70	57.0	22.8	4.2	78.00					4.51		
Air.....	70		57.0	4.2	66.17					5.08		
Air-Magnetic.....	65	42.0	20.3	4.4	74.00					3.85		
Air.....	70		19.3	3.8	104.3					5.35	1.50	39.0
Air-Magnetic.....	70	47	21.4	4.0	76.3	28.0	26.8	1.4	26.0	3.76		
Air.....	70		20.3	5.4	101.25					5.35		
Air-Magnetic.....	70	47	21.4	4.0	68.75	32.5	32.1	1.4	26.0	3.76	1.59	42.2
Air.....	70		48	19.25	3.2	56.5				6.01		
Air-Magnetic.....	70	47	11.5	2.2	22.3					5.23		
Air.....	70		48	32.5*	200.0							
Air-Magnetic.....	70	49	31.3*	6.8	187.0	94.25	33.5	3.4	33.3			
Air.....	70		31.3*	7.0	193.3	87.95	31.3	3.2	31.3			
Air-Magnetic.....	70	48	31.3*	10.2	281.25							
Air.....	70		30.0*	10.0	259.25							
Air-Magnetic.....	70		32.5*	6.8	186.8							

* The last six tests were made by running down 4 1/2 per cent grade and applying brakes when level track was reached. The speed given is the average for 220 ft preceding point of brake application and is not the speed when brakes were applied.

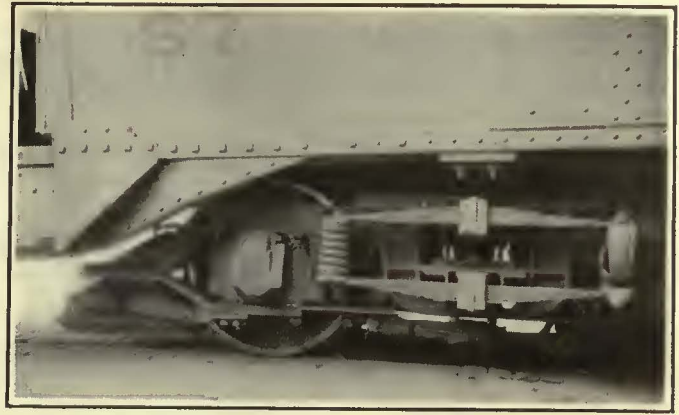


Decreased Time to Stop and Comparison of Rates of Retardation When Using Air and Magnetic Brakes as Compared with Air Alone. Same Series of Tests as Given at Top of Page 98



Comparison of Stopping Distances and Time of Stopping for Two Types of Shoes on Single-Truck Car

with air brakes alone. Tests were also conducted with two different types of shoes called H-1 and G-1. The G-1 shoe had a longer contact surface and gave the better results. It was 21½ in. long and is made in two parts. Each half has a contact area of 16.31 sq.in., or 32.62 sq.in. total, as compared with a length of 15½ in. and a total contact area of 22.88 sq.in. for the H-1 shoe. Both types have renewable portions ¾ in. thick, which should have an average life of about nine months. The new equipments are being furnished



Magnetic Track Brakes at Trailing End of Rear Truck

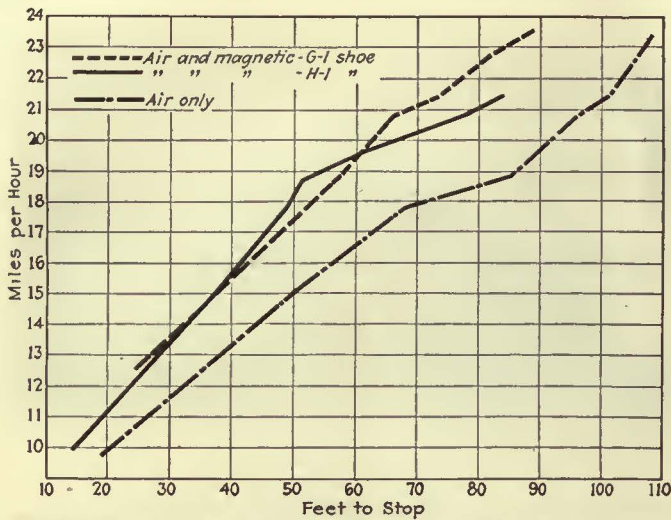
with the G-1 type of shoe. In general, rates of retardation when using both air and the magnetic track brakes were obtained up to 6.2 m.p.h. per second. Averages over a large number of tests showed that the time to stop from a speed of about 22 m.p.h. could be reduced approximately 26 per cent by the use of the magnetic brakes in addition to air. A corresponding decrease in the distance required to stop of 23 per cent was obtained and the rate of retardation was increased nearly 44 per cent. Tests were made on two types of cars. One was a single-truck car weighing 17,000 lb. without passenger load. During the test an average load of fourteen passengers was carried in the car. The braking ratio was 104 per cent and the air pressure used was 70 lb. The double-truck car used in the tests weighed 38,000 lb. without passenger load. An average of eight passengers was carried in the car during the test and the braking ratio was about 100 per cent. The average current taken by the magnetic shoe was 48 amp.

METHOD USED IN TESTS

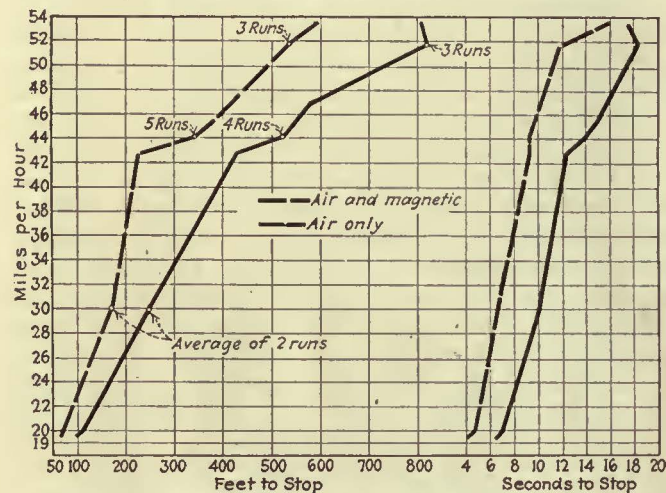
The method followed in making the tests was to place two red flags on a level stretch of tangent track spaced 220 ft. apart. The time to run over this distance was taken by two stop watches, while the speed was maintained as nearly uniform as possible. From this, the

Table II—Braking Tests on Double-Truck Car Weighing 38,000 Lb. Light

Kind of Stop	Air Pressure, Lb.	Line Volts	Current Taken by Each Magnet, Amp.	Speed When Brakes Were Applied, M.P.H.	Time to Stop, Sec.	—Decrease of Air-Magnetic Over Air Alone—				Rate of Retardation, Average	Increased Rate of Retardation With Air-Magnetic	Per Cent Increase in Rate of Retardation	
						Distance to Stop, Ft.	In Stopping Distance, Ft.	In Stopping Distance, Per Cent	In Time to Stop, Sec.				In Stopping Time, Per Cent
Air.....	70	640		19.5	6.6	97.33				3.0			
Air-Magnetic....	70	640	45.0	19.5	4.2	66.50	30.83	30.6	2.4	36.3	4.6	1.6	53.3
Air.....	70	640		20.0	7.0	112.80					2.8		
Air-Magnetic....	70	645	45.0	20.0	4.8	71.25	41.55	36.7	2.2	30.0	4.1	1.3	46.4
Air.....	70	625		30.0	10.0	245.33					3.0		
Air-Magnetic....	70	640	47.5	30.0	6.4	170.66	74.67	30.4	3.6	36.0	4.7	1.7	56.7
Air.....	70	640		30.0	10.4	256.00					2.9		
Air-Magnetic....	70	635	47.5	30.0	7.0	174.00	82.00	32.0	3.4	32.0	4.3	1.4	48.2
Air.....	70	655		42.8	12.4	427.00					3.5		
Air-Magnetic....	70	645	47.5	42.8	9.4	230.25	196.75	46.0	3.0	24.0	4.5	1.0	28.5
Air.....	70	640		44.1	14.8	537.75					3.0		
Air.....	70	630		44.1	14.0	523.00					3.1		
Air.....	70	640		44.1	13.6	479.00					3.2		
Air-Magnetic....	70	640	47.5	44.1	9.4	342.50	137.50	28.7	4.2	30.9	4.7	1.5	46.9
Air.....	70	620		45.4	15.0	553.75					3.0		
Air-Magnetic....	70	640	45.0	45.4	10.8	402.00	151.75	27.5	4.2	28.0	4.3	1.3	43.3
Air-Magnetic....	70	645	47.5	45.4	10.2	378.50	175.25	30.9	4.8	32.0	4.4	1.4	46.7
Air-Magnetic....	70	645	47.5	45.4	9.0	351.00	202.75	36.4	6.0	40.0	5.0	2.0	66.7
Air.....	70	615		44.1	13.0	562.00					3.4		
Air-Magnetic....	70	615	45	45.4	9.8	397.00	165.00	29.3	3.2	24.6	4.6	1.2	35.3
Air-Magnetic....	70	615	45	45.4	9.4	382.00	180.00	32.3	3.6	27.7	4.8	1.4	41.2
Air.....	70	620		46.9	15.6	585.00					3.0		
Air.....	70	580		51.7	18.8	829.00					2.7		
Air.....	70	580		51.7	18.2	818.00					2.7		
Air.....	70	590		51.7	18.0	821.00					2.8		
Air-Magnetic....	70	590	45	51.7	11.8	537.00	284.00	34.5	6.2	34.4	4.4	1.6	57.1
Air.....	70	590		53.5	17.6	809.00					3.0		
Air-Magnetic....	70	590	53.5	53.5	13.0	617.00	192.00	23.7	4.6	26.0	4.1	1.1	36.7
Air-Magnetic....	70	590	53.5	53.5	12.6	603.00	206.00	25.4	5.0	28.4	4.2	1.2	40.0
Air-Magnetic....	70	590	53.5	53.5	12.0	579.00	230.00	28.4	5.6	31.8	4.4	1.4	46.7



Decreased Distances to Stop and Comparison of Results Obtained with G-I and H-I Magnetic Shoes on Single-Truck Car



Comparison of Stopping Distances and Time to Stop of Air and Magnetic Brakes Compared with Air Alone on Double-Truck Car

speed at the time the brakes were applied was computed and the distance was measured from the second red flag, at which the brakes were applied, to the stopping point.

This new development was undertaken by the management with the definite idea of finding some means by which the cars could be stopped quickly under abnormal

conditions of the rail. To determine what could be done under such conditions, a test was made with greased rails, both tracks being smudged with black car oil for a distance of about 65 ft. A number of stopping tests were made on Feb. 8 and 9, 1926. At this time it was snowing and the rail was very wet, in addition to being greased. Brakes were applied 20 ft. before the greased section was reached and all wheels were locked and slid the full length of the stop. Average stopping distances were from a speed of 40 m.p.h., 450 ft.; from 25 m.p.h., 300 ft., and from 15 m.p.h., 120 ft. Magnetic brakes were used in addition to the air. These stopping distances are nearly as good as those obtained with air brakes alone on a good rail, as can be seen by referring to results in Table II.

When cars are required to stop on signal from prospective passengers accuracy in stopping is of advantage. If a car runs by a passenger, the inconvenience may put him in a disagreeable frame of mind. Where the operator sees that his car will not stop at the point desired, the magnetic brakes can be brought into action by operating the air valve even though a service application of the air brakes has been made.

Some tests of stopping distances and times to stop were made, using a service application of the air brakes together with the magnetic brakes. An average of four tests made with air alone gave a stopping distance of 561 ft. from a speed of 32.6 m.p.h. The average time to stop was 22.35 seconds and the average rate of retardation was 1.83 m.p.h. per second.

An average of four similar stops made using both air and magnetic brakes from a speed of 31.9 m.p.h. gave an average stopping time of 15.05 seconds, an average stopping distance of 334 ft. and an average rate of retardation of 2.95 m.p.h. per second.

Honolulu Company Co-ordinates Its Transportation Service

SIX buses are now being operated by the Honolulu Rapid Transit Company. The bodies were designed and built in the company's shops. Seats are provided for 21 passengers. The chassis are Reo Model W. An attractive appearance is given to the outside of the bus by a liberal use of striping. Each vehicle has a name as well as a number, and a pictorial presentation of the name is made just above the lettering.



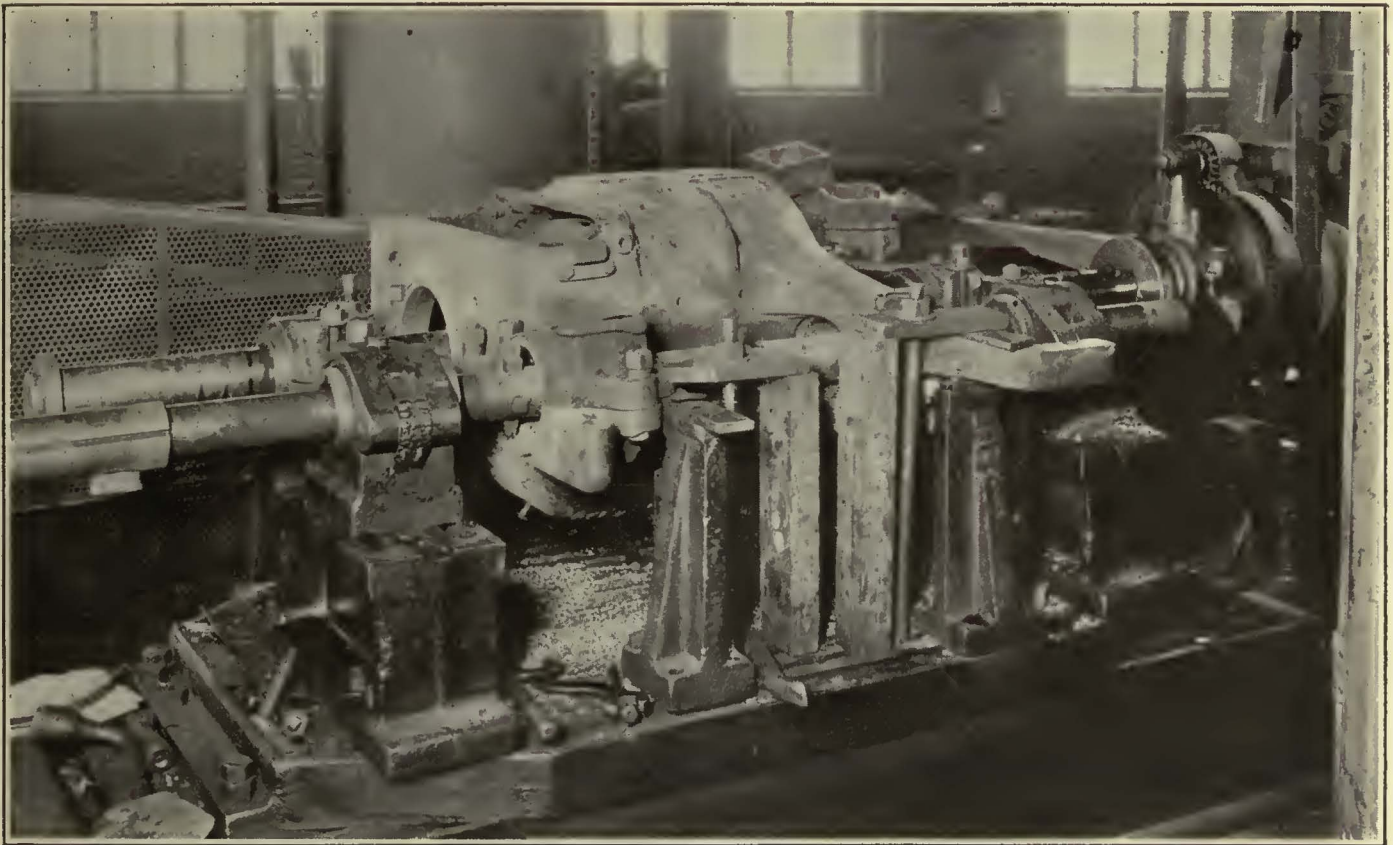
The "Red Dragon" of the Bus Fleet of the Honolulu Rapid Transit Company

Welding and Remachining Split Frame Motors

To Carry Out a Program for Welding, Building Up and Remachining Worn Motor Frame Fits Successfully Requires a Definite Plan for the Work—Such a Program Is Outlined Here

By J. M. Zimmerman

Renewal Parts Engineering, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



A Westinghouse 101-B Split Frame Motor Mounted on the Boring Mill Table After the Cast-Iron Drum Has Been Located Properly in the Frame. The Split Must Be Above the Center Line of the Boring Bar

RAILWAY shopmen, when starting a program for arc welding and reboring motor frames, are often at a loss to know the proper method of welding, machining, how to measure the machined frame and within what limits certain dimensions must be kept. The following program was outlined for the Washington Railway & Electric Company at the beginning of its practice of welding and reboring split frame motors and has proved entirely satisfactory.

Welding in order to build up worn fits of the motor frame is a very important part in rehabilitating a railway motor. Improper welding is liable to warp the frame. If this happens, the upper and lower halves may not fit properly, so as to clamp the housings and axle bearing tightly. If the motor frame is well reinforced it may be possible to rebore for oversize housings and bearings without welding. It is cheaper to rebore the housing fit oversize and purchase oversize

housings than to weld the housing bore and remachine it to standard size; this will eliminate the cost of welding. However, the extra cost of welding the housing bore may be more than offset by the inconvenience of carrying more than one size of housing in stock.

WELDING THE HOUSING FIT

The inside housing fit on the motor frame may be worn from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. Unless this face is built up by welding, the armature end play will be greater than that for which the motor was originally designed. Both the inside and outside housing fits should be welded so as to allow sufficient metal for finishing both sides. In welding this part of the frame the bead should be "put down" perpendicular to the circumference in the housing bore and not with the circumference. If it is "put down" the latter way, when the metal cools and shrinks it will set up strains which will

tend to warp the motor frame, because the length of the weld is longer and, due to the housing bore, the frame cannot resist the pulling action of the weld when it cools. On the other hand, the shrinkage of the short weld will be small as compared to a long weld. The accompanying illustration shows the procedure and the notes refer to the methods.

If the housing bore is to be welded, the beads should be "put down" parallel with the axis of the bore and not with the circumference of the bore. This again brings up the same possibility of warping the frame as explained in the preceding paragraph.

It is preferable not to weld the axle-bearing bore of the frame. All motor frames which have the gear case arm cast as part of the frame are not as well reinforced as other parts of the frame, so at this point

complete layer has been "put down" and the metal is cold it is well to hammer the entire surface of the weld either with an air or a riveting hammer. This will stretch the newly laid metal, thus relieving the shrinkage strains which are caused by the metal shrinking when it cools. This allows the motor frame to spring back to its original shape.

A low-carbon wire will give the best results. A high-carbon wire should not be used in welding the motor frame because the weld will be too hard to machine.

Good values of current to use for "putting down" the beads are 200 amp. with $\frac{3}{8}$ -in. rod and 160 amp. with $\frac{1}{2}$ -in. rod.

The reboring can be done on either a single or double-spindle horizontal boring mill. With the use of

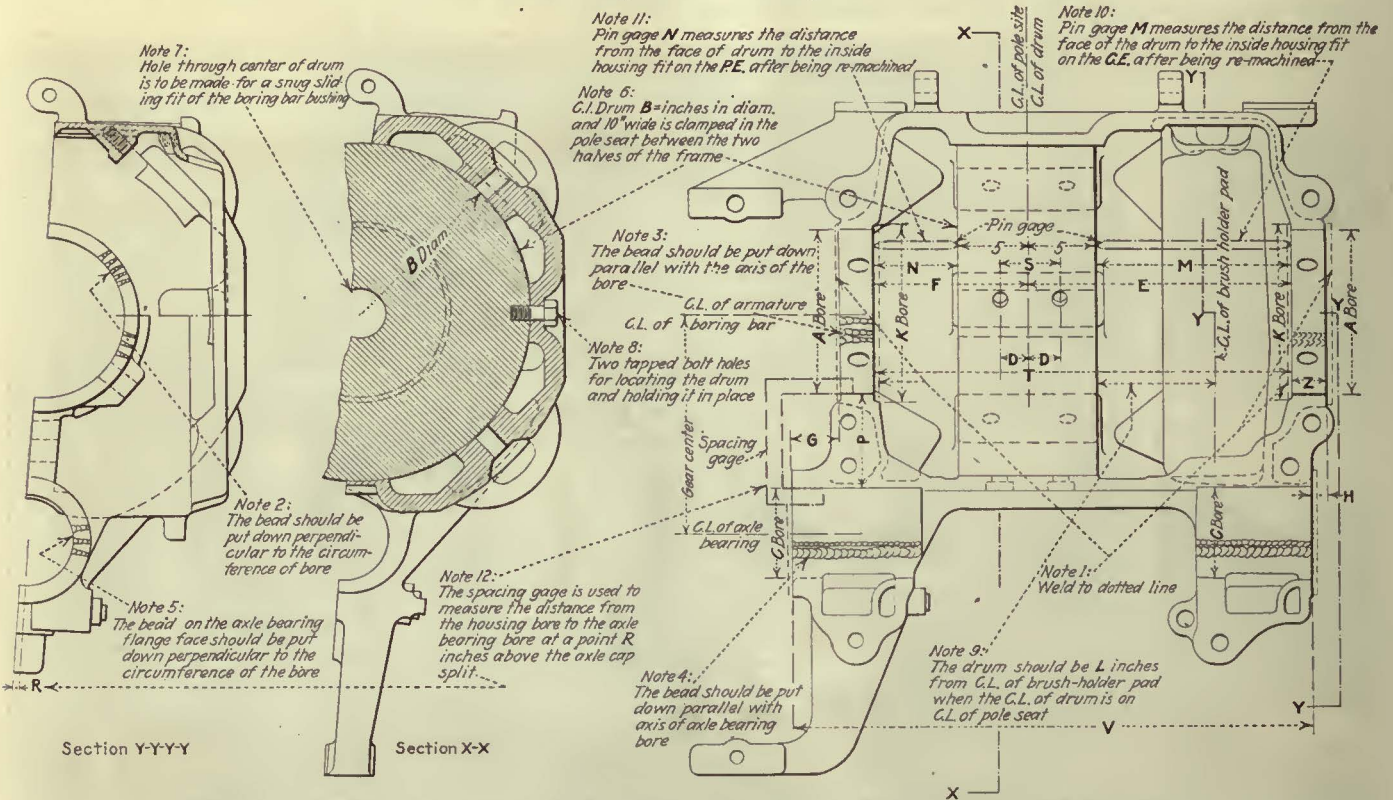


Diagram of Welding Operations and Machining Operations on Westinghouse Split Frame Motor

the warping will be more pronounced if the welding operation is not done with the most extreme care. If the axle cap warps during the welding operation the frame fit can be planed. However, the average railway shop is not equipped to plane the motor frame should the axle cap fit on the motor frame become warped. It is easier and cheaper to re bore the frame and axle cap $\frac{1}{8}$ in. oversize and purchase $\frac{1}{8}$ -in. oversize bearings. This eliminates welding costs. If the welding operation is to be done, the beads should be "put down" parallel with the axis of the axle bearing bore and not with the circumference of the bore. If they are "put down" the latter way, the warping will be more pronounced, as explained in a preceding paragraph.

The frame is always worn at the axle-bearing flange face due to loose axle bearings. In order to use a standard axle-bearing flange it is advisable to weld this face and machine it to standard size. When welding, the beads should be "put down" perpendicular to the circumference of the bore and not with the circumference.

In welding any part of a motor frame after each

a simple spacing gage to measure the gear center distance a very efficient job of reboring can be accomplished with a single-spindle boring mill. This particular operating company started its reboring program on the Westinghouse 306 split frame motor. In explaining the procedure of machining and measuring it will be necessary to use several numerical dimensions of this motor. However, all the dimensions shown in the accompanying illustration are letters instead of numbers, so that it may be used with any motor-frame drawing.

In order to machine the housing bores of the frame so that they will be concentric with the pole bore a cast-iron drum was placed between the two halves of the motor frame. This drum was B inches in diameter. The width of this drum should be exactly 10 in. because the machinist will measure from the face of this drum to the inside housing fit on the motor frame with a pin gage. The hole through the center of the drum is to be a snug sliding fit for the boring-bar bushing.

Two holes were drilled and tapped S inches apart, D inches from the center of the drum and accurately

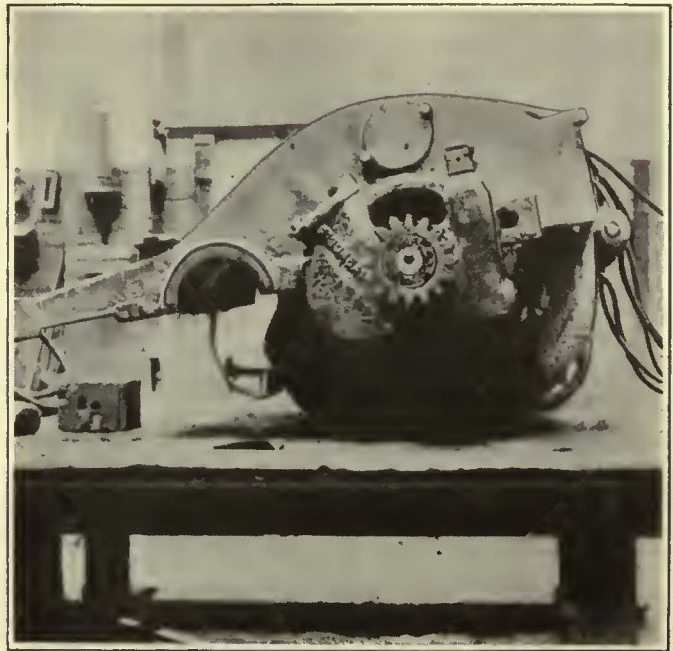
located. By means of these holes it is possible accurately to center the drum and bolt it so that the center line of the drum and the center line of the pole seat match.

The drum should be placed in the upper half of the motor frame, making certain that the center of the drum is in the center of the pole seat. It is better to have the drum closer to the pinion-end housing fit because it will increase the clearance between the brushholder box and the commutator neck. The location of the drum with respect to the center line of the pole seat measures *L* inches from the center of the brushholder pad. (On some motors the staggering of the brushes is produced by having the left-hand brushholder pad farther from the center of the pole seat than the right-hand brushholder pad.) If this dimension is adhered to the clearance between the brushholder box and the commutator neck will not be changed.

After the drum is bolted to the upper half of the frame the lower half is assembled, with a sufficient number of shims between the split so that a 0.017-in. feeler gage can be placed between the axle cap and the motor frame. This will insure positive clamping of the axle bearings and housings. A necessary precaution is to keep the split free from dirt and rough spots.

When clamping the motor frame on the boring-mill table the hole in the drum for the boring bar will locate the housing bore accurately. However, it is necessary to set the frame so that the parting of the axle cap will be *R* inches lower than the center of the boring bar. This is done so that the split of the axle bearing will be *R* inches higher than the split between the axle cap and the motor frame, which prevents the split of the axle bearing and the axle cap from coming at the same point. This dimension *R* on most split frame motors is $\frac{1}{4}$ in.

In order to insure correct armature end play so that the center line of the armature core will rotate in the center of the magnetic field it is necessary accurately

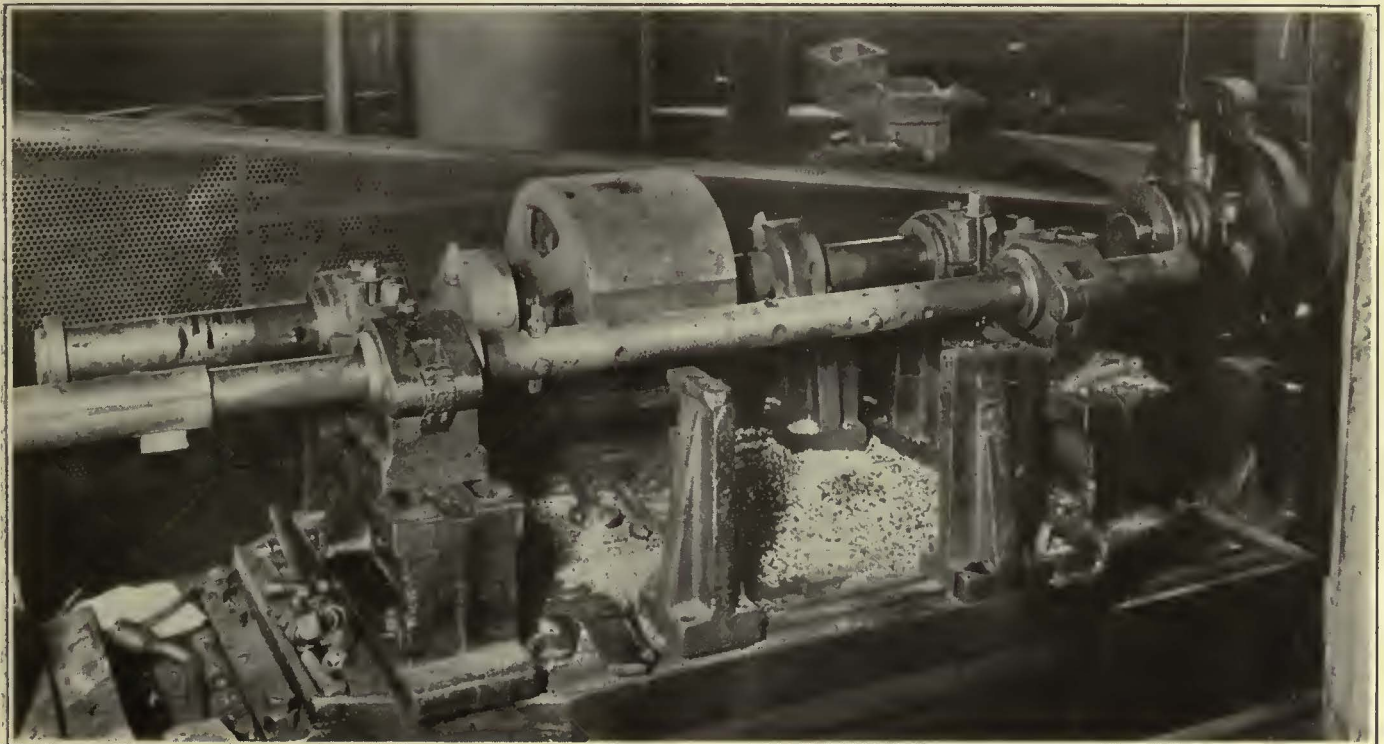


A Westinghouse 306 Split Frame Motor that Was Rebored, Welded and Equipped with Oil Sealed Housings

to machine the inside housing fits so that the dimensions *E* and *F* will not be changed. It is practically impossible to measure these dimensions after the cast-iron drum is clamped between the halves of the frame. However, if the center of the drum and the center of the pole seat coincide they can be measured in a simple manner with the pin gages *M* and *N*.

The dimensions for the pin gages to be used for the Westinghouse 306 motor are as follows:

- E* = The distance from inside C.E. housing fit to the center of the pole seat..... = 16 $\frac{3}{8}$ in.
- Half the width of the drum..... = 5 in.
- M* = The pin gage which measures the distance from the inside C.E. housing fit to the face of the drum..... = 11 $\frac{3}{8}$ in.



A Cast-Iron Drum, Shown Fastened to the Boring Bar of the Boring Mill, Is Placed Between the Halves of the Motor to Maintain Concentricity When Machining.

In the same manner:

- F = Distance from inside P.E. housing fit to center of the pole seat..... = $9\frac{1}{2}$ in.
- Half the width of the drum..... = 5 in.
- N = The pin gage which measures the distance from the inside P.E. housing fit to the face of the drum..... = $4\frac{1}{2}$ in.

After the pin gages have once been made they become a permanent gage for that type of motor.

It is very important that the same gear center be maintained. If it is allowed to become smaller the gear and pinion will bind. If it is allowed to become



The Upper Half of a Westinghouse 101-B Split Frame Motor and Axle Caps After Being Welded and Rebored

large the pressure will be at the end of the teeth, thus causing rapid tooth wear. In both cases the gears will be noisy.

A spacing gage provides a simple way to measure the gear center distances, as indicated in note 12 of the accompanying illustration. This gage is a simple caliper having an opening of P inches. Dimension P will be 5 in. if the housing bore A is $10\frac{1}{2}$ in. and the axle-bearing bore C is $7\frac{1}{2}$ in. It is found in the following manner:

- The radius of the housing bore A = $5\frac{1}{4}$ in.
- The radius of the axle bearing bore C = $3\frac{3}{4}$ in.
- Sum = 9 in.
- The gear center distance..... = 14 in.
- P = Distance between points of spacing gage = 14 in. — 9 in. = 5 in.

If the bore C is to be made $\frac{1}{8}$ in. oversize, then the gage will measure $4\frac{1}{8}$ in. between points. If the bore C is to be $\frac{1}{4}$ in. oversize and the bore A is to be $\frac{1}{4}$ in. oversize the gage would then be $4\frac{3}{8}$ in. between points.

The two points of this gage are used to measure the distance between the housing bore A and the axle-bearing bore C on a line R inches above the split of the upper frame. This line is the center line of the housing and axle-bearing bores. It may take a certain amount of "cut and try" machining when making the finish cut on the axle-bearing bore to insure accurate locating of the gear centers.

The following table shows the machining limits which should be adhered to on certain dimensions:

- Bore A = $-.000$ and $+.005$
- Bore C = $+.002$ and $-.002$
- Dimension T = $+\frac{1}{64}$ and $-\frac{1}{64}$
- Dimension V = $+\frac{1}{64}$ and $-\frac{1}{64}$
- Gear center = $+.005$ in. and $-.005$ in.

Chicago Men Instructed in Selling Transportation

TEN THOUSAND employees of the Chicago Surface Lines have received a course in salesmanship of transportation through a series of operating conferences held by Superintendent C. H. Evenson of the operating department from Oct. 12 to Nov. 3. Superintendent Evenson spoke twice daily, covering all depots and giving practically all trainmen an opportunity to meet their chief informally without the embarrassment of being "called on the carpet." Surface lines officials reported a good reaction from the conferences. Mr. Evenson stressed the point that the uniformed employees represented the company as far as the public's conception was concerned and their attitude was to a good measure responsible for the sale of transportation. Courtesy and neatness were requirements in getting a good reputation with the public, Mr. Evenson said. He showed the evils of intoxication and the danger of accidents in carelessness. The men were warned not to listen to malcontents but to try to be helpful to each other and to co-operate with the supervisors. They were invited to ask questions, which many of them did. This led to the introduction of a wide variety of problems for discussion. The conferences will be continued.

Northern Texas Traction Produces Novel Exhibit

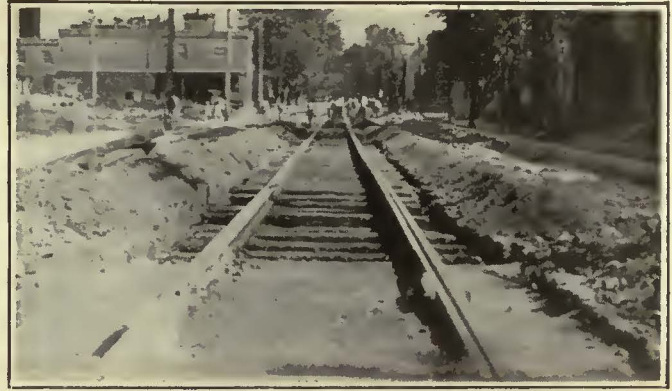
FOR several years the Northern Texas Traction Company has had a feature exhibition at the annual Fat Stock Show in Fort Worth, Tex. The picture reproduced here shows the 1926 exhibit, depicting the service the interurban lines render to the community.

An added feature this year was a replica of the Los Angeles secured to a mooring mast, but arranged so



The Northern Texas Traction Exhibit at the 1926 Fat Stock Show in Fort Worth Was One that Carried the Message of Transportation Home to the Delegates

that it slowly revolved around the mast. This with the other small working models of transportation units attracted a large amount of attention.



Original Appearance of Track and First Step in the Reconstruction Job

Typical appearance of Washington-Virginia tracks in Alexandria before resurfacing. Track was 9 in. low in spots and as much as 18 in. out of line at some points.

The track when excavated was retied and the vertical bends in the rail removed by a vertical rail bender. Bends as much as 4 in. were removed in this manner. New tie plates were put on and electrically welded to the rails. Cupped joints were built up by the electric weld process and ground to a true surface.

Inexpensive Track Reconstruction Proves Satisfactory in Alexandria

When the Washington-Virginia Railway Was Confronted with a Request to Make Track Repairs and Repave Permission Was Obtained to Use an Economical Form of Construction—Cost of Track Repairs Less than One-Third that of New Construction

By C. A. S. Sinclair

Chief Engineer Washington-Virginia Railway, Washington, D. C.

MORE than twenty years ago considerable portions of the track through the city of Alexandria, Va., were laid in dirt streets with cobblestone paving. Through the ravages of time, it well can be imagined that the street and track became in bad condition, since the entire surface had sunk considerably and unevenly. The city portion of the street was brought to the new grade by placing over it a layer of concrete, and after this had set a surface of penetration macadam was spread over the top and rolled.

Due to receivership conditions, the Washington-Virginia had to perform its portion of the reconstruction

with as little outlay of money as was possible. The following plan was worked out and put into effect last year and the first year's experience has proved that this somewhat temporary scheme has worked out satisfactorily for the light traffic conditions on this street. Both the grade and the alignment of the old track were bad and in relaying the track it was necessary to change the alignment as much as 18 in. and the elevation as much as 9 in.

First, the track space was excavated. The twenty-year-old, 7-in. girder rails were found to be somewhat surface bent at the joints. By the use of a

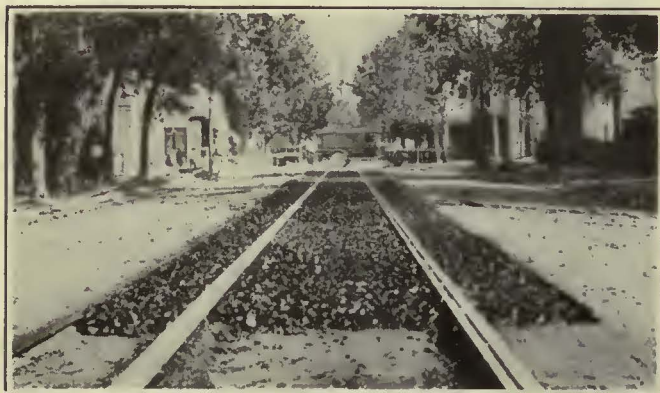


Placing the Gravel and Bringing the Track Up to Grade

About a 4-in. layer of bank gravel was dumped in the trench and the tracks brought to line and grade. This view is typical of one of the six jobs prepared by this temporary process in Alexandria, Va.

Before the two final layers of run-of-bank gravel were placed on the Washington-Virginia tracks in Alexandria, Va., the city had completed laying concrete over the old cobblestone pavement at the side of the tracks, thus furnishing solid shoulders, against which the ballast and gravel fill on top of the ties was pressed by action of the 2-ton steam roller.

vertical rail bender the rail ends were straightened. New wooden ties were placed under the rails and blocked up so that the track was brought to line and grade. Cupped joints were built up by use of the electric arc and ground down to proper surface. New joint plates were then put on and electrically welded. Some of the rail ends were as much as 4 in. below the surface, but were satisfactorily brought back by the use of the vertical rail bender. A layer of run-of-bank gravel, consisting of about 50 per cent coarse aggregate and the balance sand, was then tamped under the ties. This was placed in layers averaging about 4 in. in depth and thoroughly tamped under the ties as the track was raised to its new position. The gravel used for tamping



asphalt-coated stone screenings $\frac{1}{4}$ in. to $\frac{3}{4}$ in. in size. The 2-in. layer of asphalt-coated stone when rolled formed a very dense and compact mass against the rail that has prevented water seepage into the sub-base and ballast.

After the lower coat had been thoroughly rolled and allowed to set slightly a 2-in. topping of asphalt-coated stone, $\frac{1}{4}$ in. to $\frac{3}{4}$ in. in size, was put on to about $\frac{3}{4}$ in. higher than the desired finish. This was brought to a proper crown and slope by a drag templet and again was rolled with the 5-ton steam roller. This surface was then covered with a thin layer of sand and asphalt thoroughly mixed together and applied as a seal coat and again sprinkled with dry cement and



This view shows the application of the first 2-in. layer of Headly's Mixite, which is a cold mixture of asphalt and crushed rock. In the foreground can be seen the parget of small asphalt-coated rock laid against the rail web to provide a seal against the rail. A 5-ton steam roller was used to compact the paving material.

A Cold Asphalt and Crushed Rock Mixture Was Used for the Paving

The finished surface of this section of the Washington-Virginia tracks in Alexandria appears smooth and matches the city construction in appearance. The city construction on either side of the tracks has a varying thickness of concrete laid over the old cobblestone pavement and is covered with a hot asphalt-treated rock for paving surface.

was made somewhat moist and the placing done with tamping picks.

Another layer of run-of-bank gravel was then applied and slightly moistened with water. This second layer was brought considerably above the top of the ties and was thoroughly rolled with a 2½-ton steam roller. Those portions of the track that sank, due to the weight of the steam roller, were then retamped up to position. Then another layer of gravel was applied and rolled so that the top of gravel was a uniform distance (about 4 in.) below the top of the rail. The city portion of the street had been completed before this process was attempted, so that the ballast formed a solid support against either shoulder of the street, the trench being 9 ft. in width.

PAVING SURFACE THEN ADDED

The track at this point was true to line and grade and had a well-packed, steam-rolled ballast foundation brought up to a paving space. An asphalt-type of pavement was selected that would conform to the city portion of the street paving. The city, however, used a hot application, whereas a cold application, known as Headly's Mixite, was used on the railway portion. Crushed stone was treated to a cold asphalt emulsion in one of the company's storage yards and hauled to the job by work train. This mixture was deposited in the track from center dump cars and spread in place. This asphalt-coated stone was laid to a depth of 2 in. and was rolled with a 5-ton steam roller. Just ahead of this job a gang was kept busy painting the side of the rail with asphalt and pargeting the wet surface with

rolled again with the 5-ton roller. This furnished a surface equal in appearance to that of the street sides paved by the city.

The expense incidental to all of the trackwork on this reconstruction job covering six city blocks was \$2.25 per foot of single track, or less than one-third of the cost estimated on the basis of reconstruction with new rail. The paving surface cost \$2.40 per foot of single track, the total charge of reconstruction costing only \$4.65 per foot. After nearly a year's usage, with 30-ton cars passing over this track on headways of 7½ minutes in the rush hour to 15 and 20 minutes in the off-peak period, only slight depressions have developed, which were easily patched by the addition of small amounts of asphalt-coated stone. This patching material, being the same as that originally used, does not give a patched effect.

What the ultimate life of this class of work will be is of course not known. There is this important consideration, however. When repairs do become necessary, there is no loss of original material. The gravel can be used again with only slight additions, and the asphalt-coated stone, with the addition of fresh asphalt, can also be used. With the lower cost of digging out this class of material only a small labor charge is needed to make extensive repairs.

There is no question but what this class of construction is much inferior to that with a concrete base, but the results so far obtained indicate that a satisfactory life will be gained under light traffic conditions when money for more permanent type of construction is not available.

Maintenance Notes

Fixture for Grinding Grid Faces

PROPER contact between adjacent grid bosses is very essential in the assembly of car resistors. To insure accurate grinding of grid contact faces the Department of Street Railways, Detroit, Mich., uses a special attachment for the grinder. A brass face plate with iron center is used for the surface against which the grid is held. The center boss projects so that the hole at the end of the grid will fit over this. In grinding, the grid is held magneti-

cally against the face plate. This plate with the magnetizing coil is mounted on a rod attached to the grinder so that the whole fixture will swing in toward the grinding wheel. Pressure horizontally against the face of the wheel is produced by turning a hand wheel to work a screw drive.

In the operation of grinding the grid is placed against the face plate and the movement of swinging this in to the grinding wheel closes the circuit through a coil on the back of the face plate so as to create a magnetic circuit and hold the grid

firmly in position. As soon as the fixture has been swung in to proper position, the operator turns the hand wheel and so brings the boss of the grid against the grinding wheel. The work can thus be carried out rapidly and without danger of the grid face being held at an angle so that improper grinding would result.

Raising Low Joints on Open Track

BY D. H. WALKER

Assistant Engineer T. H., I. & E.
Traction Company

DURING the last two years the track forces on the Terre Haute, Indianapolis & Eastern Traction Company have used a vertical joint straightener for removing the surface bends at low joints. This device, consisting essentially of an I-beam, screw jack and clevis, has been very successful in eliminating low joints and improving the riding quality of the track. The rail bender was originally devised by W. A. Coleman, superintendent of the Dayton & Western, and used by him on that property. Several benders of the same style as his were made in our shops and tried out and now each division is equipped with these.

In operation this bender is handled by a gang of three or more men. With two men to operate the bender and the foreman to sight the joints an average of about 40 joints per day can be secured, but a crew accustomed to handling the apparatus will average nearer 60 joints per day. This device will straighten the plates as well as the rail. The rail and plates are not simply sprung up, to go back again under the first wheel load, but are actually bent back to original position.

The joint is first dug out and then all bolts tightened. Any necessary bolt renewals are made and the plates then fitted snugly and tightened. Two 1½-in. square steel bars about 10 in. long are then placed on the head of the rail and as near as possible to the ends of the surface bend showing in the rail and the joint plates. The distance between them will thus vary with the degree



A Special Attachment to a Standard Grinder Is Used When Grinding the Contact Face of a Resistance Grid

of surface bend in the joint. If it appears that the bend is mostly in the joint plates these bars should be placed near the end of the plates.

A 10-in. I-beam about 6 ft. long is next placed on the two square bars and a bell-base, three-way-head screw jack of 12 or 15-ton capacity placed on the I-beam and directly over the joint. The next piece to be applied is an assembled yoke of three members. Two steel rods $1\frac{1}{2}$ in. in diameter are run through a steel bar 13 in. x 4 in. x 2 in. Each rod is threaded 12 in. on the top and equipped with three hexagonal nuts, two above the bar and one below.

The steel rods have forged eyes in the bottom end with an opening of 2 in. They are 3 ft. 6 in. long from tip of the eye to top of rod and are spaced 8 in. apart through the 13-in. long steel bar. The steel bar has a slightly raised nipple in the center of



Screw Jack Exerts 15 Tons Pressure to Straighten Low Joints on T. H., I. & E. Lines

the bottom between the two rods. This nipple fits in the head of the screw jack and centers the yoke. The eyes in the rods are turned parallel to the rail and a 12-in. long steel rod of $1\frac{1}{8}$ in. diameter is thrust through the two and directly under the center of the joint.

The foreman then sights down the rail from a distance while pressure upward is slowly applied through the jack. We have found that the joint should be raised $\frac{1}{4}$ in. to $\frac{3}{8}$ in. above level, which will make it secure and stiff. The foreman sighting the joint should then be sure rails and bars are straightened after the jack pressure is removed. In some cases it is necessary to apply the pressure a second time, as when the jack is released the joint will spring down again, not having been sufficiently bent. It is very necessary to be sure that the joint is bent back be-

Dick Prescott Is Promoted And Indulges in Reverie



WHEN Dick Prescott, engineer of equipment of the Consolidated Railway & Light Company, and Thomas Mullaney, general foreman, started back to the shop from their visit to the general manager's office they were still somewhat dazed from the surprise to which they had been treated. Mr. Milburn had dictated, in their presence, an executive bulletin promoting Mullaney to the position of superintendent of equipment and making Dick his assistant.

The general manager had been most inspiring as he outlined his hopes and aspirations for the property. He dwelt particularly on the importance of the new idea of selling transportation by improvement of the product itself and pointed out the importance of developing and improving the rolling stock equipment on the property to make it more attractive to passengers.

He complimented Mullaney and Dick on their progressive views as illustrated by the report on maintenance practice that had been submitted to the operating staff.

They returned to the shop filled with new ambition and enthusiasm. Dick, who had entered the electric railway business through necessity rather than choice, was still unable to believe that he had won recognition and promotion so quickly. As it was late in the afternoon when they arrived at the shop, he left Mullaney to clean up his desk, finished up his own work and proceeded home.

Dick's mother was delighted at the good news. They discussed the details

of the day's events happily at dinner, and Dick then went into the little living room to enjoy his pipe and read a book.

But his mind refused to follow his eyes, and soon he resigned himself to the eager thoughts that crowded in on him. He began to visualize the opportunities that lay ahead because of the very difficulties in the present railway situation.

Many plans and ideas tumbled through his mind in delicious confusion. He had already won the confidence and friendship of most of the foremen in the Consolidated shop and he now contemplated with pleasure the prospect of building on that a spirit of teamwork which would have for its ultimate objective the winning of public good will and patronage.

"Every Man a Salesman of the Company," thought Dick, "would make a good slogan for the shop to lead off with. That would help to inspire the right kind of thinking and would add to the day's work the pleasure of accomplishment instead of making it a burden of necessity.

"I'm convinced that Mr. Milburn has a wonderful idea," he continued in thought. "Street cars can be made more attractive through improvement in design and better maintenance. If we can do the job right it will not only be a real service to the public in this city but it will win recognition and satisfaction for every man in the outfit."

In this spirit Dick finally turned in for the night, eager for morning and the job ahead.

fore the joint and shoulder ties are tamped.

By burning or drilling holes in each end of the I-beam web it is possible for the men to carry it easily from joint to joint by means of lining bars or crowbars thrust through.

In our first experience with this joint straightener we tamped the shoulder ties while the pressure was still on and found that some joints went back down because they were only sprung up. Removing the pressure before tamping overcomes this difficulty, however. Great care must be taken that the joints are not raised too high, as this will cause track even more rough than that due to the low joints. In such a case the joints must simply be dug out and lowered and traffic will then in time beat them down again.

During cold weather, when the rails are chilled in the mornings and there would be danger of snapping them under pressure, heat is applied to the joint before bending. Several devices were used on the different divisions, but each was, in effect, a grate built to fit over the rail and with a fire carried in the grate by means of sheet iron sides. Handles were provided to carry this from joint to joint. Blow torches were tried, but did not prove successful.

In the hands of a foreman who is careful this device will work wonders in improving the riding quality of track. On the 70-lb., 80-lb. and 85-lb. A.S.C.E. rail in our suburban track it is very effective, but we have not tried it much on anything heavier.



The Operator Uses a Respirator While Spraying the Interior Headlining

Spray Painting Inside Cars

ONE of the few electric railways in the country to use spray painting for headlinings inside cars is the New York, Westchester & Boston, New York City. A white enamel is used and J. T. Hamilton, master mechanic for the railway, reports that a much more satisfactory job is obtained than by brush.

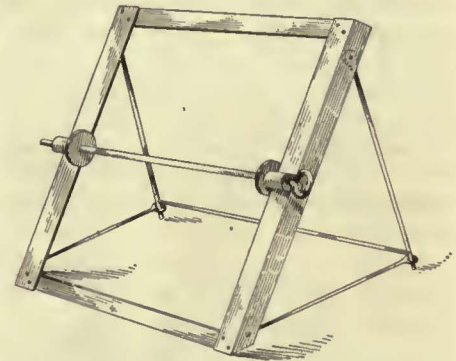
By using the spray method the time of painting headlinings has been reduced about 50 per cent. There is a slight increase in the amount of material used. Before the paint is applied the headlinings are

scrubbed with a cleaner and then washed with clean water. One coat of white enamel is then sprayed on.

When the railway changed to the spray method for painting the exteriors of cars the time was reduced approximately one-third below that taken by the brush method. Paasche type air brush and spraying equipment is used. The cars are all steel and are 67 ft. long.

Portable Pay-Out Reel Stand

MOST electric railway linemen have experienced trouble from the use of the usual pay-out reel stand on which coils of wire are placed in a horizontal position. Unless particular care is exercised in pulling the wire from the reel several turns will drop down off the side



Improved Type of Pay-Out Reel Stand

and these are sure to catch in something to cause annoyance and delay. These troubles have been solved by A. A. Riley, supervisor of the stores department for the Columbia Gas & Electric Company, who has devised a stand made with a pipe and angle framework, which can be folded up easily so as to take little space on the line truck.

The angle frame is 36 in. wide and 42 in. high. All of its joints are welded. The sides are made of 3x3x $\frac{1}{4}$ -in. angles and the top and bottom are 2x2x $\frac{1}{4}$ -in. angles. The legs or back supports are made of 1-in. wrought iron pipe. Two tie-rods at the bottom are made of $\frac{3}{8}$ -in. round iron. The pipe supports are hinged at the top of the frame and the tie-rods are hinged at the bottom and have eyes forged on the loose ends. The pipe supports are set into these eyes so as to form a rigid framework.

As an axle for the cable reels an old Ford driveshaft is used. A handle is welded to one end and the axle is supported on forged hubs, which are welded to the side angles of the framework.



Time for Painting Exteriors of Cars Was Reduced One-Third by the Spray Method

A reel is placed in position by putting the framework over it and then placing the axle in position through the center hole. The framework can then be raised and the bottom of the back-supporting pipework placed in the eyes of the tie-rods. This stand takes up little space and can be set up anywhere that is most convenient for carrying on the work.

Changing a Single-Track Line to Double

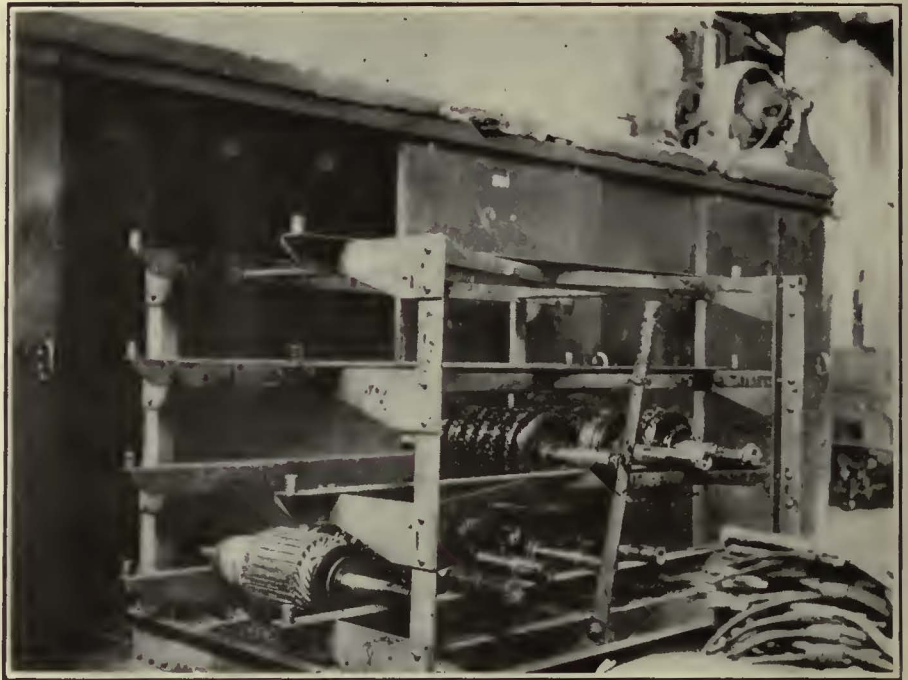
RECONSTRUCTION of the Dunbar route of the British Columbia Electric Railway, Vancouver, Canada, to provide double tracks, which is now taking place, requires 6.1 miles of new rail and an expenditure of \$200,000. In doing the work certain sections had to be regraded before the track could be shifted to one side to make room for the steam shovel used to excavate the trench for the new track foundation. A road gang followed the shovel and loaded ballast from the roadbed of the old track to be hauled to points where new ballasting was being done.

A fine grading gang followed. They set up the form boards for the concrete slab foundations of the new track and trimmed the subgrade to a uniform surface. This was gaged to correct depth and cross section by use of a template board. Track-laying gangs completed the work.

Roller Bearing Armature Baking Rack

NO ONE wants to spend much time getting material in and out of a good-sized baking oven, especially during a St. Louis summer. Besides, it isn't economical. For this reason an armature rack was constructed in the shop of the United Railways of St. Louis which even when loaded to its capacity of 25 armatures can almost be operated by a child.

The general construction can be seen from the accompanying view. The rack proper is constructed from structural steel and mounted on two axles with small flanged wheels rolling on rail set in the floor. It is mounted on the two axles using Hyatt roller bearings. Although the truck has been used daily in and out of the bake oven the bearings remain very efficient in reducing the roller friction of the truck. On account of the heat no oil is used, but



This Rack Has a Capacity of 25 Armatures and Can Be Moved Easily Due to Use of Roller Bearings

a graphite dressing was applied to the roller surfaces when installed. Nothing has been done since that time.

To start the truck out of the oven a ratchet arrangement has been attached to the axle in the foreground, which is operated by the handle seen on the front side of the truck. A single pull on this ratchet starts the truck rolling forward and once started it can easily be pulled by one man the rest of the way even when loaded to capacity with armatures. The bake oven doors are thus open for a minimum of time through the use of this truck.

Oil Furnaces Replace Coke Forges

MATERIAL improvement in the quality and quantity of work produced in the blacksmith department of the Department of Street Railways, Detroit, Mich., has been brought about through the installation of six new oil-fired forging furnaces in place of coke-fired forges. A carbonizing furnace with pyrometer equipment has also been added. An advantage found from the oil-fired furnaces is that there is much less danger of burning the material than where coke-fired forges are used. As



Heating Plects Preparatory to Repointing in One of the Oil-Fired Furnaces



General View of the Blacksmith Department with Oil-Fired Furnaces Installed by the Department of Street Railways, Detroit, Mich.

a result more material can be placed in the furnace at one time and so the various laborers are kept busy at their anvils instead of standing around waiting for the material to reach the desired temperature. Very little difference is found in the cost of heating material by oil as compared with coke, but the blacksmith department is much freer of smoke and fumes and there are no coal or

ashes to handle with oil-fired equipment.

The new oil furnaces were supplied by the Ferguson Furnace Company, Toledo, Ohio. The oil supply was piped up and air connections were made to the blowers. The old down-draft forges were provided with a suction line so these were disconnected and the new furnaces were hooked up to this.

New Equipment Available

Interlocking Plugs with Safety Switches

FOR use with portable electrical appliances, such as welding machines, track grinders, rivet heaters and other motor-driven machines, used by electric railways, a safety switch with fuse has just been placed on the market by the Crouse-Hinds Company, Syracuse, N. Y., in which it is impossible to withdraw the plug or open the door of the compartment unless the switch is open. Interlocking also provides that the switch cannot be closed unless the plug is fully inserted and the door of the fuse compartment closed.

The switch and plug interlocking mechanism is simple, consisting of a rack and pinion with a spring, rod and catch which engages a segment on the rocker arm of the switch. The switch door interlocking mechanism includes a lug on the hinge of the door, which also engages a segment of the rocker arm of the switch.

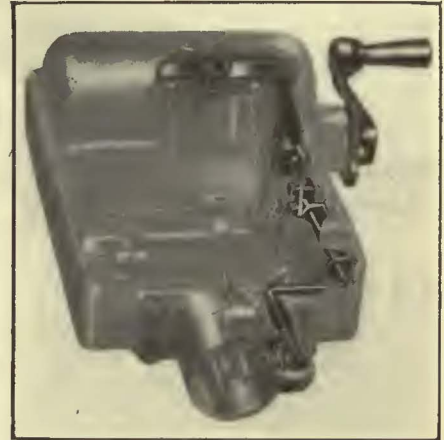
The plug interlock consists of a wing nut and I-bolt on the housing, which engages a forked lug on the plug handle. This prevents accidental withdrawal of the plug due to the weight of the cable even when the switch is open.

The plug contacts are protected by a shell or sleeve which is cast as an integral part of the aluminum



Switch Closed with Plug Locked In

handle. This is strong enough that the plugs are able to withstand unusually hard usage. The plugs and receptacles are polarized and the contacts are self-aligning. The insulating parts of both plug and receptacle are held in place without



Plug Removed, Switch Locked Open

screws and cannot become loosened by vibration. Electrical contact is maintained between the interlocking device in the conduit and the shell of the plug, which effectually grounds the plug to the conduit system.

New Line of Relays

TO SUPERSEDE the Imperial type relays a new line, Type S-R, has just been placed on the market by the Roller-Smith Company, New York, N. Y. Improvements in these relays include longer scales, which insure greater accuracy; increased torque and a type of case to match standard lines of indicating instruments.

These relays are for use on either direct or alternating current circuits and include relays for reverse current, overload, underload, closed circuit underloads, over-voltage and under-voltage. The instrument mechanism has a platinum spring contact attached to its pointer which co-operates with a similar one carried by an externally adjustable pilot needle. The pilot needle is set by means of a slotted head button projecting from the front of the relay case. The circuit established on engagement of the contacts energizes an electromagnet which is mounted below on the same base with the instrument. The switch operated by the electromagnet effects whatever external circuit change the relay is designed for. The construction provides a much wider range of adjustment than heretofore available.

Association News & Discussions

Midwest Association Holds Spirited Meeting in Denver

High-Grade Program of Management and Technical Subjects Provokes Lively Discussion at Three-Day Meeting—Improvement of Railway Service to Compete with Automobiles Receives Attention

MORE than 200 railway men and their ladies from the states of Missouri, Colorado, Oklahoma, Arkansas, Nebraska and Utah put in an active three days in spirited discussion of current local transportation problems during the annual meeting of the Midwest Electric Railway Association on July 8, 9 and 10 in Denver, Col. Despite the weight of current difficulties and the depletion of railway revenues by automobile competition, there was manifested an atmosphere of confidence toward the future and a determination to find ways and means of popularizing common-carrier transportation so as to win rates of fare adequate to make operations profitable.

Prepared papers and addresses were presented on various managerial and technical phases of railway operations. These included the following: "Fares and Fare Collection Methods," by B. W. Frauenthal, general traffic agent United Railways, St. Louis; "Modern Maintenance of Equipment," by R. W. Bailey, superintendent of power and equipment Kansas City Railways; "Effect of the Automobile on Mass Transportation," by E. E. Stenger, president Denver Tramway Corporation; "The Human Element in Industry," by F. G. Buffe, general manager for receivers Kansas City Railways; "The Interurban Bus," by B. W. Arnold, general manager Chicago, North Shore & Milwaukee Railroad; "The Industry Needs a Modern Business Viewpoint," by Charles Gordon, editor *ELECTRIC RAILWAY JOURNAL*; "Progress in Track Construction," by

Nelson R. Love, chief engineer Denver Tramway Corporation. At the annual banquet, held on Saturday night among delightful surroundings at the Denver Motor Club, situated high in the mountains west of Denver, Frank R. Coates, president American Electric Railway Association, was the guest of honor and principal speaker. His address and the papers by Messrs. Bailey and Love are abstracted elsewhere in this issue. The papers by Messrs. Frauenthal, Buffe and Gordon will appear later.

PAPERS ACTIVELY DISCUSSED

In his opening remarks and response to the welcome extended by Mayor Stapleton of Denver, President Robert B. Campbell expressed confidence for the future. He strongly urged the need of conferences and serious discussions among railway executives, looking to the frank interchange of experience and ideas. He particularly emphasized the value of discussion from the floor to supplement prepared papers and addresses on the program. As a result, each of the subjects presented provoked much questioning, comment and debate.

"Fares and Fare Collection Methods" was discussed by A. E. Reynolds, Springfield, Mo.; Aldon J. Anderson, Salt Lake City; F. S. Welty, Omaha, Neb.; H. S. Robertson, Denver, Col.; A. Blunk, St. Joseph, Mo.; D. L. Fennell, Kansas City, Mo.; H. W. Patten, Wichita, Kan.; B. Hillburn, Tulsa, Okla., and F. G. Buffe, Kansas City, Mo. Mr. Anderson outlined the experience in Salt Lake City with the weekly

pass following an increase in the single-ride fare. He said that this had resulted in doubling the sale of \$1.25 weekly passes. Mr. Welty emphasized the importance of simplicity in transfers for one-man operation and Mr. Robertson described the methods used in Denver to keep transfers simple. Mr. Blunk discussed the problems of transfer handling for pay-leave operation in comparison with pay-enter. Mr. Fennell took the position that transfer punching should be held to a minimum under any conditions, since excessive punching slows down two-man operation as well as one-man. Mr. Patten discussed the use in Wichita of three different transfer colors for various periods of the day.

On the use of tickets, Mr. Hillburn said that in Tulsa an effort is made to build ticket sales to a maximum for the purpose of combating jitney competition. He favored a large differential in price between cash and ticket fares. Mr. Buffe decried the tendency to split pennies in fare collection and strongly advocated simplicity in the fare structure.

Many features of Mr. Bailey's paper on maintenance practice provoked questions and discussion. In presenting his ideas Mr. Bailey said that he had considered primarily the maintenance of existing equipment to meet modern requirements, since there is not enough modern equipment in service to talk about. In answer to a question from John Sutherland, master mechanic Tri-City Railway, Davenport, Mr. Bailey said the reduction in pull-ins recorded in his paper amounted to an increase in miles per pull-in of from 1,500 to 5,000. Other questions were raised relative to the experience of Kansas City in reducing bolt breakage. Mr. Bailey said that the automotive industry had learned in the past that upset head bolts without a fillet under the head are unreliable. As an important step in eliminating bolt breakage he



More than 200 Railway Executives and Their Ladies Attended the Fourth Annual

explained that the lengths of wrenches used with various sizes of bolts are standardized. Workmen are not permitted to use any other wrenches, and the use of a pipe on the handle is forbidden.

Reduction in the amount of lubricants used in Omaha following improvement in maintenance practice was mentioned by Mr. Welty. Mr. Bailey and R. S. Neal explained the design of die cast bearings to prevent breakage of the flange. Mr. Neal said that the secret of success lay in maintaining certain proportions between the height of the bearing flange and the body of the bearing to prevent excessive strain being set up in the metal. H. Detrick, master mechanic Denver Tramway, mentioned the importance of giving increased attention to the reduction of noise on cars. Fred Steffens, master mechanic St. Joseph Railway, Light, Heat & Power Company, said that their practice was to keep the same set of pinions and gears together throughout their life.

COMMUTATOR LEADS SWEDGED

Other questions were directed at Mr. Bailey regarding the swedging of commutator leads. He replied that the process cost about the same as soldering, but had entirely eliminated open circuits. Mr. Gustaveson of the Westinghouse Electric & Manufacturing Company also discussed this practice. He favored the method and stated that reports made to his company by John S. Dean had also been favorable. He pointed out particularly the ease with which leads may be replaced by swedging in comparison with soldering.

Speaking on "the effect of the automobile on mass transportation," E. Stenger, president Denver Tramway Corporation, called attention to the automobile's influence on the trend of transportation development. "From the beginning of transportation," he said, "the tendency has been consistently toward economy. The growth of rail transportation was in this direction, and the resulting effect of economical facilities for the movement of passengers and commodities led to the development of modern communities which are dependent for their existence on economical and speedy transportation.

"With the automobile has come a new form of individual transportation. It has been thrust upon us suddenly and

**COMING MEETINGS
OF
Electric Railway and
Allied Associations**

July 22—New England Street Railway Club, annual outing, Portland, Me.

July 23-24—Central Electric Railway Accountants' Association, meeting, Drake Hotel, Chicago, Ill.

July 28-30—Electric Railway Association of Equipment Men, Southern Properties, semi-annual meeting, Chattanooga, Tenn.

Aug. 11—Metropolitan Section A.E.R.A., annual outing, Pelham Bay Park, New York.

Aug. 12-13—Wisconsin Public Utility Association, Railway Section, La Crosse, Wis.

Sept. 17-18—Mid-West Claim Agents Association, sixth annual convention, Elms Hotel, Excelsior Springs, Mo.

Oct. 4-8—American Electric Railway Association, annual convention and exhibits, Public Auditorium, Cleveland, Ohio.

Oct. 10-15—Congress International Tramway, Local Railway and Motorbus Association, Barcelona, Spain.

Oct. 25-29—Annual Congress and Exhibit, National Safety Council, Detroit, Mich.

Nov. 16-18—Society of Automotive Engineers, National Transportation and Service Meeting, Boston, Mass.

its growth has been phenomenal. As a transportation problem the automobile is distinctly an American problem, since its use is comparatively limited outside the United States. Even in this country the conditions which it brings about vary with cities of different size. Because of the rapidity of automobile development it is impossible to look far into the future or to forecast its ultimate effect on community life and other transportation agencies.

"Growth of the automobile is not in line with the previous trend toward economy. Other factors have dictated its widespread use. Similarly, the automobile has an opposite effect on community growth than have the railroads,

since it is leading to decentralization rather than concentration of population. Thus, today, there are two strong opposing transportation forces.

ECONOMY HAS BECOME SECONDARY

"Centralization of communities leads to many economies. These are chiefly apparent in utilities, police and fire protection, etc. The opposite tendency acts against community economy."

Mr. Stenger outlined the results of careful surveys in Denver to indicate that the convenience of access to car lines alone has little influence on choice between cars and autos for local transportation. He expressed the opinion that pride or social distinction may be an important influence. Summarizing, he said: "There is going on a fundamental change in the nature of transportation demand. In looking for a solution of the difficulties of common carriers we must strike out along new lines. It is impossible to guide the future on the experience or precedents of the past."

Discussing Mr. Stenger's remarks, Mr. Welty advocated the elimination of parking as an aid to the situation. Mr. Buffe called attention to the experience of Denver as a striking illustration of the need for even more intensive effort to meet automobile competition. "Although Denver has gone as far as any property in the Midwest. Association territory in carrying out the principles of improvement which we are all advocating," said Mr. Buffe, "the situation still seems to present a paradox and illustrates the need for still more careful analysis of the factors which influence railway riding. Commenting on Kansas City's experience, he said that the social appeal of the bus as operated there does not offer a solution, since the buses have taken their passengers largely from former street car riders.

**MERCHANTS DON'T RECOGNIZE
PARKING EVIL**

On the subject of parking elimination, he remarked that railway receipts in Kansas City had jumped \$750 per day during one week of anti-parking regulation. Downtown merchants are loath to recognize the facts of parking, however, and have a strong tendency to work against their own best interests. A survey of the shopping district in Kansas City showed that if



Meeting of the Midwest Electric Railway Association at Denver July 8-10, 1926

all parked cars carried two shoppers the total would amount to 2,000 customers. Street cars, on the other hand, carried 10,000 shoppers to the downtown district.

Further discussion of the merchandising of electric railway service ensued. Mr. Reynolds illustrated the need for advertising, from experience during the national Rotary Club convention in Denver. "With an average minimum automobile transportation cost of 11 cents per mile," he said, "the railways have an excellent opportunity of competing on a favorable basis." Mr. Gordon commented on the difference between a constructive car ride selling campaign and an appeal for relief of the railway as such, or an attempt directly to influence the use of automobiles. Mr. Fennell said that automobile dealers' associations usually object strenuously to any attempt to increase car riding.

CHANGE IN ATTITUDE OF MANAGEMENT

F. G. Buffe's paper on "The Human Element in Industry" was received with acclaim and provoked many favorable comments. A complete abstract will be published next week. In the discussion Mr. Stenger remarked that there has been a decided change in the attitude of management toward labor. "Today," he said, "the relations are squarely on a man to man basis, and management has learned that best results are thus obtained."

Due to the absence of B. W. Arnold, assistant general manager Chicago, North Shore & Milwaukee Railroad, his paper on interurban bus operation was read by President Campbell. "The time has passed," said Mr. Campbell, "when we can say 'to hell with the bus.' Buses can't be operated on the same basis as electric cars and we have to pay for the experience of learning where and how to operate them."

MENTAL FLEXIBILITY NEEDED

"Flexibility in our mental attitude and open-mindedness toward the best methods of organizing and utilizing the bus or motor coach as a transportation tool should characterize our entrance into this broadened field of transportation," said Mr. Arnold in his paper. "I feel that we are only on the threshold of bus development," he added. "The operation of motor coach service has three functions to perform—properly to serve the territory adjacent to the railroad property, to add revenue to the railroad and to create and maintain improved public relations.

"In this era of prosperity, which is providing almost every family with an automobile, it is necessary, if we are to make motor coach operation a success, to demonstrate the many advantages of this form of transportation. Its service must be made dependable, safe, clean and rapid. Schedules must be carefully studied before installation and must then be rigidly maintained. Business must be solicited for coaches just as for railway lines. One additional passenger per trip frequently spells the difference between profit and loss.

"Our chartered coach business has been a large factor in carrying the cost of pioneering new lines. Every lodge,

club, real estate firm or private party is a prospective customer for chartered business that can be handled in off-peak periods. Highway development makes possible the operation of long coach trips. The North Shore Line has sent chartered coaches from Chicago to New York and the White Mountains.

DRIVER SELECTION IMPORTANT

"Driver selection and training is of paramount importance to successful coach operation. There is more of the personally conducted tour atmosphere to a coach ride than on a railroad, and the driver is a large element in the success or failure of the trip. Selection of proper equipment follows closely in importance. Garage facilities, cleaning, inspection and maintenance are contributory to success or failure.

"Rates on the North Shore feeder coach lines are on the basis of 3.6 cents for tickets and 4 cents cash. At all main line stations the agent handles motor coach tickets and stations are used jointly by railroad and motor coach. At other than railroad stations arrangements are made with drug stores, hotels, etc., to handle tickets on a commission basis and provide suitable waiting room space and toilet facilities for patrons."

Mr. Arnold summarized the basis of all successful transportation operation, whether railway or motor coach, by saying, "If you are pessimistic as to the future of the transportation business don't get in; if you are in, get out."

MILEAGE CONTRACTS QUESTIONED

The practice of purchasing tires on mileage contracts was questioned as a sound business proposition by Mr. Bailey. He said that under present conditions of keen competition among manufacturers it is possible for railways almost to write their own tire contracts. He expressed the opinion that it would be only a matter of time before this practice would be abolished. Mr. Campbell differed with Mr. Bailey and maintained that purchase of tires on a mileage basis is a perfectly proper and practicable arrangement. In defense of his views, Mr. Bailey maintained that unless manufacturers could make a profit on such contracts this practice could not be continued. He held that if, on the other hand, manufacturers did make a profit on such contracts operators could save money by instituting their own tire service. Considerable discussion ensued regarding the design of bus tires, size of wheels and performance of brakes. Mr. Bailey said that elaborate tests which have been conducted in Kansas City to obtain data on the performance of tires and brakes will be ready for publication in the near future.

A MODERN BUSINESS VIEWPOINT

"The Industry Needs a Modern Business Viewpoint" was the subject of a paper by Charles Gordon. This was supplemented with remarks concerning the need for improvement in electric railway cars. Mr. Gordon also explained the work of the American Electric Railway Association committee on essential features of modern cars, which has just rendered its re-

port and which was published in abstract in the June 26 issue of *ELECTRIC RAILWAY JOURNAL*, page 1086. In answer to questions, the relation between the work of this committee and the committee on unification of car design was also explained. Considerable discussion arose as to the condition of existing electric railway equipment and the need for new cars in the industry. The significance of the effort in Grand Rapids to popularize electric railway service by providing a character of equipment which would have a strong appeal to prospective riders was also discussed. The basis of the surveys made by *ELECTRIC RAILWAY JOURNAL* on the age of cars was questioned by Mr. Welty. In answer to this, Mr. Gordon explained that the age of cars was in itself of little significance except as it is combined with the developments which have taken place in car construction since existing cars were put in service. Mr. Bailey commented on the difficulty of obtaining the necessary money to provide new cars even though the improvements available warrant substitution of new equipment for that now in service. He said that estimates made by the electrical manufacturers of the savings to be effected by new equipment in Kansas City did not show a profitable financing basis.

Mr. Blunk of St. Joseph cited the predicament of the small operator in purchasing new cars. He said that the small property which cannot afford the development cost of special cars is forced to take equipment offered by the car builders and that the selection is usually limited to duplicates of recently completed orders for larger properties. Mr. Campbell reported the experience of Coffeyville, Kan., where he said that according to L. L. Francis, secretary and manager, five new cars are paying for themselves through decreased operating cost and increased revenue. Mr. Bailey reported plans in Kansas City to test out thoroughly the possibilities of improved cars in attracting patronage.

CONTINUED DEVELOPMENT IMPORTANT

The responsibility of the car builder in bringing about car development and the advantages which would follow the general acceptance by railway operators of more uniform types of cars manufactured for stock by various builders was pointed out by Mr. Gordon. He emphasized, however, the importance of avoiding any arrangement which would tend to stifle development. H. R. Gass, sales engineer St. Louis Car Company, explained the difficulty which confronts the car builder in bringing about orderly development and reduced cost of cars. "In the past ten years," he said, "it has been impossible not only to sell the same type of car to more than one property but even to sell the same car more than once to the same property. The resulting development cost," he said, "has a decided influence on the cost of cars. Operators have adopted the practice of specifying their equipment in most minute detail and there has been little opportunity for the manufacturer to take the initiative in development." P. H. Conroy, sales

engineer Tool Steel Gear & Pinion Company, declared that the industry has been asleep to the need for developing attractive cars. He particularly called attention to the tendency to provide seats that are too narrow and uncomfortable.

D. L. Fennell commented on the co-operation of the technical papers in making the Midwest Association a success, and in response to a vote of thanks for the work of *ELECTRIC RAILWAY JOURNAL* in behalf of the association and the industry Mr. Gordon expressed confidence in the ability of the industry to overcome existing difficulties.

PROGRESS IN TRACK CONSTRUCTION

The paper by Nelson R. Love on "Progress in Track Construction" aroused much interest in the possibilities of improving existing construction practice. Mr. Love described the use of a single-truck car equipped with grinding bricks for removing rail corrugation and said that this method was approximately one-tenth as costly as the former grinding equipment used. In answer to questions, Mr. Love explained further the process of grinding rolled steel wheels in Denver to maintain approximately accurate contours during their life. In answer to questions by Messrs. Bailey and Blunk, he said that the section of flexible track now in service in Denver is still in the experimental stage and has not been adopted for standard construction. He also commented on the use of carbon arc seam welds and pointed out that this practice permits the same equipment to be used for special work repairs, building up cupped joints, etc.

The following officers and members of the executive committee were unanimously elected for the ensuing year: President, A. E. Reynolds, vice-president and general manager Springfield Traction Company, Springfield, Mo.; vice-president, H. B. Cobban, secretary-treasurer and general manager Northeast Oklahoma Railroad, Miami, Okla.; secretary-treasurer, J. A. Weimer, superintendent of transportation Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo. Executive committee to fill expiring terms: R. A. Leussler, general manager Omaha & Council Bluffs Street Railway, Omaha, Neb.; H. W. Patten, general superintendent Wichita Railroad & Light Company, Wichita, Kan.; Bert Hillburn, general manager Tulsa Street Railway, Tulsa, Okla.; S. B. Irelan, general manager St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.; R. B. Campbell, secretary-treasurer and general manager Arkansas Valley Interurban Railway, Wichita, Kan. Executive committee members with unexpired terms who continue in office are: R. J. Lockwood, assistant manager for receiver United Railways of St. Louis, St. Louis, Mo.; F. G. Buffe, general manager for receivers Kansas City Railways, Kansas City, Mo.; Ernest Stenger, president Denver Tramway, Denver, Col.

F. R. Coates, president of the American Electric Railway Association, was elected a life member of the Midwest Association by unanimous vote. An invitation was extended by Mr. Hillburn

to hold the next meeting in Tulsa, Okla. This was referred to the executive committee. A vote of thanks was extended to the various speakers who

prepared papers and to the officials of the Denver Tramway and their ladies, who provided an excellent entertainment program during the convention.

Transportation Must Be Put on a Profitable Basis*

Greater Co-operation Between Utilities Is Needed—Buses Are Not Destined to Replace Railways—New York Needs to Divorce Transportation and Politics

BY FRANK R. COATES

President American Electric Railway Association

PRIMARILY I want to make a plea for closer co-operation of all branches of the utility business. Utility men outside the local transportation business can be of great assistance to us by helping tell the public the facts about our situation. I use the word "situation" because I dislike the term "problems," which has so frequently been applied in recent years to local transportation matters. The fact is, there have been no great variety of so-called "problems." Just one or two fundamental economic questions have had to be answered in every community. Where these have been answered in the right way local transportation has got back on its feet, good service has been rendered and companies and communities have prospered. Where these questions have not been answered fairly or fully transportation still is crippled. Furthermore, it is likely to be for some time to come.

The outstanding questions to be answered by every community in connection with its local transportation are these: First, is there a demand for public transportation, and, second, if there is this demand, shall the local company be permitted to earn a fair return on its investment?

As to the first question, is there a demand for common-carrier transportation, we are likely to answer it quickly either yes or no. Yet it demands study. There is that school of thought which insists that there should be public transportation in every community. Obviously this position will not stand analysis. There are plenty of communities throughout the country today that will not support public-carrier transportation unless you designate a few hacks or taxicabs by such a term. Certainly there are plenty of communities that cannot support a street railway system nor even a bus system, yet, unfortunately for the local transportation business, many of these communities do have public service transportation. It is in such communities that electric railways are in particularly bad financial shape.

Transportation companies in such communities are dying, of course. In fact, that is where the mortality is greatest. You have heard a great deal in recent years about dying electric railway companies. The fact is that they have died in about 60 communities in the United States, and the aver-

age company which has died has run just seven cars. There is no doubt that electric railway properties never should have been built in these communities, and when you hear that such an electric railway property has died it is no reflection on our industry in any way. It is a reflection on the judgment of the men who built the lines.

There is, however, in the larger communities a very great demand for public transportation, and this demand is going to increase. It is going to increase for both electric cars and buses.

NEED FOR RAILWAY INCREASING

The fact that no community in the United States of more than 50,000 persons now is being served solely by buses proves the necessity for the electric railway. As cities grow larger, populations become more dense and the mass transportation problem increases, the need for the electric car becomes more apparent. Increased traffic congestion, with its consequent lack of parking places, also is driving the private car owner back to the street car. These and many other causes, which are readily apparent in every community of any size, quickly show the need for common-carrier transportation service.

Recognition of this need for service is widespread, and coupled with this comes recognition of the second point I previously made, that a street car company must be given a chance to earn a profit the same as any other business. Most enlightened communities throughout the country long since have recognized the fact that a transportation company must be entitled to earn a profit the same as any other business or it will cease to function. In other words, if the street car horse is going to work, it must be fed. I want to make it very clear that this is not a poverty plea, or that it is intended to leave the impression that most communities are striving to starve their transportation companies to death. They are not. There has been a very decided movement on the part of local, state and national officials throughout the country in the last five years to play fair with the electric railways.

Fare increases have been granted very generally, and today the average fare throughout the United States is approximately 7.6 cents. In many communities the fare is 10 cents. An honest effort has been made in most communities to arrive at fair rates for car companies.

*Abstract of address presented before annual meeting of Midwest Electric Railway Association, Denver, Col., July 8-10, 1926.

Increased fares, however, have not always proved the best solution. Many operators are of the opinion that fares may easily be made too high. High fares often discourage riding. There are other means of assisting local transportation companies to prosperity. A dollar saved is a dollar earned, and if electric railway companies, particularly those which are badly overtaxed throughout the country, are given relief from paving and other taxes they may become more prosperous. Likewise, transportation companies can be aided materially toward prosperity by giving them clear rights of way so that they can make speed. A quick ride is an attractive ride, and the way to make it quick is to put into effect parking regulations which will cause the streets to be used as thoroughfares and not as storehouses.

It is impossible for me to lay down more than general rules for making electric railway companies prosperous. Of course, there are certain fundamentals, some of which I have mentioned, that will apply in every case, but also in every case there are local conditions which are of the greatest importance. The way to arrive at proper conclusions in these situations is to bring in the best minds of your respective communities, tell them the whole story and work out a plan of operation on a basis fair to all.

NEW YORK SITUATION EXPLAINED

You have seen much in the papers recently about the New York City local transportation situation. Since this affords a striking example of a city which has driven its transportation horse to exhaustion through failure to supply it with proper sustenance, I want to dwell just a little bit on this situation. A good deal of comment has been published about the possibility of New York City doing away with all of its trolley cars because they are a nuisance and cause traffic congestion. One proposed solution of this problem is to substitute buses for the trolley cars, and the most remarkable part about it is that this proposal to bring about traffic congestion relief would mean the substitution of five buses for every three street cars. It is probably the only case in the history of the world where it has been suggested that the way to make more space available is to occupy more of the available space.

In a nutshell the trouble in New York is that the 5-cent fare has failed. The surface lines have not failed. The 5-cent fare has not paid operating expenses. The rolling stock of the lines has gone down badly. Traffic congestion in the city is terrible. This also has hampered the surface line companies greatly in rendering service.

Despite these drawbacks, the surface lines of New York City today are carrying almost 40 per cent of all riders in the greater city. The subways, elevated lines and buses carry the remaining 60 per cent. Incidentally, the number carried by buses is a very small proportion. The biggest bus line in the entire city, the Fifth Avenue Coach Company, last year carried only 70,000,000 revenue passengers, whereas

the surface lines alone carried more than 1,000,000,000.

New York is one of the last large strongholds of the 5-cent fare. This political plank is a standard one for the controlling political party in the city of New York. No politician believes that he can be elected on any other platform. Therefore they all came out strongly for the 5-cent fare. The last administration was elected on this platform and so were preceding administrations. Now the administration is face to face with the fact that transportation is breaking down and that it cannot be built up under the 5-cent fare. Therefore it must find some way to give good transportation, because this is vital to the life of the city, but at the same time it hesitates to get away from the 5-cent fare plank.

Recently the situation came to a crisis when two things happened: First, a coach company obtained control of the New York Railways, which operates some electric car lines that are in very bad condition. The coach company then proposed to the city that it abandon some of the surface car lines the coach company controls, which have not paid for many years, and substitute buses thereon, chiefly at a 10-cent fare. The fare feature of this situation is a very important one for you to remember. The coach company proposed that it give a few short haul riders at a nickel, but most of its rides were to be 10 cents.

Simultaneously ex-Comptroller Craig came to the city with a proposal that it buy from him certain obsolete electric lines controlled by the New York Central Railway. He said that these lines were a nuisance and that the owners would relinquish their franchises if they were paid \$7,000,000.

Neither of these propositions, that by the coach company nor the one by ex-Comptroller Craig, has been accepted, but they have caused much uninformed comment about New York surface line conditions. If all the electric lines involved in the two propositions were abandoned not 5 per cent of the surface passenger traffic in the city would be affected. Yet the impression has gone out that these two minor proposals involve the greater part of the New York surface line systems. Nothing could be further from the truth.

Despite the unfortunate impression which has been created in many parts of the country that New York trolleys are to be abandoned generally, much good has come out of the proposal to substitute buses for trolley cars in New York City. City officials who a few months ago took at face value the promises of bus manufacturers to supplant electric car service with buses, give adequate service and relieve congestion have learned that such a promise cannot be performed. Therefore they are moving very slowly in the granting of bus franchises, and my prediction is that the ultimate solution of the New York City transit problem will be co-ordinated electric car and bus service, with the present transportation companies operating most of the buses. If this sort of arrangement is made fares will be kept at a minimum.

If it is not made, and independent bus companies are permitted to parallel existing transportation lines, citizens of New York are going to be faced with tremendously high local fares and no transfer privileges.

It is utterly ridiculous for any one to say that buses can supplant electric cars in the handling of mass transportation. Careful tests, made both here and abroad, prove conclusively that buses cannot handle traffic in rush-hour periods as expeditiously or conveniently as street cars. The relative ability of buses and street cars to carry passengers is shown by their past performances. During the last calendar year, operating under ideal conditions on Fifth Avenue, 385 buses carried an average of 196,000 passenger per bus annually. Operating throughout the city on branch lines and under all sorts of conditions, practically none of which were as good as those enjoyed by the buses on Fifth Avenue, 3,388 street cars, representing all surface cars in New York City, carried an annual average of 336,000 persons per car per year. In the Bronx all the street cars carried an average load of 415,000 per car. This included transfer passengers on both buses and street cars.

It will readily be seen from these figures that cars carried, in round numbers, between 70 and 100 per cent more passengers per vehicle than buses. In other words, it would require between five and six buses to replace every three street cars in New York City. Thus, instead of relieving traffic congestion, the substitution of the bus for the street car would simply add to it. Not only would you have five vehicles standing where three were before, but with the increase in number of vehicles the number of stops would also increase.

The assertion that buses would relieve traffic congestion by stopping at the curb does not apply on any street where there is parking. The utter impossibility of buses making stops at the curve on Seventh Avenue, Madison Avenue and similar congested New York thoroughfares is readily apparent. They would have to stop in the middle of the street. A standing bus will congest just as much traffic when standing parallel with the curb as a street car, and if it happens to stop crosswise on the street while attempting to weave in and out of traffic, it will stop much more than a street car.

STUDIES ON TRAFFIC CONGESTION

The United States Department of Commerce recently made a study of the causes of traffic congestion in the retail districts of various cities. Of all the cities reporting, the maximum congestion charged against the street car by any group was 3 per cent. The smallest percentage of traffic congestion charged against the street car was 4/10 of 1 per cent. The report points out that delays which are charged to street cars really should be charged against vehicles that are delaying the cars. "Just as the chain is no stronger than its weakest link, so traffic can move no faster on any one lane than the slowest moving vehicle, and that slowest moving vehicle may be any vehicle occupying the street car lane," it says.

The real test of the ability of the bus to supplant the street car in giving service would come during the peak traffic hours. Fifty per cent of all traffic handled in New York is moved during two hours in the morning and two hours in the evening. At that time also street congestion from other vehicles going to and from work is at its worst. It is one thing to carry sight-seers along Fifth Avenue in a leisurely way and quite another to deliver crowds going to work or to their homes during peak-hour traffic.

London's experience proves this. Over there when the buses reached a point where they could carry 40 per cent of all the traffic street congestion became so great that it was necessary to begin to remove buses. There were something like 6,000 buses operating in the heart of London and that was more than the streets could take care of. English transportation experts say that 5,000 more buses would be required to take care of the traffic if street cars were entirely done away with.

St. Louis has both street car and bus service. A recent survey showed that throughout the day 1,976 buses carried a total of 36,233 passengers, or eighteen a vehicle per trip, whereas during the same period 9,645 street cars carried 308,779 passengers, or 32 a vehicle per trip. During the rush hours street cars carried an average of 55 per cent

more passengers per vehicle than the double-deck buses.

Possibly I have seemed to dwell at length on the New York situation and I hope that you will not feel that I think, as the average New Yorker, that it is the only place in the world worth talking about. The reason that I have discussed it so fully is that I realize there is a misunderstanding of the situation outside of New York. Furthermore, it is an excellent example of a city which does need common-carrier transportation, and which has not permitted its companies to earn a fair return. If other cities want to know how to wreck their transportation systems and inconvenience their people I would suggest they make a careful study of New York's past transportation history.

The situation is not without hope, however. The crisis is at hand. New York, like every other big city, must have good transportation, and it is going to get it. The only way that it can get it is by paying a fair rate for it. New York is going to pay this price on street cars, buses and all other kinds of vehicles. Merely because some politician wants the fare to remain at a certain figure is no sign that it is going to remain there. The fundamental laws of economics make this impossible in New York as well as elsewhere. Rides must pay a profit or there will be no rides.

general overhauls were on the basis of 60,000 miles. This basis was found to be unsatisfactory. A great many road failures and pull-ins resulted, in spite of all we could do to prevent them. We found, after a careful investigation, that our motors were failing at less than 40,000 miles and that our wheel changes averaged 40,000 miles. Other important units were being changed at intervals less than our overhaul period.

OVERLOAD PERIOD INCREASED

In an attempt to synchronize our inspection and overhaul periods with the life of the various units on the cars, we bring our cars into the shop for truck overhaul every 40,000 miles. At that time we make a careful inspection, change wheels and correct many of the defects which would otherwise become the source of road failures and expensive carhouse changes in equipment. Our regular overhaul period has been increased from 60,000 to 80,000 car-miles. At that time the regular 40,000-mile truck overhaul is again carried out.

The following table gives a comparison of "Class A" pull-ins; that is, pull-ins resulting from mechanical failures:

	For Year	Average per Month
1924	9,203	767
1925	6,361	530
1926, five months....	2,129	426

Cars are inspected at the carhouses every 600 miles. At this time controllers are gone over and the brakes are adjusted. At 1,200-mile intervals there is a general inspection. This covers all bearings, lubrication, motors, controllers, wheels, brakes, etc., and at this time all minor replacements are made. Any major repairs or changes which have to be made at this time are expensive and every effort is made to prevent them by thorough work during shop overhauls.

In connection with the inspection of cars we have worked out a system of "General Orders" covering proper maintenance methods which must be observed. These orders incorporate what is accepted as good practice and tend to educate the workman and to eliminate any tendency on his part toward makeshift repairs. It is our intention to have the same job done exactly the same way each time.

We have in service approximately 2,800 motors, the greater portion of which may be termed "of old type or design," and due to this fact, together with the age of the equipment, it is necessary that we take every precaution to prevent failures. We have had very satisfactory results from the practice of swedging all armature coil leads into the commutator ears instead of soldering them. The swedging has almost entirely eliminated open circuits, which, with the former practice of soldering joints, were a common trouble.

In all motors taking sleeve type armature bearings wear between bearings and bearing housing is compensated for by copper-plating the outside of the bearing. It is possible to obtain a tight fit in an oversize housing in this way provided less than 0.035 in. of additional metal is required. The cost

Eternal Vigilance by Maintenance Men Needed to Meet Modern Conditions*

They Have a Large Part to Play Under Competitive Conditions—Service Failures Can Be Reduced to a Minimum Only by Scientific Study and Proper Teamwork

By R. W. BAILEY
Superintendent of Power and Equipment
Kansas City Railways

THERE was a time in the electric railway industry, even with the 5-cent fare, when the low labor and material costs gave ample margin between income and operating costs. Consequently the man in charge of maintenance often did not measure up to present-day requirements. Present conditions are developing more equipment engineers and fewer master mechanics. Within the last few years more engineering research has been applied in this department of street railways than was ever conceived in preceding years. We have reached a point where advantage must be taken of every opportunity for reducing operating expenses without interfering with continuity of service.

At one time common-carrier local transportation agencies enjoyed the position of furnishing a service almost universally a necessity. This service has ceased to be a necessity to an increasing portion of the public, although it is still a utility to them. Due to the rapidly increasing use of the private automobile, it is becoming more important daily that operators consider the

likes and dislikes of car riders and provide an attractive, quiet and comfortable means of transportation. But that is not all. Cars must be moved regularly, safely and with maximum speed commensurate with safety. This means the elimination of equipment failures to cars in service. The public has become accustomed to fast individual transportation and the electric railway must do all in its power to compete with this type of transportation.

To maintain and operate our equipment at the lowest possible cost and at the same time provide satisfactory, salable transportation involves not only the replacement of defective units but, since very few of us are fortunate enough to operate modern equipment, it is necessary to add improvements and time-saving devices necessary to meet modern demands on our present equipment. The requirements for success under present conditions are managerial ability, intelligence and well-balanced engineering, including an accurate record of the performance of equipment. Last, but of greatest importance, is the need for eternal vigilance.

Our maintenance practices in Kansas City have been built up from this viewpoint. Previous to September, 1923,

*Abstract of paper presented before annual meeting of Midwest Electric Railway Association, Denver, Col., July 8-10, 1926.

of copper-plating these bearings is much less than that of using an oversize bearing and boring the housing.

During 1923 we did considerable experimenting on armature bearing lubrication, particularly in reference to automatic oiling. It was found that 57 motors were being changed due to low bearings, and that upon investigation the bearings gave evidence of having been hot at some time previous to the actual failure. It was evident that we were getting bearing failures due to improper lubrication. These failures in a great number of cases resulted in a rewind job. During the early part of 1924 oilers were installed on all armature bearings of 57 and 67 motors. The result was better than we had expected. The performance of these motors, as far as bearings are concerned, is on a par with the other motors which we have in operation. In this connection it might be well to say that a further study was made of automatic lubrication as applied to axle bearings and that during 1925 oilers were installed on axle bearings on all 57 and 67 motors.

MOTOR BOLT PROBLEMS

One problem which has confronted the mechanical department of the Kansas City Railways has been the selection of the proper motor bolts for use particularly on the heavier types of motors on our older equipment. During the cold winter months we have had innumerable derailments, pull-ins and delays to service as a result of motor and gear case bolts breaking or the nut working off. We have used everything from a standard machine bolt to a high tensile strength alloy steel, heat-treated bolt. The performance of the different type bolts was carefully watched and finally our selection narrowed itself to the use of heat-treated axle steel bolts. After exhaustive tests and experiments we found that the majority of our bolt breakage was due to distortion in the structure at the bolt head where the head had been upset in its manufacture. This condition can be helped by annealing the bolt to relieve any strains set up during manufacture. It is, however, impossible to change the structure. Heat-treating also seems to be beneficial, but the results lack uniformity. In the manufacture of some bolts the bolt head is upset with a large fillet under the head which is afterward machined away. This leaves a good structure at the head. The best, though almost prohibitive as to price, is the straight-machined, heat-treated bolt. It is very good practice to leave a small fillet under the bolt head as a means of stopping small cracks or "cold shuts" on upset head bolts.

Our present specifications call for a heat-treated alloy steel bolt of very high tensile strength and which costs us approximately 25 per cent more than the average alloy steel bolt. The practice of annealing second-hand bolts and putting them back in service has been stopped, as the savings made by this practice do not justify the risk we take in putting them in service.

While we have not verified our selection of motor bolts by performance in

normal service over a period of time sufficient to prove conclusively that the problem is solved, our tests give us reason to believe that this type of failure will be much less in the future than it has been in the past.

In an attempt to improve axle bearing conditions on the property a great deal of experimental work has been done with die cast bearings. We are at the present time using die cast axle bearings for all replacements on General Electric 57 and 67 motors. The material used is as follows: Zinc, 80 per cent; copper, 4 per cent; tin, 6 per cent; aluminum, 10 per cent. The approximate cost of this material is 22 cents per pound, as compared with 25 to 30 cents for bronze.

Many advantages are obtained from their use in place of bronze bearings. Chief among these is a large saving in cost, which makes it practicable to replace bearings within much closer limits than usually are considered feasible with the much more expensive bronze bearings. Thus it is possible to keep motors fitted closely to the axles. This reduces considerably the wear and tear on equipment as well as the noise resulting from worn bearings.

The cost of a new die cast axle bearing is \$4, against \$8 for the bronze. But in the case of the die cast bearing, when it is necessary to scrap for wear, the cost is limited to the labor of casting a new bearing. The old material is melted down and a new bearing of any desired size can be made up on short notice. There is a substantial saving due to the elimination of machining labor.

In making die cast bearings cast iron molds are made and cores are used. A description of the apparatus and process was published in the issue of the *ELECTRIC RAILWAY JOURNAL* for Aug. 15, 1925, page 229.

While the bearing is being cast it is subjected to air pressure, which improves the density and wearing quality of the material. In the finished bearing windows, key-ways, oil grooves, etc., are cast so that the bearings are ready for use without machining or other finishing. For worn axles several sizes of center cores are used. Bearings are made to under-size bores in standard steps of $\frac{1}{16}$ in. The checks which we have made to determine wear on die cast bearings show less wear than on brass bearings. Breakage at the flange has been eliminated by casting a fillet back of the flange and shortening the height of the flange on die cast bearings.

Another method adopted to maintain gear centers is to match both die cast and bronze axle bearing to the axle; for instance, each time a pair of wheels is changed bearings are returned to the shop. The new pair of wheels going into service is installed together with the bearings which have been fitted to them.

TRACK MAINTENANCE MOST IMPORTANT

There is no part of the car where poor maintenance is so noticeable as in the trucks. The rattle and clamor of loose, worn or ill-fitted truck parts acclaim in loud tones their lack of attention. Even the properly maintained

truck of modern design is far from quiet, and it is only through eternal vigilance and frequent inspection that the older designs can be operated with any degree of quietness. When we consider the weight of the older designs of trucks and the unsprung weight which is being continually hammered over special work, crossovers and high rail joints and which is all too frequently being bounced along on a pair of flat wheels at the rate of two or three hundred jolts per minute we wonder that we can keep them in service 40,000 miles.

The most important part of truck upkeep is the tramping of truck frames at regular intervals. Due to collisions, split switches, excessive wear, etc., the truck frame is frequently cramped out of line. How many times have you seen a derailed car being put back on the rails by means of a log chain and a wreck car or truck hooked on to one corner of the truck frame. This is a fruitful source of sprung truck frames and, although sometimes necessary, results in untold grief for the truck maintenance man.

We believe in giving the truck a chance by starting with a square truck frame. We have found that it is possible to obtain much more rigid and sturdy construction by riveting and in some instances welding instead of bolting the frames. The application of case-hardened wear plates as a means of reducing localized wear and of soft iron wear plates as a means of absorbing wear where it can be compensated for easily and frequently are invaluable helps in maintaining tight, smoothly operating trucks.

Springs which are poorly matched or which have attained different degrees of set are a source of trouble. The majority of derailments on single-truck cars, especially of the safety type, are due to uneven spring tensions.

We have found it necessary to work over practically all our brake rigging. In this program a standard brake lever and pull-rod layout was made for each type of equipment with the idea of eliminating all off-set brake levers and pull-rods. At one time practically every pull-rod and lever replacement had to be bent on the job, since no standard was observed.

"MATERIAL SUPERVISOR" APPOINTED

Shortage of materials must be avoided if good maintenance is desired. If material is not available when needed, worn or defective parts are permitted to go into the car, which results in failures in service. Careful supervision and constant study of the supply and demand are necessary to insure against shortage. Nothing is more disheartening to the foreman responsible for a certain class of maintenance than a material shortage. It forces him to allow poor work to leave the shop or carhouse. We have created the position of "material supervisor," whose duty it is to see that the proper supply of material is fed into the "mill." He is responsible not only for material used in routine maintenance but is also in close touch with any special work which affects the material supply.

In connection with material we have found that it is usually cheaper to buy replacement parts instead of making them in our shop. The average street railway shop cannot compete with an industrial institution which operates on a production basis, and even if the cost is slightly higher, it pays to purchase most parts from the original manufacturer. When we begin to manufacture parts on a large scale, the actual maintenance supervision, which is our primary job, usually suffers. By buying from the manufacturer we take advantage of the engineering necessary to perfect the part. Frequently an apparently insignificant change may become later the source of a great deal of trouble.

Improvements in maintenance methods, changes in design of equipment and the installation of labor-saving devices are all secondary to the importance of good management. In management I include every member of the organization whose primary responsibility is supervision or planning of the work. It has been said that the foreman is the keystone in the arch of industry. He is the link between the management and the men, and because of this relation he is well worth every effort the management can extend to

help him improve himself, so that he may do justice to the important part he plays in industry.

The workman represents a part of every company's working capital. Stop and consider the interest you pay on this investment. If your payroll amounts to \$40,000 a month, then your workmen represent an \$8,000,000 investment. The return which you get on this investment varies directly with your ability to select the proper men, then to create in them an interest in their work, loyalty to their employer and the desire to co-operate in the production of better quality of work. Create in them the desire to do more than draw their pay envelopes. If your men are content, loyal and ambitious the \$8,000,000 investment becomes a real asset.

I do not believe in condemning a man too severely for an error in judgment. The man whose judgment "batting average" is more than 60 per cent is advancing and is a valuable man. He needs help in the way of encouragement and constructive criticism. He must be not only "with you" but "a part of you." As a part of our maintenance practice in Kansas City we have adopted the slogan "Eternally Vigilant."

Progress Being Made in Track Construction*

Interesting Experiments in Denver Look to the Development of Satisfactory Flexible Track—Advantages and Disadvantages of Rigid Track Analyzed—Proper Rail Sections for Use in Paving

BY NELSON R. LOVE

Chief Engineer Denver Tramway Corporation
Denver, Col.

SINCE the construction of the first horse car lines fundamental changes in track construction have been slow. In general the tracks have comparatively long lives, which in itself retards changes. Experiments are costly and the fruition of them very slow. The weight of rail used has been gradually increased. For many years special sections have been utilized primarily for greater convenience in maintaining a flangeway in paving.

Welding joints has developed rapidly in recent years, and the process is found to be almost an ideal application, as the forces due to temperature expansion and contraction are more or less continuously absorbed by the surrounding earth or paving, and the track is well constrained against "buckling." The use of steel ties and of concrete paving is rapidly becoming general and, as a result of this alone, electric railway track practice is rapidly departing from steam railroad practice and highly specialized designs are being developed.

Of all of the problems encountered in building electric railway track, that of constructing a satisfactory track through paved areas is the most baffling

and reveals the greatest variety of methods. Probably no method of building track in paving has been devised which is entirely satisfactory from every viewpoint.

The evils of electrolytic corrosion of the rail have been mitigated by bonding or welding joints, installation of copper negative return wires and the decentralization of substation capacity through the adoption of automatic substations in comparatively small units.

It can no longer be said that the life of the joint is the life of the track. The various methods of welding joints now available effectually eliminate joints, and at moderate expense.

Much progress has been accomplished in the improvement of special track-work, particularly by the adoption of alloy steels for this purpose.

The mechanics of an electric railway track in operation are obscure, as direct observation is inherently impossible. Corrugation develops in the rails, and no one has offered an entirely satisfactory explanation or remedy for this phenomenon. The public is more and more demanding quiet operation of the cars. The rapidly increasing use of automobiles has brought a demand for more and more paving, both to eliminate dust and to make it easier for the

automobilist. Economy requires that whatever type of construction be used its first cost should be low and also its life should be long.

Much of the maintenance in city track is associated with the paving. Further than this every track repair also requires a pavement repair, so that electric railway engineers are making intensive efforts to improve the wearing qualities of paved track. Two schools have developed, one of these standing for the construction of massive rigid track, which will remain intact through its strength, the other standing for the construction of a comparatively lightweight resilient track, upon the ground that the very flexibility of the track protects it from injury.

An analysis of the conditions existing in a track while a car is passing over it would indicate that no matter how strong the track may be the forces developed will exceed this strength, even to the extent of causing permanent distortion of the metal in the surface of the rail, whereas if the track be flexible the forces are minimized, so that if construction can be made to provide for movement of the rail without any destructive action taking place the flexible track should outwear the rigid track.

DYNAMICS OF TRACK ANALYZED

Every moving body tends to move in a straight line, and if the force of gravitation be exactly equalized by spring tension it will do so. A street car must travel over slight inequalities in roadbed and rails, and is also subject to slight irregularities in the wheels. On account of the comparatively great weight combined with little room, the springs must be stiff. Added to this, a large percentage of the weight, wheels, axles, motors, truck frames, is nearly if not quite unsprung. When a car is traveling at high speed a considerable force is required to make it travel in other than a straight line.

Let us assume a wheel with an unsprung weight of 2,000 lb., and diameter of 30 in., traveling at a speed of 20 m.p.h. or 29 ft. per second. Assume further that an irregularity of 0.05 in. is encountered. If no distortion takes place, the wheel must be raised through a distance of 0.05 in. in 0.0035 second. The velocity in a vertical direction will reach 1.2 ft. per second, or approximately 0.82 m.p.h., and the acceleration will be 1.2 ft. per second divided by 0.0035 second, or 343 ft. p.s.p.s. This is approximately ten times gravity, and the force between the wheel and the obstruction will be 20,000 lb., or 10 tons; this with an unsprung weight on the wheel of 2,000 lb.

An obstruction of this magnitude is not uncommon in electric railway track, and even if the track were rigid enough to stand such forces, the metal would not. It is plain that if the rail could be depressed the 0.05 in. by a load of, say, 5,000 lb., then the impact would be not more than 5,000 lb., and probably a little less. This is only one-fourth of the impact on rigid track and requires only a very small resiliency for the reduction.

The above, while not exact, gives an idea of the magnitude of the impact

*Abstract of paper presented before annual meeting of Midwest Electric Railway Association, Denver, Col., July 8, 9, 10, 1926.

forces which may be developed in highly rigid track, and also the small amount of flexibility necessary to relieve these stresses. On account of the tendency of the moving car to proceed in a straight line, the flexible track is also a quieter, smoother riding track than the rigid track. The present tendency toward light-weight cars emphasizes the desirability of resilient track, as the lighter car requires a more flexible track to secure the same riding qualities as the heavy car.

In the foregoing illustration it will be noted that in the case of a resilient track, the track itself must be accelerated during the passage of the car over a bump, and due to its mass offers a resistance to this acceleration. In other words, the track may be resilient under static loads but apparently rigid, due to the mass of the rail, pavement and foundation, under moving loads. This dynamic rigidity is dependent not only on the mass per foot of the track structure but also upon the stiffness or section modulus. It is apparent that if a given deflection under a wheel extends for 5 ft. in front and in back of the wheel, the impact will be twice as much as if it extends only 2½ ft. front and back.

The mass of one running foot of track structure, paving, base and rail, 8 ft. 8½ in. wide and 18 in. deep, is approximately 2,500 lb., of which less than 100 lb. comprises rails. It is apparent that the dynamic rigidity of a track can be very materially reduced by separating the rail structure from the paving structure, at least in so far as vertical motion is concerned.

Thus, the impact stresses developed by a car in motion on a track are roughly proportional to the weight and speed of the car and the "dynamic rigidity" of the track; the latter in turn depends upon the rigidity of supports, the section modulus of the track and the weight of the track structure. Impact stresses may be materially reduced by lightening the car, increasing the flexibility of the track and separating paving from rail. Given common spring conditions the riding characteristic of the track is worse with light cars, but better with flexible track.

So far the practical side has not been touched upon. As an illustration of the truth of the above conclusions, think for a moment of open steam road track. Operation over such track, at speeds far in excess of the electric car speeds, is quieter and smoother than electric railway track. The ties and ballast are both highly resilient, and the amount of deflection is enormous when compared to electric railway track. The rail sections in use have much lower section moduli than do the rails used by many electric railways, and the mass of the track structure is only a fraction of that of the electric railway. In spite of the immensely greater wheel loads and higher speeds, the flowage of metal at open joints is less than on an electric railway with fairly tight joints. To watch a heavy train pass at a high speed over a crossing would make one wonder that it lasts until the train is over it, it moves so much; yet constrain the steel so that it cannot move and it will break.

In actual practice, a rigid track con-

struction presents several important advantages. Only steel and concrete are used. The construction is comparatively simple and easy and the materials required are few in variety. After the steel rail is worn out the steel ties and concrete foundation are available for use with new rail and paving surface, so that a large proportion of the first cost is permanent and suffers no depreciation. As there is no motion between rail and paving, no motion need be provided for.

On the other hand, corrugation seems to be peculiar to the more rigid types of tracks, and when it develops there seems to be no track structure strong enough to withstand the resulting vibration. The pavement separates from the rail, water gets in and frost action does the rest. Wear and tear on rolling stock is greater. If the corrugations are ground out, the rail is worn out at a far greater rate than by wheeling alone. Rigid track is invariably noisy track, and probably the noise and the corrugations both result from the same cause.

As a result of the monolithic type of construction repairs are usually difficult, as destruction of the entire paving surface is necessary. The quantities of material used are large and the rail is heavy, resulting in high cost. By very reason of its rigidity, the line and surface must be exact in order to secure reasonably smooth riding and prevent the generation of destructive stresses.

DIFFICULT TO JOIN PAVING ON FLEXIBLE TRACK

The initial stumbling block in the construction of flexible track is to secure a joint between rail and paving which will permit of movement of the rail relative to the paving, without any destructive action on the latter, but a joint which nevertheless will be watertight, to prevent the entrance of moisture and subsequent destructive action from frost. The invention within the past few years of an asphaltic rail filler, which occupies the space between rail and paving, may prove to be one means of overcoming this difficulty, but the preparation has not yet been in use for a sufficient length of time to determine whether or not any destructive action takes place in flexible track construction. Unless such a joint can be made, the construction of flexible track cannot be successful, at least in cities where freezing temperatures occur at certain seasons.

Another trouble lies in the difficulty of securing uniform resiliency. Unless special provision be made the ties supporting the rail will provide spots of greater rigidity, which are uniformly spaced. This circumstance will tend to produce poor riding qualities in the track and may lead to excessive corrugation, particularly at resonant speeds. Perishable materials are sometimes utilized in the construction of flexible track, in the effort to secure flexibility, and the life of the track is shortened to that of the perishable material.

Flexible track, if the difficulties mentioned can be satisfactorily overcome, presents several decided advantages. The tendency to corrugation is decidedly decreased, and the rail is therefore longer lived. The track and paving

structures are both considerably lighter than rigid construction, smaller quantities of material are required, so that such a type of track construction is considerably less expensive than a corresponding rigid construction.

For a number of years the standard for paved track construction in Denver has been what might be termed a semi-flexible type. This construction uses 65-lb. A.S.C.E. rail on 6-in. x 8-in. treated wood ties. The whole structure rests on from 6 in. to 9 in. pit run gravel ballast. The character of the climate and soil is such that further sub-surface drainage is unnecessary. Solid concrete paving to a depth of 9 in. is placed between the rails and to a distance of 15 in. outside of each rail. Within the last two years it has been found possible, by means of an electric vibrating apparatus, to improve the bond between the concrete and rail very materially. Results obtained with this type of track have been very satisfactory. About five years ago the wheels were changed from cast iron to steel wheels. At the same time the practice of maintaining proper coning of wheels was instituted. Coincident with this change, corrugation developed at a number of places where it had not existed before. Much of this corrugated rail has been ground and since that time corrugations have not reappeared except in a few isolated cases. Some of the older track shows a separation between the concrete paving and the steel rail. This has not developed at any location where the vibratory tamping was employed. The chief objections to this type of track are that it is somewhat noisy and in addition its life is limited by the life of the wood ties used in the construction.

FLEXIBLE TRACK WITH STEEL TIES

Within the past year further experiments have been conducted with the aim of securing a flexible track approaching as closely as possible the requirements for an ideal flexible track as previously set up, using steel ties, concrete and asphalt exclusively. In this construction the steel ties have been allowed to function only in a horizontal direction in order to maintain gage and proper tilting of the rail. Vertical load is sustained entirely upon ordinary paving asphalt mixed and solidly tamped underneath the rail and ties by means of electric tampers. This track has been in service for approximately one year. The rail does not come in contact with the concrete paving at any point whatever in the construction. The space between the rail is paved with concrete and the rail is kept separated from this paving by means of a special rail filler. The paving outside of the rail is the asphaltic street paving laid against the rail. A stretch was also tried with the rail filler between the rail and the street paving. The joint between the street paving and the rail is not yet satisfactory, as there is excessive deterioration of the street paving at some points. Further experimentation in this respect will soon be under way.

The steel ties were bent so that the rails were canting to a slope of 1 to 25. No sign of corrugation has developed in any of this track. This rail has worn

very smoothly. The track is decidedly quiet in operation and very smooth riding. The cost of this construction was approximately the same as for the standard type of track previously described—wood ties on ballast with 9-in. depth of concrete paving. The surface appearance of this type of track in the street is much more pleasing, primarily on account of the fact that the rails themselves constitute the only joints in the paving. The asphalt is continuous between the tracks from curb to rail, and the concrete is continuous in the track so that only four lines of separation appear in the paving. If the principles of the process prove satisfactory this type of construction can probably be installed at a lower cost than any other type now in use.

At this point it seems proper to mention a further result of this paving. No expansion joints were placed in the concrete, a continuous stretch approximately 1,200 ft. long. No large cracks whatever have developed and only a few hair cracks. In the older type of paving it was found that installation of expansion joints served no useful purpose, inasmuch as the concrete paving cracked without regard to the presence or absence of expansion joints. This was probably due to the fact that with welded joints the linear dimension of the steel rail could not change with the change of temperature. With cold weather the concrete contracted with a force greater than its tensile strength. The ties, and bond between the concrete and the rail, effectively held the concrete stationary at frequent intervals, so that frequent cracks would result. These cracks are easily treated by the use of primer paint followed by hot asphalt which effectively seals the cracks, but, nevertheless, results in unightly appearance.

DESIGN OF RAIL WARRANTS STUDY

The rail used by electric railways has varied from the very lightest sections to some of the heaviest sections, with a strong tendency in the past few years, particularly among the advocates of rigid type of construction, to the heavier rails. The heavy rails are particularly well adapted to electric railway construction on account of the ease with which stone block tothing can be laid against the rail. It is, however, subject to the same disadvantages as the rigid track on account of a dynamic rigidity as previously explained, being introduced through the mass of the adjacent paving and of the rail itself, which must be accelerated when any motion in the rail takes place.

Special sections of rail have been developed for use by the electric railways better to accommodate paving and to provide flangeways. The special sections are particularly characterized by being extremely heavy and, further, having a high section modulus compared to the weight of the rail. In other words, the rail is very stiff, having excessive height of web and narrow flange. The extremely light rail is much less costly but has a limited life due primarily to corrosion of the flange and web. On account of the extreme lack of rigidity of the very light rails it becomes necessary to maintain the ties

or other supporting structure in good condition at all times or the rail is ruined on account of surface bending and breaking. The railway type of sections of comparatively light weight—65 lb. to 80 lb.—offer a rail which is sufficiently great in cross-section to withstand corrosion for a longer period of time than it takes the head to wear out. It is sufficiently flexible to permit of material reduction of impact. It is not as costly as the heavier sections.

In recent years the subject of canting of rail has been given considerable attention and there are some electric railway engineers who believe that this is the only thing necessary to prevent the formation of corrugation. This practice has in fact been found to be very effective in reducing corrugation. The reason back of this seems to be that if a properly coned wheel rolls on a vertical rail the area of contact between the wheel and the rail is extremely small as the contact takes place on a portion of the rail where the curvature is large. This results in high pressure per unit area, and the surface of the rail is easily subjected to a stress higher than its elastic limit with the result that cold rolling immediately takes place. If the rail be canted or tilted by means of canted tie plates, or if the rail section itself provides for the tilting on the upper surface of the rail, then the contact between the wheel and the rail takes place on a part of the rail of a much larger radius of curvature. As a result of this the effective area of contact becomes much larger with a small distortion of the rail surface so that the elastic limit of the steel is not reached.

Clambake Planned for New Englanders

PLANS for its annual outing on Thursday, July 22, have been announced by the New England Street Railway Club. This year it will be a sail on Casco Bay with an old-time clambake on Long Island.

The steam *Aucoscisco* has been chartered for the trip. It will leave Customs House Wharf, Portland, Me., at 10 a.m. A second trip will be made, leaving Portland at 12:30 p.m., arriving at Long Island in time for the clambake at 1 p.m.

Beginning at 11 a.m. there will be the usual program of sports for both men and women, followed by a baseball game between railway men and manufacturers. After the clambake there will be dancing.

Returning to Portland, the boat will leave Long Island at 4 p.m., reaching Customs House Wharf at 5:30, after a sail around the bay. The day's program will end with a light supper at the Falmouth Hotel.

Free transportation by bus from Boston will be provided, leaving North Station Wednesday, July 21, at 6 p.m. and arriving at Portland about 10:30 p.m. Returning the bus will leave the Falmouth Hotel 6:30 p.m., July 22. Those preferring can take the boat of the Eastern Steamship Line leaving Boston at 6 p.m. Wednesday and Portland 8:30 p.m. Thursday or the Boston & Maine train leaving North Station at 9 a.m. on Thursday and returning

from Portland at 7:10 p.m. Thursday.

All schedules are on Eastern daylight saving time.

Those desiring reservations for the trip or accommodations at the Falmouth Hotel should write George E. Haggas, Cumberland County Power & Light Company, Portland, Me.

American Association News

Way and Structures

HARD centers and switch tongues were the subjects of discussion at a meeting of the special way and structures committee No. 2 held on June 11 at the office of W. W. Wysor, chief engineer United Railways & Electric Company, Baltimore. Members present were C. A. Alden, R. B. Fisher, H. F. Heyl, G. A. Peabody, W. W. Wysor and E. M. T. Ryder, chairman. Messrs. Bragg and Davis of the United Railways & Electric Company attended as guests.

Discussion on hard centers was opened with the submission to the committee of several plans to show a comparison of the lengths of centers which are now being manufactured by large trackwork companies with those proposed by the committee. Several motions were then passed covering suggested changes in the plans which were made to produce an agreement with manufacturing practices.

At the last meeting of the committee assignments were made to the members for the preparation of sketches showing proposed devices for tongue switches. These sketches were submitted at this meeting for the purpose of criticism and discussion. A sketch of a new type of holding device will probably be prepared and presented at the next meeting of the committee.

In the afternoon Mr. Wysor and Mr. Davis took the committee on a tour of inspection through the Carroll Park Yards and the General Shops of the United Railway & Electric Company on Washington Boulevard.

Engineering Symbols

THE special committee on engineering symbols held its third and final meeting at association headquarters, New York City, on July 1. The meeting was attended by H. W. Coddington, chairman; J. D. Kent, C. W. Squier and G. C. Hecker.

Each of the members had completed his portion of the work of preparing the symbols, and the business of this meeting consisted of reviewing the finished portions of the report and preparing the sheets of symbols for submission to the association. The tentative report previously sent out to the members of the committee for comment and criticism was revised. This report includes 33 plates of symbols which have been agreed upon by the committee for submission as standards of the association.

The News of the Industry

Conference in Chicago

Mayor Seeks to Have Traction Officials Meet on July 22 to Discuss Terms of Proposed Franchise

Failure of officials of the Chicago elevated and surface lines to appear before the local transportation committee of the City Council after repeated invitations has evoked action from Mayor William E. Dever. Until now the Mayor has appeared only in the background, but he recently invited officials of both companies and bankers representing surface lines security holders to appear in his office on July 10 to discuss the proposed traction ordinance. Several of the company executives were absent from the city on that day, however, and the conference with the Mayor was postponed to July 22.

A proposal to bring about a referendum that would strip the Illinois Commerce Commission of its regulatory powers over all public utilities in Chicago, including traction lines, was introduced at the same time by Alderman J. M. Arvey. In order to put the question on the ballot at the next mayoralty election, the Alderman said, it will be necessary that a petition be signed by 25 per cent of the city's voters. The resolution calls for the appointment by the Mayor of a committee to prepare and circulate such a petition.

Another solution for the traction problem was presented to the Council in the form of a resolution calling for the appointment of a citizens' committee to iron out the differences between city and company officials. As conditions stand, there appears to be little prospect of an early agreement being reached.

A resolution introduced last month by Alderman Oscar F. Nelson and adopted by the City Council, which, if enacted as the result of appeal to the State Commerce Commission, would have compelled the surface lines to expend from its depreciation and renewal fund some \$5,000,000 for new cars and track extension, was withdrawn on July 13, when Corporation Counsel Busch told the Aldermen that the city did not have the right to enforce such expenditures. The fund is an integral part of the companies' properties that has been specifically appropriated for the renewal of parts, he said. Another opinion by Mr. Busch held that the State Commerce Commission is without authority to direct the surface lines to invest its damage claims reserve fund to obtain higher rates of interest than at present. A resolution to this effect had also been introduced by Alderman Nelson.

Alderman Nelson immediately announced that he would call upon the City Council to set aside \$100,000 from the city traction fund to conduct a city-wide survey for the purpose of ascer-

taining what will be necessary for the municipality to operate large fleets of motor buses to take the place of surface cars when the company's franchise expires next February.

Conciliation Board Begins Wage Hearing at Winnipeg

The board of conciliation appointed to investigate the dispute between the Winnipeg Electric Company, Winnipeg, Man., and the one big union unit of its street railway employees commenced its inquiry on July 13. Justice Lamont of Regina, Sask., is the chairman of the board; J. B. Coyne, K.C. is the company's representative on the board, and F. J. Dixon is the representative for the men. The dispute arose over the refusal of the company to recognize the one big union, which is an avowed communistic organization. The company is also resisting a demand for an increase in pay of 6 cents an hour which the one big union is making. The hearing will likely be a protracted one and the decision of the board is not expected for some time.

Legal Difficulties Delay Pittsburgh Subway

Although actual construction of the subway is not in prospect in Pittsburgh, Pa., study of the subject will proceed. Part of this study will consist of making surveys and drawings, for which Council recently approved the addition of seventeen new employees. Members of the transit department held a secret conference with the Council previously on the much discussed subway to relieve traffic congestion and to aid rapid transit. After the meeting it developed that there was little likelihood of a start being made on a subway before 1928. It was reported that the spokesman for the transit department discouraged starting on the underground street artery until legal provision was made to assess the expense of such an improvement against owners of all property benefited.

Traffic Survey at Cincinnati

In conformance with the request contained in a resolution adopted by the City Council the Rapid Transit Commission at Cincinnati, Ohio, has voted to use \$50,000 in bonds to defray the expense of a traffic survey to be made as a preliminary step in negotiating a lease of the transit system. In its formal action the commission adopted a resolution asking the City Council to allow the commission to issue \$50,000 for transit purposes. The bonds are available as the remaining portion of a \$150,000 allowance provided in the state law creating the Transit Commission.

Interborough Sues Strikers

Seeks \$239,000 Damages for Injuries to Its Business—Steady Improvement in Service

There were three outstanding developments during the past week in the partial strike which is in progress on the subway lines of the Interborough Rapid Transit Company, New York. First, the strikers failed to get out any considerable number of the transportation men on the Manhattan elevated division, or in the power houses, or any material addition to the number now striking on the subway division. Second, there was a continual improvement during the week in service given on the subway division, as evidenced by the increasing number of trains run and passengers carried. Third, suit was brought by the Interborough Rapid Transit Company on July 13 in the Supreme Court of the State of New York against 62 ex-employees, named in the summons and complaint, for \$239,000 damages already sustained and plea for injunction before other damages and loss are inflicted.

The complaint points out that the company operates approximately 130 miles of elevated railroad and 244 miles of subway with 9,000 trains daily which carry 3,500,000 passengers; that it has about 14,000 employees who, under an association known as the Brotherhood of Rapid Transit Company Employees, treat with the company on the question of wages and working conditions; that through this brotherhood a contract covering these matters was entered into between the brotherhood and the company on June 30; that all employees of the company have agreed to be members of this brotherhood and not of any other employee organization, but despite this fact the defendants are unlawfully persuading or attempting to persuade large numbers of employees of the plaintiff to refuse to continue in its employ at the wages agreed upon and to break their contract of employment, are holding meetings, using threatening language, circulating false reports about the company and making unreasonable demands upon it for increased wages, all of which is an unlawful combination and conspiracy to injure the company's business.

The injuries so far inflicted are said to be upward of \$239,000, for which the company asks damages, as well as an injunction to prevent further damage. It asks particularly that the defendants be restrained from persuading present employees to absent themselves from their duties, from making demands on the company for increased wages, from circulating letters or other communications among the employees of the company urging them to join any union other than the brotherhood, from doing

any acts knowingly and wilfully to get the employees or any of them to break their contracts with the company, from picketing or loitering on or in the neighborhood of the company's cars, stations, structures or other premises for the purpose of persuading the company's employees to desist from the performance of their duties, from injuring any of the property of the company, etc. With the summons and complaint, the Interborough Rapid Transit Company submitted a copy of the con-

stitution and by-laws of the brotherhood, correspondence between some of the strikers and the company and other exhibits.

The legal basis for a suit of this kind is discussed editorially in this issue of this paper.

On Thursday, July 15, service on the subway division was more than 60 per cent normal even in rush hours. At no time during the strike has there been any material decrease of trains operated on the elevated division.

New South Shore Equipment in Service

Brief Review of Progress Made on the Program for Rehabilitating Road Operated Through Steel District of Indiana—More Than \$3,000,000 Spent So Far for Reconstruction

COMPLETION of the first unit in the rehabilitation program of the Chicago, South Shore & South Bend Railroad was announced on July 13 when the new steel passenger equipment was placed in service between Michigan City and South Bend, Ind., the eastern terminus of the road. Extension of the use of the new equipment over the entire line from South Bend to Chicago will be made later in the month.

Use of the new motor passenger cars was begun on the eve of the first anniversary of the acquisition of the railroad by the Midland Utilities Company and the operation of the line by Samuel Insull and associates. The railroad was formerly operated by the Chicago, Lake Shore & South Bend and the property was purchased by the Chicago, South Shore & South Bend Railroad at public auction on June 29, 1925.

Actual operation of the railroad as a subsidiary of the Midland Utilities Company began on July 15, 1925. Since that time an extensive program of rehabilitation has been carried on and a total of \$3,618,250 has been invested in improvements. Of this amount \$2,761,250 has been spent by the railroad, including \$1,330,000 for new equipment, \$1,428,250 for changing of the entire electrical overhead, new rail, new ties, improvement of passenger stations, freight houses and other expenses. An "ideal" section of double track right-of-way, 1 mile in length, has just been completed near Miller, Ind. Three-wire catenary trolley construction replaces the old center-pole trolley suspension. In addition \$857,000 has been invested by the Northern Indiana Public Service Company for eight new electric substations and high-tension lines, from which the railroad will be supplied with power under the new direct-current operation. Five of the substations will have a capacity of 1,500 kw. and the remainder 750 kw. Four of them will be equipped with mercury arc rectifiers, a type said never before to have been used by an electric railway in the United States.

The motor passenger cars which were tested in the yards at Michigan City and placed in service last week on the east end of the railroad are part of an order of 25 new cars which are being built by the Pullman Car & Manufacturing Corporation. More than half of these cars have been received and the others will be delivered within the next few days. Three of the four new

electric freight locomotives have been delivered and these also were placed in service on July 13, hauling freight trains between South Bend and Michigan City. Two dining cars and two parlor-observation cars are likewise being built by the Pullman Company, but these will not be delivered until later in the summer.

The new cars have deep-cushioned mohair velvet seats, dome ceiling lights, three electric fans in each car, deeper car springs and separate smoking compartments for each car. Several of the cars will have the regular Pullman car type smoking rooms, with an aisle around the side. This is an unusual type of car for use on an electrically operated railroad.

The next few weeks trains will stop in Michigan City and trailers will be transferred from the old section to the new, with the beginning of operation of the steel cars. This is necessary because the new equipment is operated with direct current and the old cars with alternating current.

The growing popularity of the Sand Dunes country at the foot of Lake Michigan and the increasing traffic to points in this territory have made it necessary for the company to add several new trains and new stops to the summer schedule. Special low rates are now in force from Chicago and other stations.

Fare Case in Omaha Not to Be Reopened

The State Railway Commission has refused to reopen the fare case of the Omaha & Council Bluffs Street Railway, Omaha, Neb. The proceedings covered the rates fixed for Omaha only. They were placed at 10 cents cash with six tickets for 40 cents. City Commissioner Butler, leader of the opposition to an increase, asked for a rehearing on the ground that the company, when the rate case was pending, contended that the bridge connecting the two cities and owned by it was no part of the system and that its cost, revenues and profits should not be considered in determining a proper rate of fare, but that the company revised its stand when it protested to Congress against a bill to permit a free bridge across the river at Omaha. When advised by the commission that if the revenues of the bridge are to be considered with respect to rates now when it is making money,

whatever deficit might arise in the future from its operation would then have to be borne by the car riders, Mr. Butler was content to let the matter drop.

Cincinnati Wages to Be Arbitrated

By a vote of 758 to 345, members of the Amalgamated Association turned down the proposal for a graduated increase in the pay of motormen and conductors, as well as other employees, as submitted by the Cincinnati Street Railway, Cincinnati, Ohio. The question now goes to arbitration. The employees sought an increase of 12 cents an hour, but the proposal of the railway offered them a contract for two years with an increase of 1 cent an hour every six months for a period of two years. The motormen and conductors are now getting 53 cents an hour and the operators of the buses run by the company 57 cents an hour. The proposition of the company for an increase of 4 cents an hour covering a two-year period also applied to the bus drivers. The arbitration of the problem will be conducted by three men, one from each of the respective factions, and a third chosen by the two representatives.

Strike in Indianapolis on Wane

Members of the citizens' committee, seeking to aid in the settlement of the Indianapolis strike, met on the afternoon of July 15 with officials of the Indianapolis Street Railway. The conference lasted almost the entire afternoon, but it failed to bring about any definite results. The committee said it was interested only in restoring service and in seeing that fair play was received all around.

Members of the committee were informed by officials of the company that service had been restored. It was pointed out that the company was now fewer than 25 men short of the 40 per cent who quit work more than a week ago. In reference to the method of settling disputes between company and men, officials of the company cited the committee a contract with the men, approved both by Judge Anderson, when he was on the federal bench there, and by Judge Baltzell, present federal judge, in which it is specified that disputes be taken up first with the superintendent of the company. If no satisfactory settlement can be made, then the matter is referred to the president of the company, and in event of failure of settlement the men have recourse to the Indiana Public Service Commission. Officials of the company pointed out that in the present instance the men listened to the advice of organizers and "kicked over the traces," leaving the company entirely unprotected. Officials of the company signified they would not discharge men hired recently and take back strikers.

Officials of the company report that during the peak load hours morning and evening little difficulty is being experienced in handling the crowds. Most merchants report business good and the downtown shoppers show no lack of buying power. As for the general public, it appears to be indifferent.

Relief from Paving Asked— Passengers Off in Seattle

Demand that the Seattle Municipal Railway be relieved of paving or planking between car tracks and that the cost be assessed against the abutting property was voiced at a recent meeting of the utilities committee of the City Council by D. W. Henderson, superintendent of railways.

A petition from a West Seattle Improvement Club for repaving with planks between car tracks on California Avenue caused Councilman Ralph D. Nichols to declare that the "time has arrived when these communities which are asking the municipal system to spend its money in improving the streets in their districts should be given to understand that they must support the street cars."

Mr. Henderson declared that privately owned traction lines all over the country are being relieved of the burden of paying for paving.

According to William Pitt Trimble, chairman of the rapid transit committee of the City Planning Commission, average daily passenger traffic over the municipal traction lines has decreased steadily during the first six months of 1926 over the figure for the corresponding period of last year.

The Trimble committee submitted figures to show that 47,094,051 passengers were carried on the municipal lines in the first six months of 1924; 46,113,640 in the corresponding period of 1925, and 45,050,004 in the first six months of 1926, a loss averaging about 1,000,000 passengers during each succeeding six-month period.

P.R.T. Band Wins Cup at Festival

The Co-operative Welfare Band of the Philadelphia Rapid Transit Company, Philadelphia, Pa., won first place in the band competition held on June 24, in connection with the musical festival at the Municipal Stadium. The 110-piece band was declared the winner in the senior band event in competition with thirteen other bands. In the drum and trumpet corps event the company also won first place in a field of six. The first prizes awarded to the Philadelphia Rapid Transit Company are two silver loving cups, the formal presentation of which will be made at the company's picnic on Aug. 31.

Curbed Parkway for St. Louis Railway Cars

The Board of Public Service of St. Louis, Mo., on June 25 approved the plan for a curbed parkway for street cars in the center of Olive Street when that thoroughfare is widened between Twelfth Boulevard and Channing Avenue. The board acted on the recommendation of Director of Streets and Sewers Brooks, who submitted an extensive statement outlining the advantages of the plan for segregation of street car and other vehicular traffic on the street, which is the city's chief east and west highway.

Under the plan approved by the board

when Olive Street is widened from 60 ft. to 100 ft. there will be a 23-ft. neutral zone in the center for street cars, with two 26½-ft. roadways for other vehicles and 12-ft. sidewalks for pedestrians. He said it would speed up street car traffic and reduce considerably the danger of accidents.

Safety islands will be installed for street car riders and stops will be made only every three blocks from Grand Boulevard to the down-town district. The Olive Street cars, which now average 9 m.p.h., can increase their speed safely to 15 m.p.h.

Conference on Segregation Issue Called at Albany

Chairman William A. Prendergast of the Public Service Commission has called a conference for July 20 at the office of the commission in Albany in the matter of the petition of the United Traction Company for increased fare in Albany, Troy, Rensselaer, Cohoes and other communities. The conference will be for the purpose of hearing arguments on the applications of the interested communities that for the purpose of the present rate proceedings the property of the company be segregated.

Wage Arbitration in East St. Louis Closed

Testimony was closed on July 9 before the board of arbitration named to decide whether the motormen and conductors of the East St. Louis & Suburban Railway, East St. Louis, Ill., are entitled to increased wages. The men desire an increase of 10 cents an hour approximately from the present scale. The arbitration board is composed of C. E. Smith and B. F. Thomas, St. Louis engineers, representing the company; W. L. Perry and J. R. McMurdo, representing the men, and Frank M. Slater, St. Louis attorney, as chairman. Decision in the case has been reserved.

Amortization Versus Improvements in Buffalo

Commissioner Frank C. Perkins of the department of public affairs in the Buffalo, N. Y., City Council has asked the city law department for an opinion on the legality of a sinking fund of \$2,940,990 set aside by the International Railway in 1925 for amortization of intangible capital, especially in view of the fact that Bernard J. Yungbluth, president of the railway, says the company is without funds to make improvements to its tracks as ordered by the Public Service Commission. Commissioner Perkins in his appeal to the city law department recommended that the Public Service Commission direct the company to keep its property in safe operating condition. The International Railway is questioning the authority of the Public Service Commission, which recently ordered it to make repairs to its tracks. Mitten Management, Inc., which operates the Buffalo traction system, is taking the matter before the courts.

Knights Templar Parade Handled Well in Springfield

Many compliments have been received by the management of the Springfield Street Railway, Springfield, Mass., on the successful manner in which it handled the crowds gathered there June 24 for the Knights Templar parade, in which some 10,000 persons were in line. This was the biggest undertaking of its kind ever tackled by the company of that city.

Two distinct problems were involved in handling the crowds. One was to keep the regular traffic moving throughout the entire system with the exception of portions of Main and Dwight Streets and certain side streets, where traffic was suspended for two hours and fifteen minutes. The operations involved the transport of thousands into the business district to witness the spectacle. The other problem was to provide prompt and efficient service at the point where the marchers broke ranks to board special cars for the Eastern States Exposition grounds in West Springfield. There were 70 of these specials, and by a plan carefully worked out in advance 40 of these cars left the carhouse at 11:20 o'clock, or 40 minutes ahead of the time the parade was due to start, and the rest at 12:15, just after the procession had got under way.

Many cars not chartered were run as extras for the accommodation of those who did not go over in the main body and also for returning crowds. General traffic on the system was handled by turning cars back over their regular lines from points near the line of march, leaving the parade route clear for the occasion. The police gave efficient co-operation.

Toledo Ordinance Issue to Be Rushed

Speed in the preparation of an ordinance embodying changes in the Milner franchise governing the operations of the Community Traction Company, Toledo, Ohio, is being demanded by Mayor Fred J. Mery. The document may be ready to submit to City Council at its meeting on July 26. The Mayor has assurance from Law Director Frank M. Dotson that he will devote his entire time in the interval to work on the franchise ordinance. If an early agreement is reached there is a possibility that the matter may be submitted to voters at the regular November elections.

Henry L. Doherty, representing the holding company owning most of the Community Traction Company securities, has informed the Mayor that he will favor a plan worked out along the suggestions of Prof. H. E. Riggs, who made the transit survey last summer.

A recent questionnaire of the Chamber of Commerce shows that many business leaders are anxious to arrive at an early solution of the transit problem. This indicates that the modifications of the present plan to obtain better railway and bus service co-ordinated under one management will probably have plenty of support from the business interests.

Rapid Transit and North Shore Trainmen Denied Wage Increase

The demands of approximately 4,500 trainmen of the Chicago Rapid Transit Company for a wage increase of 5 cents an hour and other concessions were rejected on July 12 at a conference between union leaders and officials of the company. Instead, a counter-proposal of a decrease of 5 cents an hour and no overtime until after a ten-hour day was brought forward by the company.

If the company should grant the increases asked—and it is without funds to do so—\$700,000 would be added to its annual payroll, B. J. Fallon, vice-president, told the workers' committee. The employees are seeking restoration of the 1922 peak scale, which was reduced by 10 cents in 1923. Since that date they have regained 5 cents an hour. At the present time motormen are receiving 77 cents an hour, conductors 72 cents and guards 70 cents. The wage agreement expired on June 1.

The company's reply will be submitted to the union officials at once. Arbitration will probably follow. Both sides say there is no immediate prospect of a recurrence of the five-day strike in August, 1926.

Trainmen of the Chicago Surface Lines, who are endeavoring to obtain similar wage increases, are expected to be strongly influenced by the outcome of the negotiations between the elevated men and their employers.

In referring to the short life of the present franchises, Guy O. Richardson, vice-president of the Surface Lines, announced on July 13 to representatives of the 5,000 shopmen employed by the company that their demands for an average increase of \$1 a day after the union contracts expire next month could not be granted.

Trainmen of the Chicago, North Shore & Milwaukee Railroad have also demanded that their wages be increased from 76 cents to 82 cents an hour. The company, on the other hand, proposes a reduction to 73 cents an hour and the shortening of the present nine-hour working day to eight hours.

Discussion of New York State Fare Continued

The hearing on the petition of the New York State Railways to charge a 10-cent cash fare or three tickets for 25 cents on its Oneida-Kenwood line has been closed before the Public Service Commission. According to evidence submitted by the company there have been operating deficits for the past three years ranging from \$8,065 in 1923 to \$28,836 in 1925.

Based on the proposed increase in cash and ticket fare, the company's witness figured an increase in revenue of \$13,359 in 1926, due to the increased fare, if allowed. This estimate is based on a 2 per cent decrease in the riding and 20 per cent of the riders paying a cash fare and 80 per cent buying tickets.

The hearing before the commission on the petition of the New York State Railways to charge a 10-cent fare with three tickets for 25 cents in the city of Rome was postponed until July 27 to give the city an opportunity to examine

the exhibits and the evidence submitted.

The company claimed operating deficits of \$10,632 in 1920, \$23,967 in 1921, \$13,431 in 1922, \$4,235 in 1923, \$10,498 in 1924 and \$6,914 in 1925 under the present 7-cent fare.

Based on the revenue passengers carried in 1925 and the proposed increase, if granted, the company estimated an increased revenue of \$19,069 in 1926.

Wage Increase Asked by Cincinnati Men

An increase in pay of 12 cents an hour is requested by members of the Amalgamated Association, who are endeavoring to negotiate a new contract with the Cincinnati Street Railway, Cincinnati, Ohio. The present wage agreement, made two years ago, expired on June 30. Motormen and conductors now are paid 53 cents an hour. In view of the fact that no new agreement has been reached, it is likely that the question will go to arbitration. The new demands call for 60 cents an hour for the first three months, 63 cents for the next nine months and 65 cents thereafter. Shopmen, greasers, power houses and car-house employees also are asking for increases.

Analysis of Causes of Delays in Milwaukee

Congestion of streets is the outstanding and predominating cause of interruptions and delays in electric railway service, according to a compilation made by the Railroad Commission of Wisconsin.

Of the total of 8,886 causes of delay in one month in Milwaukee, 5,370 are attributed to interference with the movement of cars occasioned by street congestion.

A table listing the causes of delay follows:

Causes	Number	Per Cent of Total
1. Street congestion	5370	80.5
2. Operating conditions	840	9.5
3. Rolling stock	638	7.2
4. Electric distribution	456	5.1
5. Accidents	307	3.5
6. Weather conditions	267	3.0
7. Steam railroad crossings	221	2.5
8. City equipment	195	2.2
9. Bridges	159	1.8
10. Trainmen	133	1.5
11. Way and structures	88	1.0
Cause not given	212	2.4

The items included in the above column of "causes" are in general as follows:

1. Street congestion—This consists of delays due to street traffic, both vehicular and pedestrian, interfering with the movement of the cars; cars held by other cars ahead; regulation of traffic by officers or light signals; and accidents not involving street cars.

2. Operating conditions—This consists of time required to load passengers; heavy loading; waiting for passengers transferring from other cars or those not ready to board; failure of passengers to step away from the loading door after paying fare; slowness of passengers in paying fare; lapse of time after passengers are loaded before conductor signals motorman to proceed; lapse of time after receipt of signal before car starts.

3. Rolling stock—Car trouble and car changes.

4. Electric distribution—Power off; low voltage; wire down; phones and signals in bad order.

5. Accidents—Those accidents involving street cars, such as derailments.

6. Weather conditions—Rain; snow; sleet; fog; bad rail; snow sweepers.

7. Steam railroad crossings—Delays caused by trains or crossing gates held down for trains.

8. City equipment—Fires; fire apparatus; patrol wagon; ambulance.

9. Bridges—Opening at such times as to delay cars.

10. Trainmen—Due to use of students, pulling out late; late relieving; calls of nature; tending stoves; getting sand; late from previous trip.

11. Way and structures—Trackwork; switch trouble; utility cars; temporary track.

News Notes

900 Turns a Day Saved.—The Board of Public Utilities has sanctioned the rerouting of a number of lines of the Los Angeles Railway that will materially affect the entire system. Approximately 900 car turns a day will be eliminated from the congested district. In addition, considerable mileage is saved.

Receiver of Company Honored.—Col. Albert T. Perkins, general manager for Receiver Rolla Wells of the United Railways, St. Louis, Mo., has been named chairman of the committee on military and naval affairs of the Greater St. Louis Exposition to be given by the St. Louis Chamber of Commerce in Forest Park next September. With the co-operation of the War Department assured by Secretary of War Dwight Davis, Colonel Perkins and his committee have made tentative plans to present the greatest military tournament ever arranged in conjunction with a non-military affair.

Fewer Stops to Expedite Travel.—The City Council of Macon, Ga., recently approved an agreement entered into by a committee of Council and the Macon Railway & Light Company to eliminate a number of railway stops on the system. This was done with a view to speeding up traffic and reducing dangers from automobile accidents. The move is in line with the police committee's efforts to improve traffic conditions throughout the city generally.

Through Service Between Washington and Annapolis.—The Washington, Baltimore & Annapolis Electric Railroad, with headquarters in Baltimore, Md., has started a through service between Washington and Annapolis, eliminating the necessity of changing cars. Trains leave West Street station, Annapolis, at 6.50 and 7.20 a.m. daily, except Sundays, and leave Twelfth Street and New York Avenue, Washington, at 4 and 5 p.m. daily, except Saturdays and Sundays.

Parades Banned.—In accordance with an order of City Manager Sherrill of Cincinnati, Ohio, street parades are banned in the congested districts of Cincinnati except for those of a strictly civic nature. The order will eliminate all organization parades, whether religious, political or fraternal. In the opinion of the Police Department this regulation has become necessary because of the tremendous congestion and the interference with business that accompany such parades.

Recent Bus Developments

Legislative Study of Bus Question in Massachusetts

Massachusetts has settled the status of its bus business for the present. In other words, things will probably go on as they are for another year. The law covering common carriers, however, as it stands and as it operates today is not wholly satisfactory. The faults in it are to be studied and recommendations made to the next Legislature.

All the individuals and corporations undertaking to provide coach services in the state have had hearings before the various public tribunals and have obtained their licenses, permits and certificates and they are now operating under a law which has been tested in court and upheld in several court decisions, and they are following rules and regulations carefully prepared and adopted by the Department of Public Utilities. By this long process they have qualified as legalized carriers.

There are today 116 such individuals and corporations owning bus certificates in Massachusetts, and they operate over about 250 definitely established routes, for which they hold licenses from the city and town authorities.

The process for all of them was to secure a license from the city or town authorities, a permit from the highway division of the State Department of Public Works to use the streets, and finally a certificate of public convenience and necessity from the Department of Public Utilities, to whose officially promulgated rules and regulations they must conform in the matter of equipment and service.

In issuing certificates of public convenience and necessity to these 116 firms and individuals the Department of Public Utilities has sought to protect existing transportation lines against needless and ruinous competition. Routes have been approved and business rights have been defined in each individual license with due regard for the effect upon the other transportation service in the community, in so far as the public tribunals have been free to act. There are a few cases where the Department of Public Utilities probably would not issue any certificates on the basis of the present merits of the situation, but the concerns were operating a year before the new law went into effect and that gave them *prima facie* evidence of public convenience and necessity and the required certificate could not be denied. In cases where motor coach certificates have been issued to the railroads and to electric railways the Department of Public Utilities has sought to co-ordinate the service, so that bus service meets the train schedules, and it has ordered the maintenance of through fares, making bus tickets valid on trains.

In cases where electric railway and the bus lines were operating on somewhat the same schedule in the same territory, the bus perhaps starting just

a little before the trolley and sniping the passengers, the Department of Public Utilities has ordered a spread in the schedules so that the half-hour service of one of the agencies would supplement the half-hour service of the other. In one instance where a corporation was operating on an early license issued to an individual, as was the case between Orient Heights and Revere Beach, the department required the filing of a new petition.

Highway Commissioner's Ruling Hits Columbia Jitneys

Samuel McGowan, chief highway commissioner of South Carolina, has issued a memorandum to the superintendent of motor transportation to the effect that new applicants for class "C" licenses, to which belong the 10-cent jitneys, file with the highway department a liability bond in the sum of \$250 and that all certificates revoked by failure to file bond on June 17 will remain revoked for the rest of this year. It is stated that only fourteen of the 143 jitneys now operating in Columbia and its suburbs abided by the requirement to file bond on June 17, so approximately 130 are outlawed.

This order, it is believed, will serve to simplify greatly the transportation problem in Columbia. Heretofore the 10-cent jitneys have been operating over the city, offering a sharp competition to both the bus lines and the railway system. They were for the most part under no bond and passengers rode in them at their own risk, yet because they carried passengers at the same rate as street cars and buses and carried them direct to their doors jitneys have been heavily patronized. The buses now operate on practically all of the principal streets and issue transfers to the three street car lines which are still operating, all other street car lines having been discontinued because of falling revenue.

It is said that the jitney union has engaged the services of an attorney to oppose the order of the highway commissioner on the ground that the commissioner has no authority to bond cars operating within the city limits of Columbia.

The buses operated by the Carolina Transit Company are bonded to the extent of \$11,000 each, according to state highway department officials.

The manager of the Carolina Transit Corporation, Chester Hawkins, is quoted as having said that unless something were done to prevent the 10-cent jitneys from picking up passengers he would have to abandon operations. Action of this kind on the part of the bus company would leave Columbia, the capital of the state, without transportation facilities. The street cars were allowed to discontinue operations on all but three lines when they reported steady losses because of the failure of the people to ride the trolleys.

Buses Proposed for Lincoln

The Lincoln Traction Company, Lincoln, Neb. has the backing of the City Council in an application made to the State Railway Commission for authority to abandon certain suburban trackage and substitute bus service. The buses will operate from the business center to the state penitentiary and state hospital for the insane to the south and southwest at the same fare, 10 cents cash and four tickets for 30 cents, with transfers, as charged on the street car. This is the beginning of a development of bus service co-ordinated with railway service for the city.

At the hearing C. N. Chubb, one of the officers of the United Light & Power Company, which owns the traction company, told the commission that his company's experience had convinced him that railways in cities of less than 100,000 population were doomed unless a profitable method of combined bus and car service were worked out and unless the companies were relieved of paying for paving between the rails and adjacent to them, together with occupation taxes. Decision was reserved.

Application Before Commission for Bus Rights in Hornell

A hearing was held before the Public Service Commission on June 24 on the application of Raymond E. Page to operate bus lines in the city of Hornell and to the village of Canisteo, Steuben County. Service would also be offered to the village of North Hornell. At the present time transportation service in this territory is furnished by the Hornell Traction Company. Proof presented at the hearing showed that the trolley lines would be discontinued July 15, when the property of the traction company is to be sold under mortgage foreclosure. It appears that the company has defaulted in payment of its bonds and further operation of the railroad has become unprofitable. Consent to the operation of the new bus lines has been granted by the Common Council at Hornell.

Mr. Page, the bus applicant, was formerly receiver of the Hornell Traction Company. He has been identified with that property for some time.

Temporary Order Against Bus Permits in Omaha

The City Council of Omaha, Neb., has been temporarily restrained from issuing permits to bus lines to carry passengers within the city limits in competition with the Omaha & Council Bluffs Street Railway. The plaintiff in this case was the Guarantee Trust Company, New York City, representing the bondholders. That company raised the question of an exclusive franchise as the principal bar. The State Supreme Court recently freed the hands of the Council, tied by previous injunctions obtained by the railway on the ground that the permits the Council proposed to issue were legally franchises and that a vote of the people was necessary. The Supreme Court held that the grants did not partake of the irrevocable nature of franchises.

Financial and Corporate

Separation of Alton Properties Effected

Four new companies have been formed by the North American Company to take over and operate various parts of the properties of the Alton, Granite & St. Louis Traction Company and the Alton Gas & Electric Company, recently purchased at foreclosure sale by representatives of the North American Company for \$1,965,000. The North American Company owned all of the common stock and about 90 per cent of the bonds of the two companies prior to the sale, which was ordered by the federal court at Danville. The new companies, formed so that the various properties could be split up into unified and compact businesses, are the St. Louis & Alton Railway, which will operate the interurban lines between St. Louis, Mo., and Alton, Ill.; the Alton Railway, which takes over the city lines in Alton, Ill.; the Alton Gas Company and the Alton Light & Power Company. George K. Miltenberger has been named president of each company.

The arrangement of having the interurban and city electric railways, gas system and electric light and power services together under one management, with all of them hampered in financial and other operations by the laws designed to govern any one of them, proved awkward, uneconomical and inconvenient. This opinion was expressed by Louis H. Egan, president of the Union Electric Light & Power Company of St. Louis, representative of the North American Company in that district.

The bonds of the Alton, Granite & St. Louis Traction Company had paid no interest from 1920 and on Aug. 6 of that year a petition for a receiver was filed with the United States District Court. On Aug. 11, 1920, receivers were appointed. The Alton Gas & Electric Company went into receivership on Dec. 31, 1925.

Baltimore Easements Must Be Valued

The Maryland Court of Appeals recently handed down an opinion in the valuation case of the United Railways & Electric Company, Baltimore, Md., under which the Maryland Public Service Commission will have to hold a new hearing in the case for the purpose of placing a value on the easements. The case was taken to the Court of Appeals by Clarence W. Miles, formerly people's counsel, who sought to have stricken out the \$7,000,000 allowed by the commission for easements and upheld by the lower courts. The total valuation on the property as fixed by the commission was \$77,000,000, including the \$7,000,000 for easements.

The Court of Appeals neither affirmed nor reversed the decision of the commission or the lower court, but the action pleased the officials of the United. The

highest court of the state took the stand that the company should be allowed a valuation for easements, but this should not be allowed as easements but as interest in real estate.

In a statement issued by the United following the action of the court it was stated that the company naturally was gratified that the opinion upheld its contention that easements were property, like any other property, and the company was entitled to include them in its valuation. The company also stated it contemplated no increase in fare, "preferring to work things out on the present fare as long as possible."

The commission does not expect to conduct the rehearing until the fall.

\$1,060,000 South Shore Equipment Trust Issue Offered

Equipment trust gold certificates, Series A, of the Chicago, South Shore & South Bend Railroad, South Bend, Ind., to the amount of \$1,060,000 are being offered for subscription by Halsey, Stuart & Company, New York. They are dated July 1, 1926, and are due serially over a period of ten years. They are in the denomination of \$1,000 except those due July 1, 1931, and 1936, which are in the denomination of \$1,000, \$500 and \$100. So significant is the offering, regarded from the standpoint of those interested in obligations of this kind, that the maturities and prices quoted by the bankers have been reproduced in the accompanying table.

The certificates will be issued by the trustee and will represent about 80 per cent of the actual cost of new equipment, consisting of ten three-compartment baggage, smoker and passenger motor cars, fifteen two-compartment smoker and passenger motor cars, four 80-ton electric locomotives, two dining cars and two parlor observation cars.

In the opinion of counsel, upon the delivery of the equipment to the railroad full title to the equipment will be vested in the trustee for the benefit of the certificate holder. The lease will be assigned to the trustee and will provide for rentals to pay the certificates and dividend warrants as they come due. Under the terms of the lease the railroad will covenant to maintain and keep the equipment in good order and repair, to replace any of said equipment that may be worn out, lost or destroyed, and to insure the equipment against loss or damage by fire to an amount of not less than the bal-

ance of the certificates unpaid and outstanding.

The Chicago, South Shore & South Bend Railroad owns and operates the high-speed electric railroad, 69 miles in length, extending from South Bend, Ind., westward to the Indiana-Illinois state line. The outstanding common stock is owned or controlled by the Midland Utilities Company.

Sales of W., B & A. Bonds Attract Attention

Bonds of the Washington, Baltimore & Annapolis Electric Railroad, Baltimore, Md., 5 per cent issue of 1941, were dealt in heavily again on July 13 on the Baltimore Exchange, one block of \$50,000 changing hands. Total transactions amounted to \$105,000, all at 64½ to 64¾.

This quotation has ruled for several days, despite the fact that sales during the last few days have amounted to more than \$250,000, face value. Practically all the bonds offered have been bought by one house.

The liquidation is said to have been for account of interests compelled to dispose of their holdings. Despite the large amounts of the issue coming on the market the liquidation has failed to break the price under 64½. This has caused more or less comment and has resulted in a revival of the stories of a closer affiliation of local utility interests with the affairs of the company.

Short Hudson Valley Line Abandoned

The Hudson Valley Railway, Glens Falls, N. Y., has abandoned its Geysers, Belt and Kaydeross lines as well as the Mechanicsville-Ballston line, 13.67 miles long. Permission for the abandonment was given by the Public Service Commission. The evidence showed that the revenue from these lines had been steadily decreasing since 1922, and that the operation had resulted in a deficit since 1923. In connection with this abandonment trouble arose with the United Transportation Company (the Albany-Pittsfield Bus Company), which received a certificate under which it operated from Troy to Mechanicsville and Saratoga. After the abandonment by the Hudson Valley this company started operating from the city line of Mechanicsville to Saratoga Springs. The railway obtained an injunction restraining the United Transportation Company from operating in Mechanicsville in competition with it. The matter has been argued before Supreme Court Justice Christopher J. Heffernan, who has reserved decision. Another incident in this case occurred on July 6, when the Public Service Commission

MATURITIES AND PRICES OF CHICAGO, SOUTH SHORE & SOUTH BEND RAILROAD

(Accumulated dividend to be added in each case)

Amount	Annual Dividend	Maturity	Price	Yield	Amount	Annual Dividend	Maturity	Price	Yield
\$106,000	4½%	July 1, 1927	99.76	4¾%	\$106,000	5½%	July 1, 1932	100.00	5¾%
106,000	4½%	July 1, 1928	99.06	5%	106,000	5½%	July 1, 1933	98.58	5¾%
106,000	5%	July 1, 1929	99.66	5½%	106,000	5½%	July 1, 1934	98.42	5¾%
106,000	5%	July 1, 1930	99.11	5½%	106,000	5½%	July 1, 1935	98.26	5¾%
106,000	5%	July 1, 1931	98.37	5¾%	106,000	5½%	July 1, 1936	98.12	5¾%

held that granting certificates for the operation of bus lines by Peter Palmer between Mechanicsville and Saratoga Springs and by Anthony Verno, Anthony and Michael Zappone between Mechanicsville and Saratoga Springs, by way of Ballston, did not appear to be a public necessity in view of the service which is now being afforded by established service.

Balance in Porto Rico \$103,432

The net income of the Porto Rico Railways, which controls the Porto Rico Railway, Light & Power Company, San Juan, P. R., for the year ended Dec. 31, 1926, amounted to \$371,710, after providing for depreciation. Income derived from other sources, \$12,250, made the total net income \$383,961. This fact was contained in the report of the directors at the nineteenth annual meeting of the shareholders. After many appropriations

CONSOLIDATED STATEMENT OF PROFIT AND LOSS OF THE PORTO RICO RAILWAYS, LTD.

(For year ended Dec. 31, 1925)

Net profit from operation for year after providing for depreciation.....	\$371,710
Add: Net income from other sources.....	12,250
	<hr/>
	\$383,961
Less: Interest on bonds—	
First mortgage bonds.....	\$113,045
Refunding mortgage bonds....	64,483
	<hr/>
	\$177,529
Office site reserve.....	25,000
Income tax reserve.....	8,000
	<hr/>
	210,529
	<hr/>
	\$173,432
Deduct: Dividend on preferred stock.....	70,000
	<hr/>
	\$103,432
Add: Balance at credit Dec. 31, 1924.....	691,494
	<hr/>
Combined surplus carried forward.....	\$794,926

STATISTICAL STATEMENT OF THE PORTO RICO RAILWAYS, LTD.

	1925	1924	1923	1922
Expenses per cent of earnings..	64.83	60.54	67.27	61.15
Passengers carried....	2,611,748	3,935,713	5,103,186	6,069,237
Passenger car-miles..	891,708	1,092,260	1,164,838	1,183,693
Passenger earnings per car-mile..	14.47	17.96	21.92	26.68

had been made, including interest on mortgage bonds, office site reserve and income tax, there remained a profit of \$173,432, out of which has been paid \$70,000 dividend on the preferred stock for the year. The balance of \$103,432 has been added to surplus account, which was carried forward at \$794,926.

The accompanying statement shows the consolidated account of profit and loss for the year ended Dec. 31, 1925, with some statistical data for 1925 and the three preceding years.

Interstate Company Gets Attleboro Branch Railroad

The Interstate Street Railway has bought the franchise and property of the Attleboro Branch Railroad, Attleboro, Mass., and the transaction has been approved by the Massachusetts Department of Public Utilities. The

financing that is involved has the department's approval in the following order:

Ordered, that the commissioners of the Department of Public Utilities hereby approve as reasonable and proper and for a lawful purpose the issue by the Interstate Street Railway, in conformity with all the requirements of law relating thereto, of bonds to an amount not exceeding the par value of \$150,000, said bonds to be dated April 1, 1926, and to be payable April 1, 1951, to be known as 6 per cent sinking fund gold bonds and to bear interest at the rate of 6 per cent per annum, and to be equally secured by a first mortgage upon all of the company's franchise and property, such bonds or the proceeds thereof to be used solely for the payment and cancellation of \$50,000 car trust notes of the company now outstanding and \$100,000 in payment for the property and franchises of the Attleboro Branch Railroad and for no other purpose.

The Interstate company, the purchasing company, operates an electric railway in Plainville, Seekonk, North Attleboro and Attleboro.

Rumors and More Rumors of Impending Deals

Charles S. Hand, writing in the *New York American*, says the Brooklyn-Manhattan Transit Corporation in the last year or so has purchased 100,000 of the Interborough's 350,000 shares of stock and that Thomas L. Chadbourne, dominant figure in the B.-M. T., is credited with holding 60,000 shares, while the remaining 40,000 are in the name of Gerhard M. Dahl, chairman of the B.-M. T., and his lieutenants. He says that William F. Kenny, business associate of the Bradys and intimate friend of Governor Smith, is reported to have control of the Third Avenue Railway. According to Mr. Hand, a new traction merger is in prospect welding subway and important surface lines into a unified system. Similar stories, not quite so definite, have appeared in other papers, notably one in the *Brooklyn Standard Union*.

In commenting on the latest rumor, J. L. Quackenbush, for the Interborough, said:

I do not know whether Gerhard M. Dahl and Thomas L. Chadbourne and their associates have purchased 100,000 shares of Interborough Rapid Transit stock.

The last time I looked at the stock list of the Interborough the names of Dahl and Chadbourne did not appear, but of course their holdings could be obscured under the names of brokers.

The company is keeping the fare question out of this strike. We have not asked for an increased fare since a year ago last March, when we presented a memorial to the Legislature. The fare question may be taken up in connection with the \$22,000,000 platform extension program.

Seeks to Abandon Six-Mile Line.—The Northern Ohio Power & Light Company, Akron, Ohio, is seeking abandonment of its East Greenville line, operating out of Massillon. This line covers a distance of approximately 6 miles.

Steam Line Negotiating for Electric Railway.—Representatives of the Missouri Pacific are negotiating for the purchase of the Murphysboro & Southern Illinois Electric Railway, which operates between Murphysboro and Carbondale, Ill.

Short Abandonment Rights Sought.—The Utah Light & Traction Company, Salt Lake City, Utah, applied for permission to abandon a part of its Third East Street line. The company also

desired to remove the tracks. It is urged that economy in operation of the traction system requires this change.

Line No Longer Necessary.—The Buffalo & Erie Railway petitioned the Public Service Commission on July 9 for authority to abandon that portion of its line in Lackawanna, N. Y., on Ridge Road between South Park Avenue and Abbott Road. The company alleges that this part of its line has been operated at great loss and is no longer necessary for successful operation of the road or for the convenience of the public.

Permission to Sell Is Sought.—Authority to abandon and sell as salvage the property of the Lebanon-Thortown Traction Company, Lebanon, Ind., was requested in a petition filed July 6 by the company before the Public Service Commission of Indiana. It set out that the line, 10 miles in length, is losing money, that it owes large sums for electric current and other bills it is unable to pay and that it cannot keep the road in repair. Permission is requested to sell the road at the best salvage prices obtainable.

Increase in Net Income.—The net income of the United Railways & Electric Company, Baltimore, Md., was \$104,861 during May, 1926, an increase of \$26,636 over the corresponding month of last year. The total revenue was \$1,464,456, or an increase of \$30,734 over May, 1925. Revenue passengers, exclusive of transfer passengers, numbered 19,778,990, an increase of 346,345 over the number carried in May, 1925.

Earnings of Connecticut Roads Decline.—Earnings of electric railways in Connecticut in 1925 were \$14,726,915, showing a decrease from the \$15,586,454 reported a year ago. The net tax to be paid is \$435,838. The business of the Connecticut Company forms the major part of these figures, the gross earnings for the year being \$13,794,645 and the amount of tax \$408,155. Earnings of other companies and the tax assessed against each follow: Bristol & Plainville Electric, \$189,514, tax, \$5,574; Danbury & Bethel, \$132,983, tax, \$3,821; Groton & Stonington, \$138,623, tax, \$4,158; Hartford & Springfield, \$155,222, tax, \$4,551; New Haven & Shore Line, \$106,686, tax, \$3,200; Thompson Line of "New Haven" road \$5,817, tax, \$174; New York & Stamford, \$147,270, tax, \$1,684.

Line Formerly Under Lease Is Sold.—Sale of the street car tracks on College Avenue north of 46th Street to Broad Ripple and east on 63d Street to Broad Ripple Park, formerly owned by the Indiana Union Traction Company, to the Indianapolis Street Railway, Indianapolis, Ind., is announced. The price, \$85,477, has been approved in the Madison Circuit Court. This stretch of track has been under lease to the Indianapolis Street Railway since the spring of 1924, when city service to Broad Ripple was instituted. The extension of service was made at that time, when, under an order of the Public Service Commission, a 7-cent fare was established to Broad Ripple with the understanding that the Indianapolis Street Railway would take the line over.

Personal Items

M. T. Montgomery Joins J. G. Brill

Twenty-eight years of operating experience in the electric railway industry may be credited to M. T. Montgomery, who has just become affiliated with the J. G. Brill Company, Philadelphia, Pa. His career to date has been a most interesting one. Beginning as a motorman in his home town, Pittsburgh, he has been intimately associated with actual operating practice in this country, in Mexico and in Cuba. Of course, with the advancing years came responsibilities on an ever-ascending scale, new problems, widened horizons. Among the positions held were those of traffic manager, division superintendent, freight agent, manager of railways. Now, with this background of transportation and mechanical experience, he steps into another phase of the industry.

Mr. Montgomery will handle sales in the southeastern territory, including Virginia, North Carolina, South Carolina, Georgia and Florida, for the Brill company. He will be actively concerned only with the electric railway sales of that concern. The wide experience gained during his years as an operating man will doubtless prove invaluable in the work which he now undertakes. Mr. Montgomery will make his headquarters at the Brill plant in Philadelphia.

A. W. Robertson Heads Philadelphia Company

Successor Named to A. W. Thompson with Utilities at Pittsburgh—Thirteen Years an Officer of Companies There

Ex-Judge James H. Reed, senior vice-president of the Philadelphia Company, announced on July 14 the election of A. W. Robertson as president of the Philadelphia Company and affiliated corporations, effective Sept. 1. He will succeed A. W. Thompson, appointed to the United Gas Improvement Company.

Mr. Robertson is well qualified, both by training and experience, to head the utility companies serving Pittsburgh and vicinity. A resident of Pittsburgh for twenty years, he has been in close touch with the development of the greater Pittsburgh district. His experience as an executive of the Philadelphia Company dates back to 1913. As vice-president in charge of public relations he has been in touch with nearly all operations and in direct charge of the general service department, which maintains all relations with domestic customers of the company, the adjustment or claims department, the advertising department, and relations with the public service commission.

Andrew Wells Robertson was born in Panama, N. Y., in 1880. He attended Allegheny College at Meadville, Pa., was graduated in 1906 and entered the law

school of the University of Pittsburgh in that year. He was graduated with the degree of LL.B. in 1910 and was admitted to the bar. After several years of general law practice he became attorney for the Pittsburgh Railways and the Duquesne Light Company. This was in 1913. In 1918 he was made general attorney for the Philadelphia Company and affiliated corporations, and in 1923 was elected vice-president in charge of public relations, retaining also his position as general attorney.

Mr. Robertson is a member of the Pittsburgh Chamber of Commerce, Pennsylvania State Chamber of Commerce and the following clubs: Civic Club of Allegheny County, South Hills Country Club, University Club, Duquesne Club, Phi Delta Theta Fraternity.

In referring to the resignation of Mr.



A. W. Robertson

Thompson and the election of Mr. Robertson, John J. O'Brien, president of the Standard Gas & Electric Company, said:

It is a matter of keen regret to lose Mr. Thompson as president of the Philadelphia Company. Mr. Thompson holds a high place in the affections and regard of the people of Pittsburgh, as well as the executives and employees of the Philadelphia Company, and we wish him great success in his new work. We are glad that there is within the organization a man so capable as is Mr. Robertson, whom we can promote to the presidency with the full knowledge that he possesses all the qualifications necessary to fill this important position satisfactorily. Mr. Robertson is thoroughly familiar with the institutions and ideals which have made Pittsburgh the great industrial and cultural center that it is. His experience as vice-president in charge of public relations has brought him in close contact with the public, and I feel that he is an excellent choice for the presidency of the Philadelphia Company. He and his associates can depend on the complete co-operation of our entire organization.

Charles D. Hardin, Seymour, Ind., general agent of the railway department of the Interstate Public Service Company, Indianapolis, Ind., will assume charge of the traffic department of the company as acting traffic manager. In this capacity he succeeds to the duties previously performed by the late Bert Weedon.

C. J. Norstrand Promoted

Long Island Electric Lines Under Supervision of Experienced Transportation Exponent

The new general manager of the Jamaica Central Railways, Inc., which has taken over the lines and operation of the Long Island Electric Railway, New York, N. Y., is C. J. Norstrand. His principal experience in the transportation field was gained from his connections with steam roads, where he filled various positions as accountant, statistician, auditor, claim agent and comptroller. Electric railroading also contributed to his fund of knowledge during the time he served as comptroller for the three Long Island Electric railway lines, which were under Gen. Lincoln C. Andrews as receiver. He held this position for two years, ending March, 1926.

Mr. Norstrand's activities, however, have not been confined to the transportation field. He has devoted his energies to banking concerns, army corps and shipping ventures and has more than once cast his lot with Uncle Sam. Such was his colorful career when in 1908 he entered the service of the Union Pacific at Omaha, Neb., in the traffic department. After advancing through various positions with this company he resigned in January, 1913, to become assistant statistician and later chief statistician and general accountant with the El Paso & Southwestern Railway, El Paso, Tex. In November, 1915, he became affiliated with the Chicago Great Western Railroad as valuation accountant. During the next few years he served in the United States Marine Corps. However, some force must have been directing his footsteps back into the transportation business, for in 1920 he went back to the steam railroad field, lining up first with the Erie Railroad and later with the Pittsburgh, Shawmut & Northern Railroad. Early in 1924 he assumed the duties of comptroller of the Long Island Electric lines under General Andrews.

Since taking over the operation of the Long Island Electric, now known as the Jamaica Central, he has made traffic surveys and is regulating the present service to meet the increasing demand. He has found that much of the equipment now operated is too heavy and large for most economical service and his plans for future equipment are based upon the modern conception of efficient operation with small units at short headways. As the funds of the new organization would not permit buying new cars, he has leased some and bought ten others, which he hopes will tide the line over until the railway is in position to provide new cars.

His staff of officers includes men taken from General Andrews' organization in connection with the three lines under him as receiver. William Ross is superintendent of maintenance and was formerly engineer of maintenance of way for the lines under General Andrews. Harry Weissmann is superintendent of transportation and was formerly a dispatcher for the Long Island lines. Thomas J. Lawson is auditor, William A. Methone is claim agent and served in this capacity for

twenty years with the New York & Long Island Traction Company. The officers of the corporation are H. Pushae Williams, president; Park A. Rowley, treasurer, and C. J. Norstrand, secretary.

Mr. Norstrand was born in 1883. He was educated in private schools and the Gymnase and the University of Christiania, Norway, and was graduated in 1903 with the degree of B. A. In 1904 he entered the service of the Bergen Credit Bank in its foreign department and later spent two months in banking houses in London, Paris and Amsterdam. Early in 1904 he took a position with a shipping concern and a short time later he enlisted in the U. S. Marine Corps and was honorably discharged in 1908 with rank of sergeant.

Messrs. Chilton and Sargis Advanced in Syracuse

Appointment of W. H. Chilton, division superintendent, and M. J. Sargis, supervisor of schedules, as assistant superintendents of transportation of the New York State Railways, Syracuse lines, has been announced by E. K. Miles, superintendent, effective at once. The appointments are part of a reorganization of the operating departments made necessary by the death of John E. Duffy, veteran general superintendent.

Mr. Sargis began his service with the company as a clerk in 1906 and Mr. Chilton as a conductor in 1905. Under the new plan Mr. Sargis will continue in charge of schedules and Mr. Chilton will supervise the employment and other divisions, with Mr. Miles in general charge of all operations of the Syracuse lines.

C. H. Robinson Leaves Bloomington

Charles H. Robinson, master mechanic of the Bloomington & Normal railway lines of the Illinois Power & Light Corporation, has resigned, effective July 15, to engage in personal enterprises in the Pacific Northwest. Mr. Robinson entered the shops of the company in 1898 and was gradually advanced to chief electrician and master mechanic. He had charge of maintenance of the Park Street power house and at the time of the consolidation of the Bloomington Electric Light Company and the Bloomington & Normal Railway, he was advanced to supervise all its electrical units.

Personnel Changes in Sandusky

Three changes in personnel have been announced by the Lake Shore Electric Railway, Sandusky, Ohio.

O. H. LaZelle, Salem, freight agent of the Youngstown & Ohio Railway, succeeds J. F. Starkey, who resigned as traffic manager of the Lake Shore Electric Railway. W. A. McNeal, Dayton, superintendent of overhead lines on the Cincinnati & Dayton Traction Company, succeeds George H. Moore, Jr., Fremont, as superintendent of the overhead lines. Albert Brownworth, superintendent of carhouse and shops at Sandusky, succeeds Frederick Heckler, Fre-

mont, as superintendent of motive power and of cars at Fremont.

Mr. Starkey has been in the service of the Lake Shore Electric for fifteen years, and until three years ago served as general passenger agent. At that time freight over the electric line became an important feature and he was promoted to the position of traffic manager.

F. N. Robinson Leaves New York Commission

Frank N. Robinson, assistant secretary of the Transit Commission, New York, N. Y., has tendered his resignation, effective August 1. He will accept a position as publicity director of the National Council of Boy Scouts of America. Few newspaper men in New York are better known than is "Robbie." Few newspaper men were or are better informed than he on transit. His term of service in the employ of the news-gathering agencies in New York City and on New York City newspapers covered a period which totals more than fifteen years.

Regulation came into being in 1907 in New York, and no sooner had it been ushered in than Robinson, then in the employ of the City News Association, was assigned to cover the workings of the new body. Effectively to do this he made his headquarters with "Jim" Walker, then assistant secretary but now secretary of the commission. All during the days of the negotiation of the so-called dual subway contracts, which gave New York its present system of rapid transit lines, Robinson was one of the chief avenues through which the newspaper reading public of New York was kept informed about what was going on.

Not only that but the idea of commission regulation was new. New York had subways before the dual contracts were negotiated, but it had little or no regulation, so New York, and the rest of the country for that matter, were concerned with the precedents that were being made. Robinson wrote about transit and the doings of the commission, wrote about them understandingly and interestingly. For eight years he did this. Then in 1916, when Mr. Walker was made secretary of the commission, "Robbie" was made assistant secretary, a public relations as well as a newspaper post and one that included among its duties the preparation of the proceedings of the commission for publication. There he has been ever since, surviving each successive political change. He has resigned now only because his new work is national in scope and affords a wider field for his activities than does the work with the commission.

So "Robbie's" service with the commission as an employee covers a period of ten years, while his career on newspapers covers a period of about sixteen years. Other than his work for the City News Service, "Robbie" served the New York *Mail* on City Hall and transit matters. "Robbie's" counsel and help on transit matters and political trends will be missed by a myriad of newspaper men and by his immediate associates, to whom he had endeared himself over a long period of years.

Obituary

G. L. Fowler

George L. Fowler, consulting mechanical engineer, editor and writer on literary and scientific subjects and a member of the American Society of Mechanical Engineers and the American Electric Railway Association, died on July 2. He was one of the early editors of the ELECTRIC RAILWAY JOURNAL, then known as the STREET RAILWAY JOURNAL, but for the past 30 years he had been a consulting engineer, specializing in handling railway mechanical problems.

Most of this work had been for steam railroads. It included research in the field of locomotive design, construction and operation, investigations regarding the qualities of steels used in steel tires and solid steel wheels, the stresses in car wheels, the lateral stresses imposed on track by loaded cars and locomotives while in service, etc. His work along these lines had many practical and tangible results.

Mr. Fowler gave considerable attention also for various clients to electric railway problems. Here the fields of his research work included studies in rolling resistances, the gyroscopic action of the motors on electric locomotives, and rail corrugation. On the latter subject he conducted a series of tests for the ELECTRIC RAILWAY JOURNAL about twenty years ago, the results being published later in this paper. Mr. Fowler was for many years contributing editor to the *Railway Age*, and was the compiler and editor of the 1906 and 1909 locomotive dictionaries issued by the publishers of that periodical.

He was born at Cherry Valley, N. Y., in 1855 and was graduated from Amherst College.

Andrew Nance

Andrew Nance, at one time manager of the Belfast Street Tramways, died on June 22. During his managership, from 1881 to 1905, at which latter date the Belfast tramways were acquired by the Belfast municipality, the operation of the system was marked with much success. Mr. Nance was continued in the managerial position by the City Council, and the electrification of the tramways was carried out under his supervision.

On his retirement from the post of general manager of the Belfast tramways in 1916 Mr. Nance was appointed consulting engineer to the City Council. By his death the United Kingdom has lost one of the most forceful and enterprising personalities in the tramway field.

Valentine Hechler, 87 years old, a pioneer in the building of the first electric railway of Richmond and one of the first in the country, and also in the building of the Richmond-Seven Pines interurban electric railway, is dead. For a long time he had not been active in business, but he preserved many of his contacts of former years. He was born in Richmond on March 10, 1839.

Charles A. Coffin

Founder of General Electric Company Dies at His Long Island Home—Had Been a Potent Factor in Electrical Manufacturing Industry for Forty Years

CHARLES ALBERT COFFIN, president of the General Electric Company from its organization until 1913 and chairman of its board from then until his retirement in May, 1922, died on Wednesday night, July 14, after an illness of a week, at his home at Locust Valley, Long Island, N. Y. He was 81 years old.

ENCOURAGED SCIENTIFIC STUDY AND INVENTION

It is probably no exaggeration to say that during his long connection with the General Electric Company Mr. Coffin did more to create and stabilize the electrical industry than any other man or group of men. His encouragement of invention along useful lines, his financial talents, his tireless energy and his courage in introducing new apparatus made his work supreme in the field to which he devoted his life. His energy and executive talent were part and parcel of the whole electrical advance and found an opening in the development of the steam turbo-generator, hydro-electric machinery, propulsion of ships, street railway transportation and the electrification of steam railroads and finally in the progress of radio communication.

The development of the electric light and power industry was influenced to no small extent by his remarkable foresight and leadership. Without any special scientific or technical training, but with an intuition almost uncanny, his recognition of men of great scientific attainment and of purely scientific research and the part they play in industrial development is singularly illustrated by the research laboratory at Schenectady, the establishment of which was made possible by him. On one of the few occasions at which he was induced to speak for publication Mr. Coffin said that he had early recognized that research laboratories, manned by great scientists, could not be restricted to commercial purposes. It had been the laboratories' job to discover all that could be discovered about electricity, and the company had had to "apply those discoveries to human need, to broadcast the knowledge, to translate the discovered truths into concrete service."

He was among the first to recognize the desirability of bringing the use of electrical energy to every household and every workshop, and a large part of his career had been devoted to the development and financing of electric transportation companies and local electric light and power companies and to the establishment of the vast power systems of the present time.

A MANY-SIDED MAN

He was a many-sided man. He had the highest possible conception of the duties of citizenship. He had the keenest appreciation of the arts, of literature and of nature. As one of his associates said of him, "Mr. Coffin's char-

acteristics were so catholic in character that his right hand hardly knows what his left hand does."

In May, 1924, he was made an honorary member of the Franklin Institute of Philadelphia. On this occasion Samuel Insull, president of the Commonwealth Edison Company of Chicago, introduced Mr. Coffin as a man whose "vision, courage and constructive ability" had signally contributed "to the upbuilding of the great electrical and other industries," but who was "modest beyond ordinary conception, desirous



of giving credit at all times to others and claiming none whatever for himself, with a loveliness of character which endears him to his friends."

FOUNDATION NAMED FOR HIM

After his retirement from active work for the General Electric Company the directors, calling him "the founder and creator of the General Electric Company, of which he has been the inspiration and leader for 30 years," established the Charles A. Coffin Foundation "as an expression of appreciation of Mr. Coffin's great work not only for the General Electric Company, but also for the entire electrical industry, and with the desire to make the appreciation enduring and constructive, as Mr. Coffin's life and work have been." The Charles A. Coffin Foundation is a fund of \$400,000, the income from which, amounting approximately to \$20,000 a year, is used for "encouraging and rewarding service in the electrical field by the award of prizes to the company's employees and by giving recognition to lighting, power and railway companies for improvement in service to the public, fellowships to graduate students and funds for research work at technical schools and colleges."

It will be recalled that under the conditions of the foundation it is provided

that an annual award of the Charles A. Coffin gold medal will be made to that electric railway company in the United States which during the year has made the greatest contribution toward increasing the advantages of electric transportation for the convenience and well-being of the public and for the benefit of the industry. It is also specified that the company receiving the medal shall receive \$1,000 for its employees' benefit or other fund. A similar award is made within the electric light and power industry.

During the war Mr. Coffin, despite his years, organized in 1915 the War Relief Clearing House for France and her allies, an organization later consolidated with the American Red Cross, and he remained active in the work of the latter body throughout the conflict. For his services France made him an officer of the Legion of Honor and Belgium and Serbia also decorated him. Honorary degrees were conferred upon him in his later years by Union, Bowdoin and Yale Universities. But these and other honors were unsought by Mr. Coffin and lightly worn. His distinguishing characteristic was extreme modesty, avoidance of ostentation and dislike of any personal publicity. His desire was to sink his own individuality in that of the General Electric Company.

HAD MANY BUSINESS CONNECTIONS

Mr. Coffin was born in December, 1844, in Somerset County, Me. He was a shoe manufacturer in Massachusetts prior to 1881, when, with others, he purchased the Thomson-Houston Electric Company, then established at New Britain, Conn. He was active in the management of this pioneer electrical manufacturing company and soon began to extend the scope of its operations. He purchased control of the Excelsior Electric Company, the Schuyler Electric Company, the Van Depoele Electric Railway Company, the Brush Electric Company and the Bentley-Knight Electric Company, and finally he organized the Thomson-Houston International Electric Company to act as agent of the home company in foreign lands. In 1892, realizing the benefits that would follow a consolidation of the Thomson-Houston Electric Company and the Edison General Electric Company, the two leading factors in the trade, he succeeded in blending these two concerns into the General Electric Company, of which he became president, retaining this office until 1913, when he surrendered it to become chairman of the board of directors. As chairman he served until May, 1922. He was thus 77 years of age when he retired from exercising or sharing executive control of the company which he did perhaps more than any other man to bring to its pre-eminence in electrical manufacturing.

Despite his age, Mr. Coffin kept up many business associations. He was a director of the General Electric Company, the Electrical Securities Corporation, the International General Electric Company, Inc., Light & Power Securities Company, the Underhill Development Corporation, the Union Carbide & Carbon Corporation, and the United Electric Securities Company.

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

The Week in American Industry Analyzed

Chart No. 135 of the National Industrial Conference Board shows the changes in hours in the normal or prevailing work week in American industry as a whole and the situation in the major groups of industries in 1923. It discloses that the proportion of wage earners working on a schedule of more than 54 hours a week has decreased almost continuously since 1909, which is the first year in which statistics of this kind were gathered by the United States Census Bureau. The proportion of wage earners working on schedule of 48 hours or less per week increased slowly from 1909 to 1914 and very rapidly during the war. Since 1921 a week of less than 48 hours has become more prevalent. In 1923 nearly 80 per cent of the wage earners in the manufacturing industries were employed on a schedule of 54 hours a week or less.

The chart pictures the great gain of leisure for industrial workers which improved management and increased productive efficiency in industry have made possible. It shows also the tendency of industrial organization since the war to adjust its working schedule to a more stable basis, following the wide changes during the war period.

Lower Prices on Tires

Tire manufacturers have announced reductions in prices of from 10 to 25 per cent on casings of bus size and from 12 to 18 per cent on tubes. The cut is regarded by observers as due to a desire

to overcome sales resistance, for the companies are not yet profiting by the lower price of crude rubber. Beneficial results of the cut have already been noted by Akron tire companies. Increased sales and production are reported by most factories, with prospects that the volume of business during the next two or three months will be the largest in the history of the industry.

Tire prices are now back to levels of late 1924 and early 1925. In fact they are almost as low as they have ever been, despite the fact that crude rubber costs about twice what it did in 1920 and 1921. Improvements in tire construction have also resulted in a greatly increased tire life.

Manufacturers report a constant increase in the demand for balloon tires for buses. Not only are new buses being equipped with balloon tires but bus operators are, to some extent, substituting the balloon equipment for high-pressure casings.

Tubular Construction of Castings Overcomes Crossing Difficulties

In the early days of manganese steel castings the manufacturers of railway crossings were confronted with two serious problems, the initial pounding down of the points and adjoining receiving surfaces and the frequent cracks occurring at the bottom of the flangeway intersections. The pounding down took place within the first 60 days of service and amounted from $\frac{1}{4}$ to $\frac{1}{2}$ in. After this initial compression the steel became fixed and was subject only to abrasions. The original pound-

ing, however, resulted in rough riding, increased maintenance cost and a decreased life of the structure. The metal was forced into the flangeways, causing the latter to become unduly narrow. To meet these objections several special process crossings were brought out, among these being the Amsco process, wherein extra metal is cast upon the receiving surfaces and mechanically compressed at the foundry so that the metal becomes fixed on the true surface of the member.

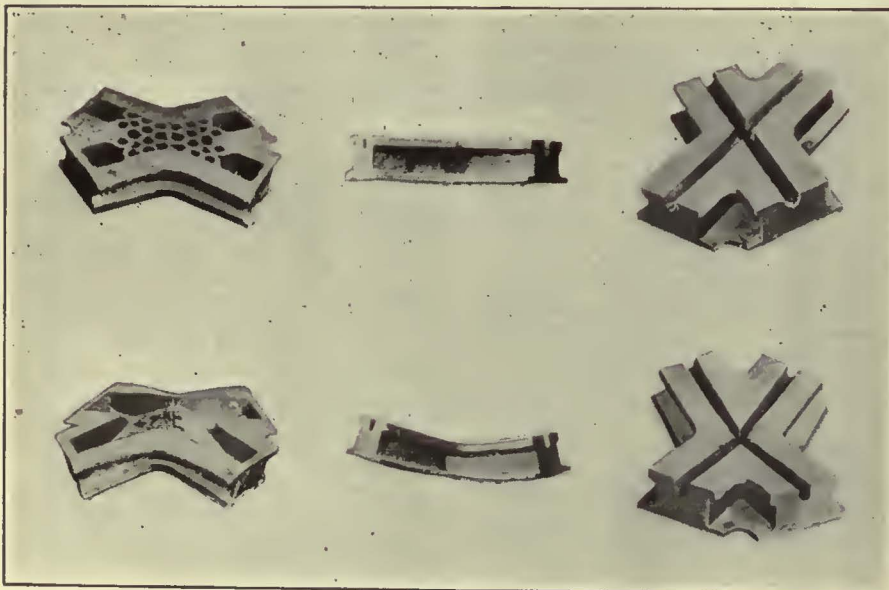
The Amsco process attacked the second problem, namely, that of overcoming unsoundness in the metal due to excessive thickness at the intersection, by developing a tubular construction formed by introducing a series of cored holes on the underside of the crossing. In this way a solid thickness of $1\frac{1}{2}$ in. of metal is provided under the tread and 1 in. under the flangeway, while the remaining depth under the flangeways and the treads consist of a series of ribs approximately $\frac{3}{4}$ in. in thickness.

An inspection of more than 100 Amsco crossings, after they had been in service from six months to $1\frac{1}{2}$ years, disclosed that no receiving surface was depressed more than $\frac{1}{8}$ in. and in the majority of cases the depression was less than $\frac{1}{16}$ in., according to the American Manganese Company, which holds the patents on these crossings. It is also claimed that the tubular construction permits of a high degree of resiliency and at the same time allows the section insuring uniform treatment of the metal. In other words, a more thorough heat treatment of the thinner metal section at the difficult intersection point is made possible. Attention is called to the fact that this is solid construction throughout and must be compared on this basis with various types of built-up crossings. Several other types of solid crossings that have met the fundamental difficulty described heretofore in various other manners are also on the market. Amsco crossings have been used extensively in steam railroad work, but are also claimed by their makers to be suitable for electric railway use.

Unusually Complete Catalog of Rail Sections

More than 125 full size drawings, dimensioned in inches and in the metric system and showing standard rail sections and rail accessories, are included in the new rail catalog issued by the Carnegie Steel Company, Pittsburgh, Pa. On each section information is given on the properties of the section, such as area, weight per yard, moment of inertia, section modulus, for both head and base; ratio of the moment of inertia to the area, ratio of the section modulus of the head to the area and gross tons per mile of single track. In addition to the drawings of rail sections and angle bars a number of tables are included in the front giving valuable information.

The pages are $8\frac{1}{2}$ in. x 11 in. and are arranged in a loose-leaf binder with flexible leather cover. Altogether the catalog is very nicely arranged and will prove a valuable reference book.



At the Top Are Shown Views of the Amsco Tubular Crossing, While the Three Lower Views Show the Old Type Standard Construction

The views at the left show the bottoms of the two types of crossings, the tubular reinforcing of the Amsco crossing preventing the breaking down indicated on the right. The illustrations in the middle and at the right show the manner in which the two crossings react to the initial pounding down by car wheels.

Where Is Your Car in This Exhibit?



Additional units to the Municipal Auditorium at Cleveland, Ohio, which will be the home of the electric railway convention to be held in Cleveland Oct. 4 to 8, inclusive, as the artist conceived them, are shown in the accompanying illustration.

Adjoining the auditorium will be the electric car exhibit. Already space for

about twenty cars has been requested, but this is not half as much as needed. Freight rates are low to this central point, and the Cleveland Railway will handle these exhibit cars, including unloading, placing, washing and reloading after the convention, at a nominal charge, probably not exceeding \$25 a car.

To the left is the 600-ft. building to be erected. This building is to be 200 ft. wide for about half its length and 100 ft. wide for the balance. It will be constructed of steel and stucco, with a solid wood floor. Connecting it with the present auditorium to the right is the wide canopy as illustrated. The entire exhibit will be compactly arranged.

Large Motor-Generator Locomotives for Great Northern

Construction work is being rapidly pushed by the American Locomotive and General Electric Companies on two large motor-generator type electric locomotives for the Great Northern Railway similar in general to those being secured by the New York, New Haven & Hartford Railroad. The two locomotives weigh 250 tons each, with 200 tons on the driving wheels. They are to be used in connection

Length inside knuckles.....	73 ft. 6 in.
Length inside cab.....	61 ft. 0 in.
Height inside cab.....	13 ft. 11 in.
Height over trolley locked down.....	15 ft. 3 in.
Total wheelbase.....	60 ft. 0 in.
Rigid wheelbase.....	15 ft. 10 in.
Total weight.....	509,800 lb.
Weight on drivers.....	409,800 lb.
Weight per driving axle.....	68,300 lb.
Weight per guiding axle.....	50,000 lb.
Diameter of driving wheels...	54 in.
Diameter of guiding wheels...	36 in.

with the extension of the railway electrification from Skykomish to Wenatchee, a distance of 80 miles. In connection with this extension of electrification a 7½-mile tunnel is being constructed through the Cascade Mountains, which will lower the present summit 500 ft. The new line will substitute 9 miles of practically straight track for 18 miles of very curved and heavy grade line.

The tractive power of the locomotives is exerted by two three-axle trucks, each equipped with three 750/1,500-volt direct-current motors. Power will be received through a pantograph trolley from the 11,000-volt, single-phase, 25-cycle line, transformed to 2,300 volts and then converted through a 2,500-kw., three-unit

synchronous motor-generator set to direct current.

Each motor is connected to the axle through twin cushion type gears. Two motors are permanently connected in series. The three-unit set consists of a centrally located motor with a 1,250-kw. direct-current generator at each end. By means of guiding axles at each end of the unit provisions are made for operating at speeds up to 40 m.p.h., with a maximum emergency speed of 50 m.p.h. Type PCL control is provided with arrangements for multiple-unit operation of the two locomotives.

Regeneration will be obtained by controlling the excitation of the traction motor fields. The use of regeneration permits the use of the motors as a brake, the power generated in this way being fed back into the transmission system. A high-speed circuit breaker is used to protect both the locomotives and the supply lines from short circuits. The two pantograph collectors will have a range of from 16½ to 26 ft., one being used as a spare.

The maximum tractive effort of the locomotive, based on 30 per cent coefficient of adhesion, is 122,940 lb. The principal weights and dimensions are given in the accompanying table.

Bookings of G.E. for Quarter Up 10 per Cent

Orders received by the General Electric Company for the first six months of 1926 totaled \$165,405,720, representing an increase of 10 per cent over the \$150,315,228 booked in the corresponding six months of 1925. For the three months ended June 30 this year orders totaled \$78,972,062, compared with \$66,468,992 for the second quarter of 1925, an increase of 19 per cent. In the first six months of this year there were 152

working days, including Saturdays, showing General Electric orders received thus far this year have been at a rate of better than \$1,000,000 a day.

Hereafter the company will report earnings quarterly to its stockholders. For a long time the officers have been developing plans for reporting earnings more frequently than has been the practice. To carry out the plan of sending quarterly statements with the dividends, it will be necessary to change the dividend date from the 15th to about the 25th of the month. Accordingly the next quarterly dividend will be payable on or about Oct. 25, 1926, and will be accompanied by a statement of orders received and earnings for the first nine months of this year.

Giant Converter Just Installed by N. Y. Rapid Transit

Installation has been made of the largest automatically controlled synchronous converter for railway service at the Avenue T substation of the New York Rapid Transit Corporation, New York, N. Y. The machine is a 4,000-kw., 575-volt, direct-current, shunt-wound converter and is supplied from a 3-phase, 4,200-kva., 11,000-volt, 25-cycle power transformer. The high-tension connections of the transformers are connected in star for starting and in delta for full secondary voltage when the running breaker is closed.

An interesting feature of the equipment is the method of operation by means of supervisory control. To start up the machine the operator at the adjacent New Utrecht station operates a small telephone key, which initiates the operation of the automatic supervisory relay equipment, resulting in the closing of a relay at the substation to start the machine. The machine then automatically starts and

connects itself to the alternating-current and direct-current systems without an attendant.

In addition to starting up the machine, supervisory control will regulate other operations, such as shutting down the machine, operating thirteen feeder breakers, closing or opening the high-tension breakers and closing or opening any of the six track breakers. The dispatcher has at all times an indication of the position of all the breakers listed above, of the position of the main current breaker, and even of the opening of the substation door. By a unique method of remote metering the total current furnished by the unit may be read continuously. By a selective method the current in any one of the individual feeder circuits may also be read by the dispatcher.

A control line of five wires is used between the dispatcher's office and the station. Four of these wires are used for supervisory control, while the fifth is used for the continuous meter reading of the load. The station is equipped with Westinghouse switching equipment, converter and transformer.

Wood Preserving Treatment Very Effective in New Orleans

As an example of the efficacy of preservative treatment for railway ties, the June issue of *Wood Preserving News* carries an account of a number of ties which were recently removed after fourteen years of service in New Orleans. When it was decided recently to widen North Rampart Street for a distance of approximately 1/2 mile in order to break the bottleneck which had been impeding traffic in the central portion of the city, it was found advisable to place the street car tracks on

the parkway in the center of the new connecting street. The line had been laid approximately fourteen years before, using hewn Southern pine cross-ties creosoted under pressure and laid in the concrete roadbed. The published account declares that the treated ties were found to be in perfect condition and were stacked in the storage yard of the railway company to be used in future installations where long life and freedom from decay are essential.

Describing the track installation which was made in the parkway, *Wood Preserving News* goes on to state:

"The new track is laid with strong Southern pine cross-ties treated with 6-lb. creosote per cubic foot by the empty-cell process and imbedded in concrete. The poles on this highway are Southern yellow pine treated by the empty-cell process with a final retention of 8-lb. creosote per cubic foot and the cross-arms are Southern pine similarly treated."

Track and Line

Interurban Traction Company, Helena, Ark., has started to repair its line through the business district. After completion of the work the city will begin resurfacing and repairing other parts of the street under a separate contract.

Wheeling Public Service Company, Wheeling, W. Va., plans to replace old rails and ties. Old paving blocks will be relaid after the tracks have been repaired.

Washington-Virginia Railway, Washington, D. C., has been instructed by the Public Utilities Commission of the District of Columbia to replace all

broken portions of the track substructure, repair all rail joints and restore its track to proper line and grade on Twelfth Street and on C Street. This work is to be started not later than July 15, 1926, and be fully completed by Sept. 15, 1926.

Trade Notes

Walker Gilmer, who has been associated with L. H. Gilmer Company for twenty years, has resigned his connection as chief of engineering, though remaining as a director of the company. He contemplates locating in Detroit, Mich., where he will do consulting and sales engineering and development work.

General Electric Company, Schenectady, N. Y., has announced that F. E. Case, who for many years has been in charge of the railway equipment engineering department of the General Electric Company, has had added to his responsibilities the supervision of the railway motor and railway locomotive engineering departments.

Timken-Detroit Axle Company, Detroit, Mich., has announced that George E. Watts, formerly with Duff Manufacturing Company, Pittsburgh, has joined it as a railway representative with his headquarters in Atlanta. Mr. Watts will call on the officials of the electric and steam railways in the South and endeavor to co-operate with them in the work of extending their lines by motor coaches and motor trucks.

Woonsocket Manufacturing Company, Providence, R. I., manufacturer of all types of bus bodies, announces the appointment of John D. Baukat to be vice-president and sales manager of the company, with offices at 2607 Grand Central Terminal Building, New York City.

New Advertising Literature

Sullivan Machinery Company, Chicago, Ill., has issued Bulletin No. 76-G and 83-B. The first describes portable single and double drum electric hoists, while the latter is a second edition illustrating single and two-stage straight-line air compressors for belt drive.

Engberg's Electric & Mechanical Works, St. Joseph, Mich., has issued bulletin No. 302-B, which is to supplement catalog 302 covering Engberg's vertical engines and giving comprehensive horsepower tables. New bulletin 601 has also been issued. This fully describes and illustrates Engberg direct and alternating current generators and their application to internal combustion engines. Bulletin 801 covers alternating-current, direct-connected generating sets.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued the second of a series of hanger cards on motor maintenance data. The first card of this series was on the subject of axle and armature bearings and was issued about a month ago. The most recent card describes the winding insulation and the banding and core insulations.

ELECTRIC RAILWAY MATERIAL PRICES—July 13, 1926

Metals—New York		Paints, Putty and Glass—New York	
Copper, electrolytic, cents per lb.....	14.225	Linseed oil (5 bbl. lots), cents per lb.....	11.80
Lead, cents per lb.....	8.20	Whit lead in oil (100 lb. keg), cents per lb..	15.25
Nickel, cents per lb.....	35.00	Turpentine (bbl. lots), per gal.....	\$0.88
Zinc, cents per lb.....	7.90	Car window glass, (single strength), first	
Tin, Straits, cents per lb.....	63.25	three brackets, A quality, discount*.....	84.0%
Aluminum, 98 to 99 per cent, cents per lb..	27.00	Car window glass, (single strength), first	
Babbitt metal, warehouse, cents per lb.:		three brackets, B quality, discount*.....	86.0%
Commercial grade.....	54.50	Car window glass, (double strength) all	
General service.....	30.50	sizes, A quality, discount*.....	85.0%
		Putty, 100 lb. tins, cents per lb.....	4-6
		* Prices f.o.b. works, boxing & charges extra.	
Bituminous Coal		Wire—New York	
Smokeless mine run, f.o.b. vessel, Hampton		Copper wire, cents per lb.....	16.00
Roads.....	\$4.425	Rubber-covered wire, No. 14, per 1,000 ft...	\$6.25
Somerset mine run, Boston.....	1.95	Weatherproof wire base, cents per lb.....	18.00
Pittsburgh mine run, Pittsburgh.....	1.75		
Franklin, Ill., screenings, Chicago.....	1.825	Paving Materials	
Central, Ill., screenings, Chicago.....	1.50	Paving stone, granite, 5 in.	
Kansas screenings, Kansas City.....	2.425	New York—Grade 1, per thousand.....	\$147
		Wood block paving 3 1/2, 16 lb. treatment,	
		N. Y., per sq. yd.....	\$2.70
		Paving brick 3 1/2 x 8 1/2 x 4, N. Y., per 1,000 in	
		carload lots.....	51.00
		Paving brick 3 x 8 1/2 x 4 N. Y., per 1,000 in	
		carload lots.....	45.00
		Crushed stone, 1-in., carload lots, N. Y.,	
		per cu. yd.....	1.85
		Cement, Chicago consumers' net prices,	
		without bags.....	2.10
		Gravel, 1-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.....	7.375
		Zinc, old scrap, cents per lb.....	4.125
		Lead, cents per lb. (heavy).....	6.75
		Steel car axles, Chicago, net ton.....	\$17.75
		Cast iron car wheels, Chicago, gross ton....	16.75
		Rails (short), Chicago, gross ton.....	17.25
		Rails, (relaying), Chicago, gross ton.....	26.00
		Machine turnings, Chicago, gross ton.....	8.25
Track Materials—Pittsburgh			
Standard steel rails, gross ton.....	\$43.00		
Railroad spikes, drive, Pittsburgh base,			
cents per lb.....	2.90		
Tie plates (flat type), cents per lb.....	2.30		
Angle bars, cents per lb.....	2.75		
Rail bolts and nuts, Pittsburgh base, cents, lb.	4.20		
Steel bars, cents per lb.....	2.05		
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.....	3.125		
Sheet iron, galvanized (28 gage), cents per lb.	4.25		
Galvanized barbed wire, cents per lb.....	3.35		
Galvanized wire, ordinary, cents per lb.....	3.10		
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		



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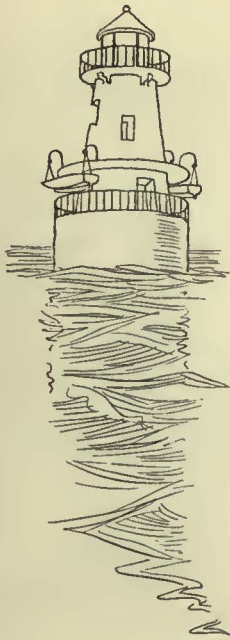
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Lost and Found

When you lose your pocket-book, your watch or dog, you advertise to find it. Then why not likewise advertise the equipment which *loses its identity in service?*

Many of the products which make up a trolley car are soon lost to sight in the construction of the car as a whole. Who knows, unless you tell them, what varnish has been used to insulate the coils? Who knows what the car floors are made of or who made the motors, seats or straps?

Trade mark labels cannot be conspicuously placed on all these substances and parts. Many of them, in fact, are permanently buried out of sight. Their identity is "lost" and can be "found" only when their maker *advertises* their existence to the travelling public or to railway operators.

As long as their identity is veiled or hidden, their use upon a thousand or a million cars has little or no

meaning. But advertise their presence and each new installation spreads the gospel of increasing use and becomes an aid to further sales.

Our business is to help the transportation advertiser make his products better known. This applies not only to manufacturers who sell equipment to the railways but to railway operators who sell service to the public. We are, in other words, experts in calling attention to the identity of any product or service in every branch of transportation.

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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 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.”

A year’s operation has vindicated the judgment of the C.P.R. in their selection.

FAGEOL
SAFETY COACH

The Economy of the Fageol is Fundamental

Take for example the Hall Scott Engine, designed throughout to meet the severe requirements of motor bus work. It offers the following exclusive features:

1. Quickly replaced interchangeable units throughout.
2. A lubricating system which constantly refines and purifies the crankcase oil, holding it at its original viscosity for thousands of miles.
3. Complete cam and valve mechanism contained in interchangeable head. Valve grinding, maintenance work on head, and replacement of worn parts do not tie the bus up needlessly for hours or days.
4. Radiator mounted as unit with engine, so weaving of frame does not damage it.
5. Stainless steel pump shaft running in soft metal glands, eliminating troublesome pump leaks.
6. Higher compression ratio, to get more power out of the fuel.

7. Heavyweight aluminum alloy pistons, which limit carbon formation.
8. Combustion chamber design and valve arrangement which makes the necessity of valve grinding quite infrequent.

—and many more.

The final test of all endeavors to create a better, or more economical, more durable product is this: How does it work out in the hands of the user?

Operators who have used the Fageol Hall Scott engine for 300,000 miles or more say that there is no reason to believe that it will ever wear out. It is brutally strong, and the occasional replacement of a few simple parts brings the engine back to new condition.

Its phenomenally low maintenance cost, and its economy of fuel and oil, have been the chief contributing causes which have created the recognition for economy enjoyed by the Fageol Safety Coach.

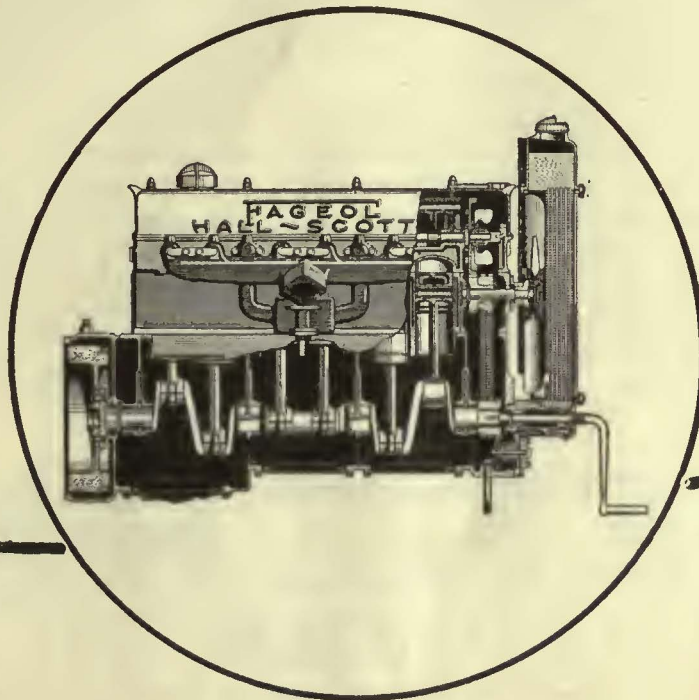
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THE FAGEOL COMPANY

A Division of

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30 CHURCH STREET, NEW YORK, N. Y.





In England -

Warwick-Wright, Ltd., Swings to Generals

to make sure of the lowest possible tire cost per mile

Good news travels far—and fast! Across the broad waters of the Atlantic sped word of General's great records on the leading bus lines of America. Tales of the lower tire costs, the greater freedom from internal friction, the reduced bus operating costs made possible by Generals reached the ears of the purchasing agent for Warwick-Wright, Ltd. — famous bus operators of England.

Before long, Generals were being tested in side-by-side service against other well-known makes. Tire costs and mileage records of each make were noted to the fraction of a cent per mile. And these service records soon made apparent the greater worth of The General Tire.



The

GENERAL TIRE

— goes a long way to make friends

The result of those tests is revealed by the photo at the top of this page. The bus pictured is a Fageol Safety bus owned and operated by Warwick-Wright, Ltd. *And its tire equipment is 100% General!*

On some of the largest bus fleets in America and abroad, Generals have repeatedly demonstrated their ability to out-travel all competition. Carefully kept records of large fleet operators prove beyond argument that 100% General equipment means a substantial yearly saving in power and gasoline consumption, greater protection for the mechanism of the bus, the lowest possible cost of operation — the very things every fleet operator wants!



Motor Coach Economy

Street railways operating Graham Brothers Motor Coaches profit by their substantial and demonstrated economies.

These savings extend straight through the extra long life of the coach—from the low initial investment to the final accounting for operation and maintenance.

Exceptional sturdiness, no excess weight and Dodge Brothers dependable engine are among the numerous economy advantages that set these vehicles apart in their field.

Coupled with this economy is the opportunity for greater frequency of service. Likewise a smartness of appearance that attracts patronage and a comfort and ease of riding that holds it.

21 Passenger
Street Car Type
Motor Coach
Complete,

\$3815

f. o. b. Detroit

GRAHAM BROTHERS
Evansville - DETROIT - Stockton
A DIVISION OF DODGE BROTHERS, INC.
GRAHAM BROTHERS (CANADA) LIMITED - TORONTO, ONTARIO

GRAHAM BROTHERS MOTOR COACHES

SOLD BY DODGE BROTHERS DEALERS EVERYWHERE



Time to Re-tire
Get a FISK
TRADE MARK REG. U. S. PAT. OFF.

"I did not neglect to specify Fisks"

Read this unusual testimonial from Mr. Clarence W. Cummings of Providence, Rhode Island. Specifying Fisk Transportation Cords has become a habit with successful bus operators.

"You will no doubt be interested to know that in placing my order for the bus shown in the inclosed photograph, that I did not neglect to specify my preference for Fisk Transportation Cords, as experience has taught me that the tire equipment should be selected just as carefully as any other detail which enters into the purchase of a new bus.

"I operate on a schedule from Providence, R. I., to Narragansett Pier and have had absolutely no delays for tire trouble.

"Be assured that I will specify Fisk on future business."

Fisk Transportation "Fillerless" Cords
are made in all bus and truck sizes.

The Fisk Tire Company, Inc., Chicopee Falls, Mass.



Transportation Companies Adopt Six-Wheel Idea

Detroit	100	Six Wheel	Single Deck
	36	Six Wheel	Double Deck
Cleveland	50	Six Wheel	Double Deck
Akron	28	Six Wheel	Single Deck
	2	Six Wheel	Double Deck
New York	24	Six Wheel	Single Deck
	1	Six Wheel	Double Deck
Kansas City	5	Six Wheel	Single Deck
	18	Six Wheel	Double Deck
Cincinnati	18	Six Wheel	Single Deck
Pittsburgh	9	Six Wheel	Single Deck

Smaller Fleets of Six-Wheel Single- and Double-Deck Coaches in St. Louis, Boston, Washington, Montreal, and many other cities are

EARNING BIG PROFITS



Full Particulars of all Models on request.

THE SAFEWAY SIX-WHEELER

THE SIX WHEEL COMPANY, 1800 W. LEHIGH AVENUE, PHILADELPHIA, PA.

Manufacturers of De Luxe, City, and Double Deck Type Six-Wheel Coaches

TIMKEN



In Atlanta—

Fifteen double-deck, gas-electric Fageols being operated by Atlanta Coach Company—subsidiary of Georgia Railway and Power Company—are averaging 45,000 miles a month.

The routes served by these vehicles encounter many steep grades, and the operating company reports "No axle trouble in this service, although the operating conditions are severe."

These vehicles are equipped with Timken Axles—front and rear.



THE TIMKEN-DETROIT AXLE CO., DETROIT, MICH.

AXLES

The Public must believe Buses are safe

Public confidence and patronage are closely interwoven. They are the source of all revenue

The bus that has a tendency to skid when the brakes are applied is dangerous and, what is just as bad or worse from the standpoint of public confidence, it gives the impression of being more dangerous than it actually is.

Nine times out of ten or better a good driver can bring his machine up without an accident, even when he goes into a bad skid. But to the passengers a skid is remembered as an unpleasant experience, an accident narrowly averted, and bus transportation gets a black eye. Skidding strains the whole machine, too; is hard on tires and hard on the driver.

Skidding when the brakes are applied is due, primarily, to the application of un-

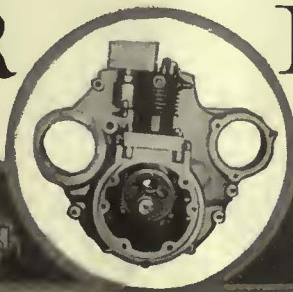
equal braking pressures. One wheel absorbs most of the braking effect, becomes locked, or drags, and the vehicle pivots, with consequent loss of control. This most dangerous source of skids can be removed by the use of Christensen Air Brakes—a system that automatically applies equal braking pressure to wheels on the same axle regardless of band wear or any such variable factor. Because, in the Christensen Brake, the power is applied directly, without the complication of outside levers, pullrods, shafts, knuckles, mechanical “equalizers” and cams, it can be depended upon to MAINTAIN the equalization of braking pressure applied. A permanent cure of skids from unequal braking pressures is effected.

To promote public confidence, to reduce operating expense, to relieve driver fatigue, and to prevent accidents specify Christensen Air Brakes on every bus you buy.

Christensen AIR BRAKES

CHRISTENSEN
6513 Cedar Ave.

AIR BRAKE CO.,
Cleveland, Ohio



WINDOWS DO MAKE A DIFFERENCE



Versare-Westinghouse Coach for Chicago & Alton R.R. Equipped with Edwards Metal Sash, in windows, deck lights and windshield. Note the clear vision afforded.

It's Light!

Eight wheels—a 120 horsepower engine—a 40 kilowatt generator—two 28 horsepower electric motors—a body with capacity for 35 seated passengers and 37 standing—and yet it is light!

This Versare-Westinghouse coach has achieved lightness through the use of aluminum in its body structure, and in this design and construction Edwards Metal Sash fits perfectly!

For Edwards Metal Sash is not only light in itself, but permits of lighter upper construction. And it surely makes bus windows perfect for both operators and passengers, as scores of body builders can attest.

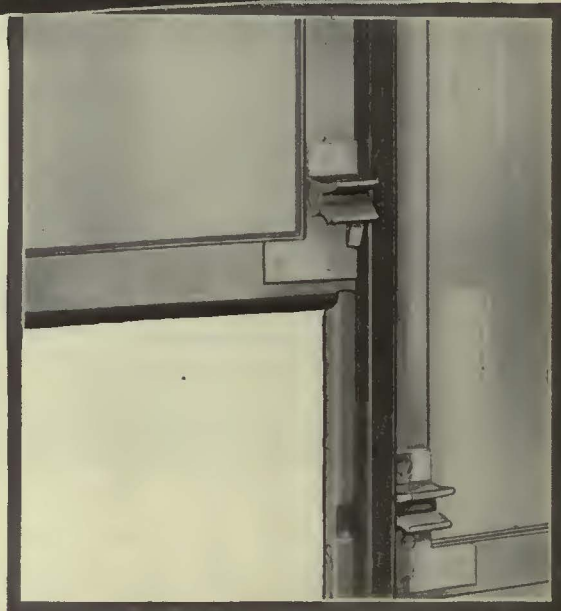
Send for catalog and full details of Edwards Metal Sash—without obligation on your part.

O. M. EDWARDS CO.

Syracuse, N. Y.

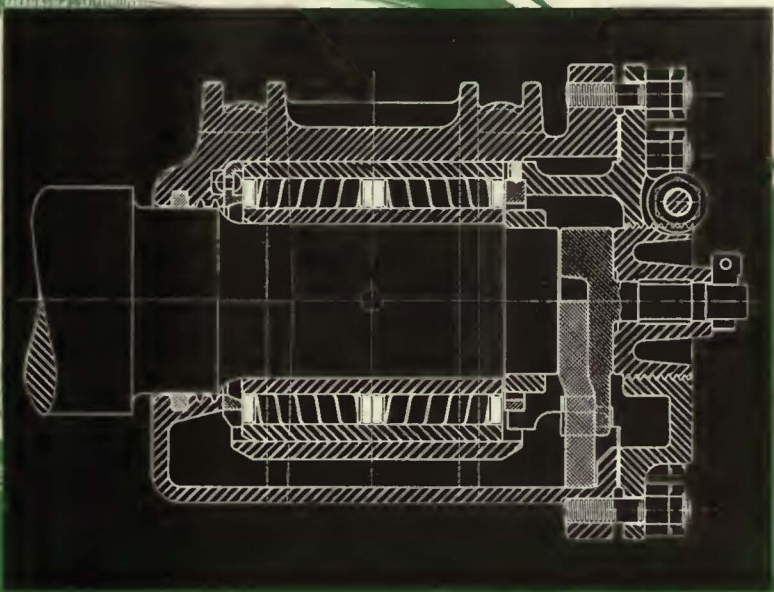
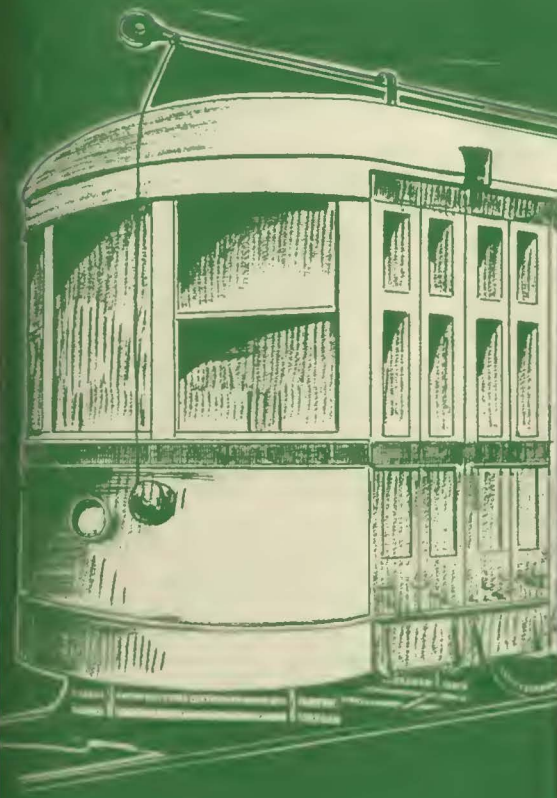
Canadian Representatives:

Lyman Tube & Supply Co., Ltd., Montreal and Toronto



EDWARDS
TRADE
PAOWNYC
MARK

Edwards Metal Sash



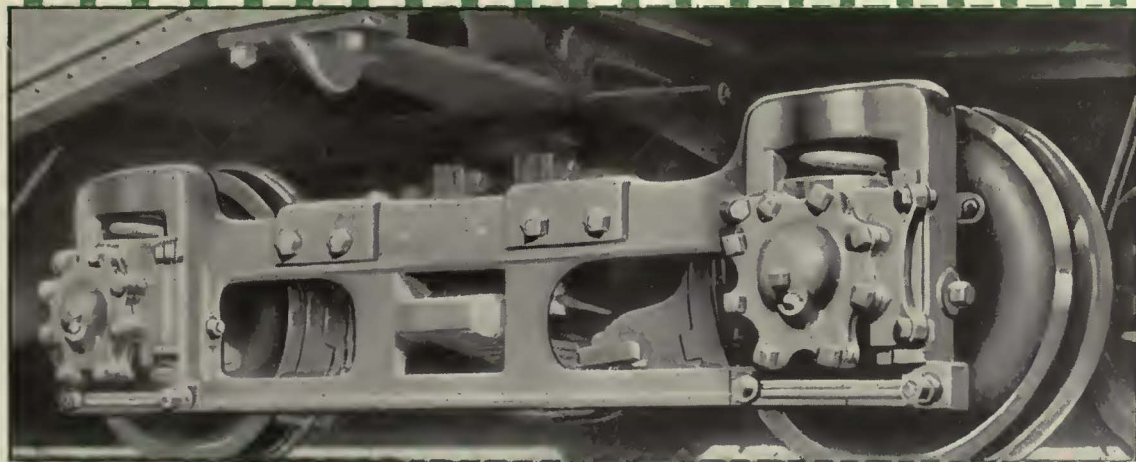
Modern truck design includes

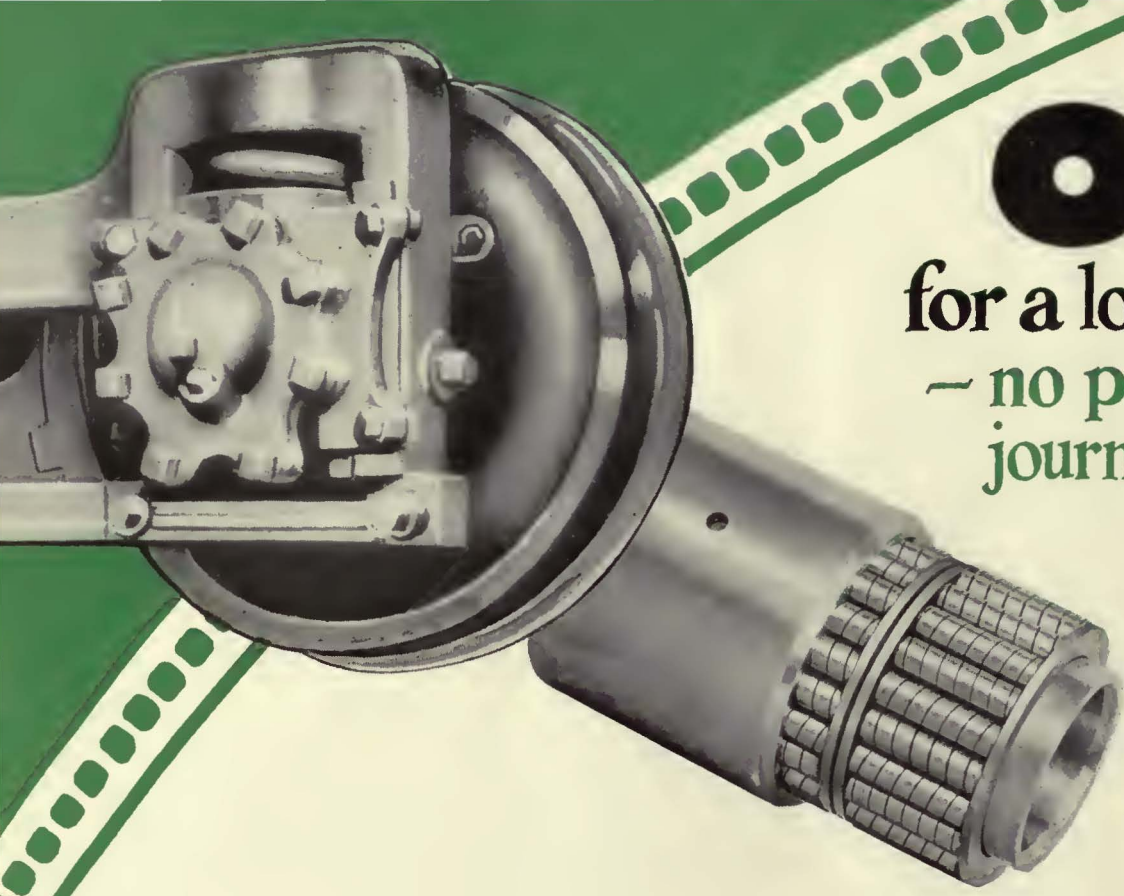
Obsolete ideas concerning trucks are just as much a drag on the industry as is out-of-date thinking about car bodies and motor equipment. Trucks with plain bearings are wasting millions of kilowatt hours annually, struggling to overcome a friction load as unnecessary as surplus weight.

Plans and specifications are now available for your use, covering Hyatt Roller Bearing applications for every type of service. This equipment meets every A.E.R.A. requirement for standard equipment.

HYATT

QUIET ROLLER BEARINGS





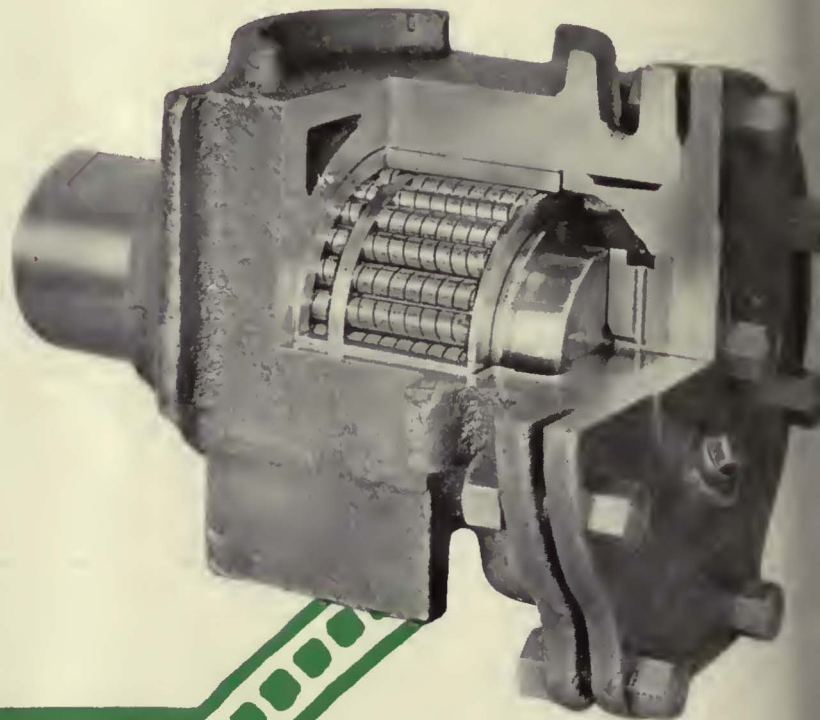
O.K.
for a longer period
— no pull-ins for
journal trouble

Maintaining the modern car made easier and cheaper—

The basis of reduced maintenance is the positive clean lubrication obtained with Hyatt Roller Bearings. Sealed in oil-tight journal boxes, the lubricant can neither leak nor become dirtied by grit or foreign matter. Helical rollers, wound alternately right and left hand, evenly distribute oil to every part of the bearing surface, so long as the oil level in the box touches the roller assembly.

With positive lubrication, hot boxes are eliminated and other journal bearing maintenance is reduced to a minimum. The lid is bolted tight to the box, and no waste or other packing is used. Pull-ins for journal trouble are practically unknown. In fact, all maintenance on trucks is reduced to checking for loose bolts, and lubrication at intervals, which are less frequent than with ordinary bearings.

Hyatt Roller Bearings meet every A. E. R. A. requirement. They carry full standard loads in boxes which fit all standard trucks without change.

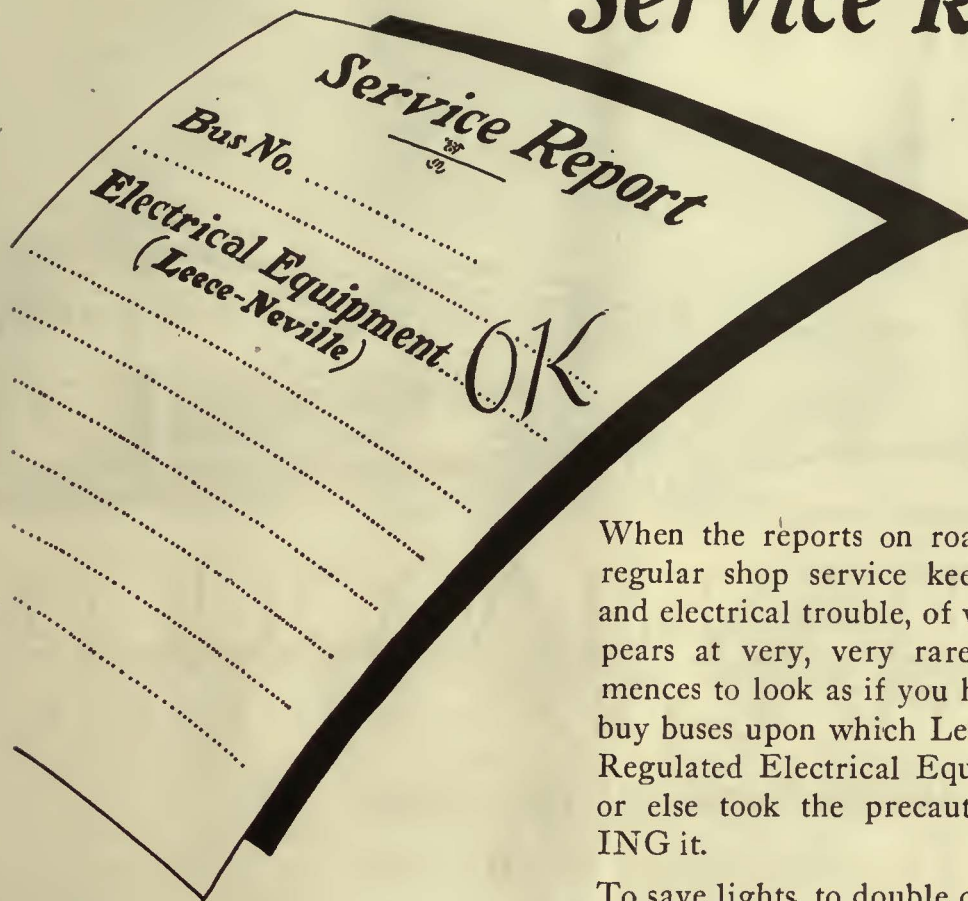


HYATT ROLLER BEARING CO.
NEWARK, N. J.

(Division of General Motors Corporation)

HYATT
QUIET ROLLER BEARINGS

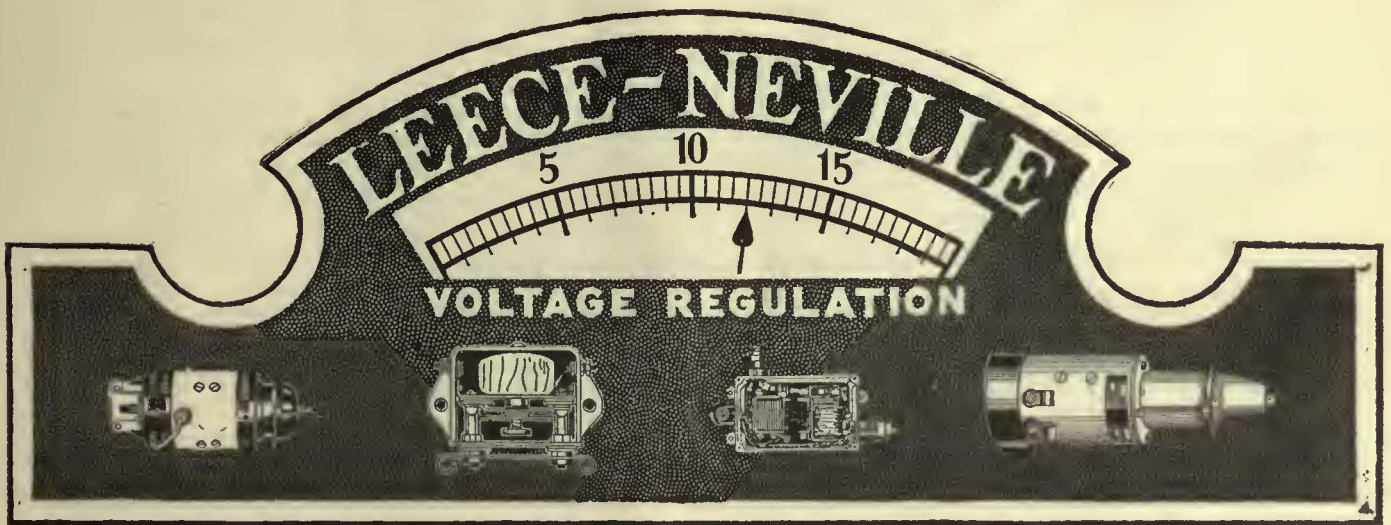
Seldom Mentioned on "Trouble Call" or Service Reports



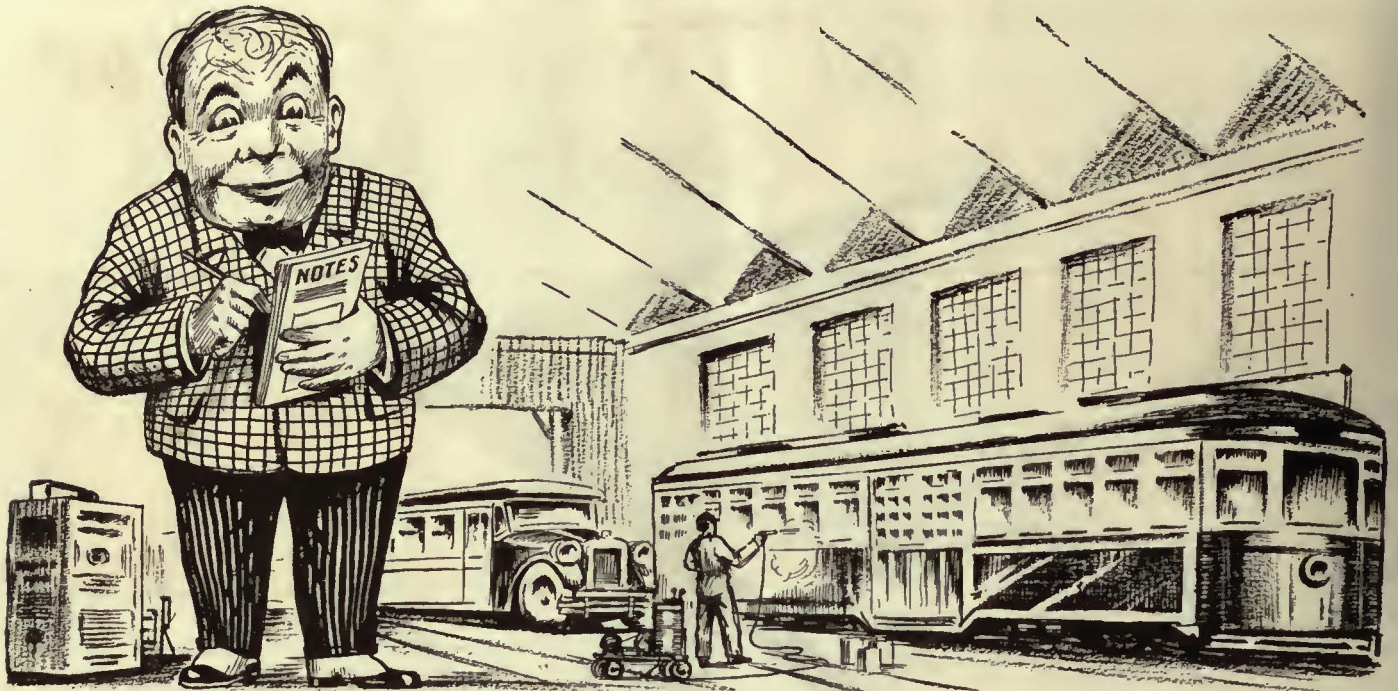
When the reports on road trouble-calls and regular shop service keep coming through, and electrical trouble, of whatever nature, appears at very, very rare intervals, it commences to look as if you had the good luck to buy buses upon which Leece-Neville Voltage Regulated Electrical Equipment is standard, or else took the precaution of SPECIFYING it.

To save lights, to double or triple battery life, to make even routine attention less frequent, and in general, to keep the electrical system off the trouble or service reports, don't trust to luck—Specify "Leece-Neville."

THE LEECE-NEVILLE CO.
Cleveland, Ohio



 SUPERIOR LACQUERS FOR FIFTY YEARS



EGYPTIAN LACQUERS

FOR BOTH CARS and BUSES

Better looking than paint
 Longer lasting than paint
 Easier to clean than paint

and applied in a fraction of the time

Electric railway men have been looking for just such a finishing system as this.

Drying to a rich lustrous surface of infinitely greater depth and beauty than paint, Egyptian Lacquer fully measures up to modern standards of car and bus appearances.

And Egyptian Lacquer retains its beauty through an exceptionally long service life because its dense smooth texture does not collect dust, is easy to clean, and will not crack, blister or peel under any conditions likely to be met with in service.

Furthermore, where formerly it required anywhere from seven to fourteen days for a good paint job, it

takes but a fraction of this time to do a first class job with Egyptian Lacquer. Less sanding, less material and less skilled labor, to say nothing of very much less "shopping" time, these economies have made the Egyptian Lacquer System the choice of a rapidly growing list of prominent electric railway operators.

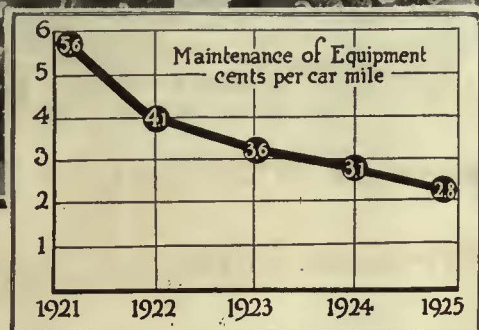
The Egyptian Lacquer System is simple in the extreme. Primers and finishes are sprayed on at hourly intervals with any standard spray painting outfit. No special equipment of any kind is needed.

Consult us concerning your next finishing or re-finishing job. We'll gladly demonstrate to your satisfaction. Bulletins on request.

THE EGYPTIAN LACQUER MFG. CO.

90 West Street, New York

“Railway doing well” in AUGUSTA, GA.



Maintenance of equipment in cents per car mile—1921 to 1925.

Modernization wins again!

Now the story of Augusta can be told! Its rolling stock has been thoroughly modernized during the past four years with the result that maintenance expenses have been greatly reduced as shown above. Operating expenses also have been cut substantially.

Practically half the rolling stock operated consists of new modern Thomas-built cars—producing substantial economies which are responsible for the authentic report—“railway doing well” in Augusta.

PERLEY A. THOMAS CAR WORKS
HIGH POINT, N. C.



THOMAS BUILT CARS
are doing their share



Globe Ticket Features

Accurate Numbering

High Quality Printing

Protection Against Counterfeiting

Satisfactory Perforation

Deliver on Time

and don't forget the Transfers



GLOBE TICKET COMPANY

makers of tickets and checks since 1873

116 N. 12th St., Philadelphia, Pa.

Los Angeles

New York

San Francisco





DALLAS

EQUIPPED with "STANDARD" Rolled Steel Wheels this car of the Dallas Street Railway is serving well the leading manufacturing city of Texas.



Rolled Steel Wheels
 Quenched and Tempered
 Carbon Steel Axles
 Coil and Elliptic Springs

STANDARD STEEL

WORKS COMPANY

PHILADELPHIA, PA.

BRANCH OFFICES:

CHICAGO	PORTLAND, ORE.	ST. PAUL, MINN.
ST. LOUIS	RICHMOND, VA.	PITTSBURGH, PA.
NEW YORK	SAN FRANCISCO	LOS ANGELES, CAL.
HOUSTON, TEXAS	BOSTON	MEXICO CITY, MEX.

WORKS: BURNHAM, PA.



THE ONE great factor in the wearing out of machinery is friction. Machinery will rust, of course, if it is not protected from the weather, and it will corrode if exposed to acid fumes, but these are unusual conditions. Friction is the one agency that is continually at work while the machinery is running.

Friction is the cause of a large percentage of all repair and replacement costs. Reduce friction and there is an immediate reduction in these two items of your operating expense.

Reducing friction means choosing the right grade of oil for each piece of machinery. There is a right grade of oil for every bearing. This grade will permit the bearing to operate with the least possible wear and on the least possible power.

Standard Oils and Greases

are made in many grades to suit the lubrication requirements of every kind of machinery in use in the industrial world. The representative of the Standard Oil Company (Indiana) can tell you the correct grades to use on your equipment. Follow his recommendations and you will reduce your repair and replacement costs to the lowest possible figure.

STANDARD OIL COMPANY

(INDIANA)

General Offices: 910 S. Michigan Ave., Chicago, Illinois



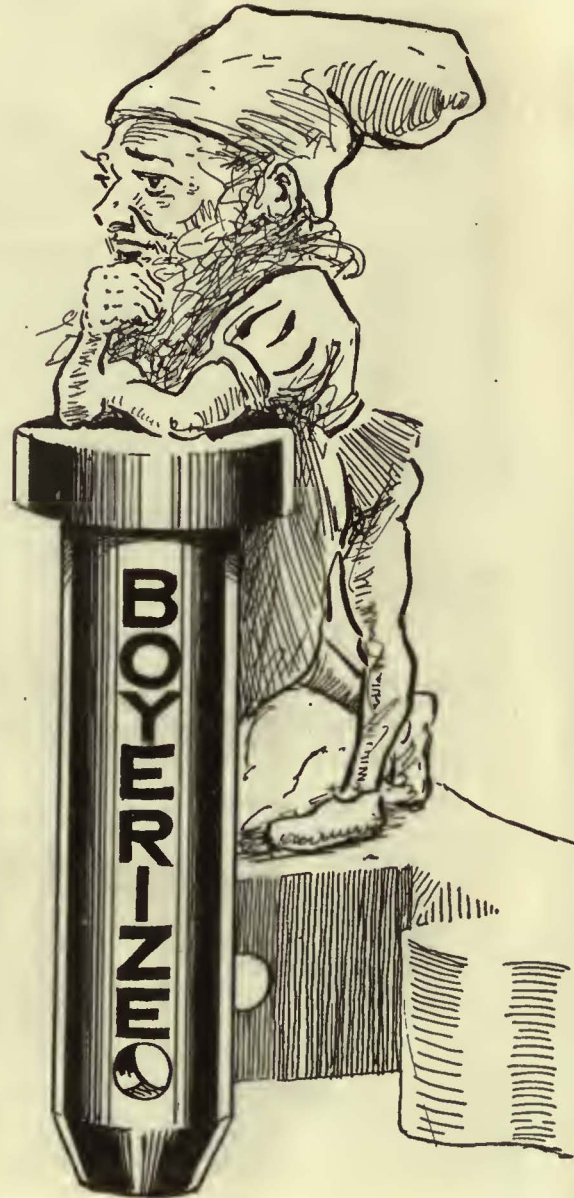
Some common-sense thinking will result in your getting **Boyerized Parts**

Because of the special Boyerizing treatment—which gives them a glossy, glass-hard, armor-plate surface—Boyerized products outwear ordinary case-hardened steel parts three to four times.

They easily stand the grind of long hard service so that they not only cut maintenance costs but also guarantee a comfortable margin of safety between inspection periods.

Under such conditions it is merely common-sense to use Boyerized Parts.

Select some from the list below—then try them out on your own cars to convince yourself of their safety and economy.



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

Bemis Car Truck Company

Electric Railway Supplies

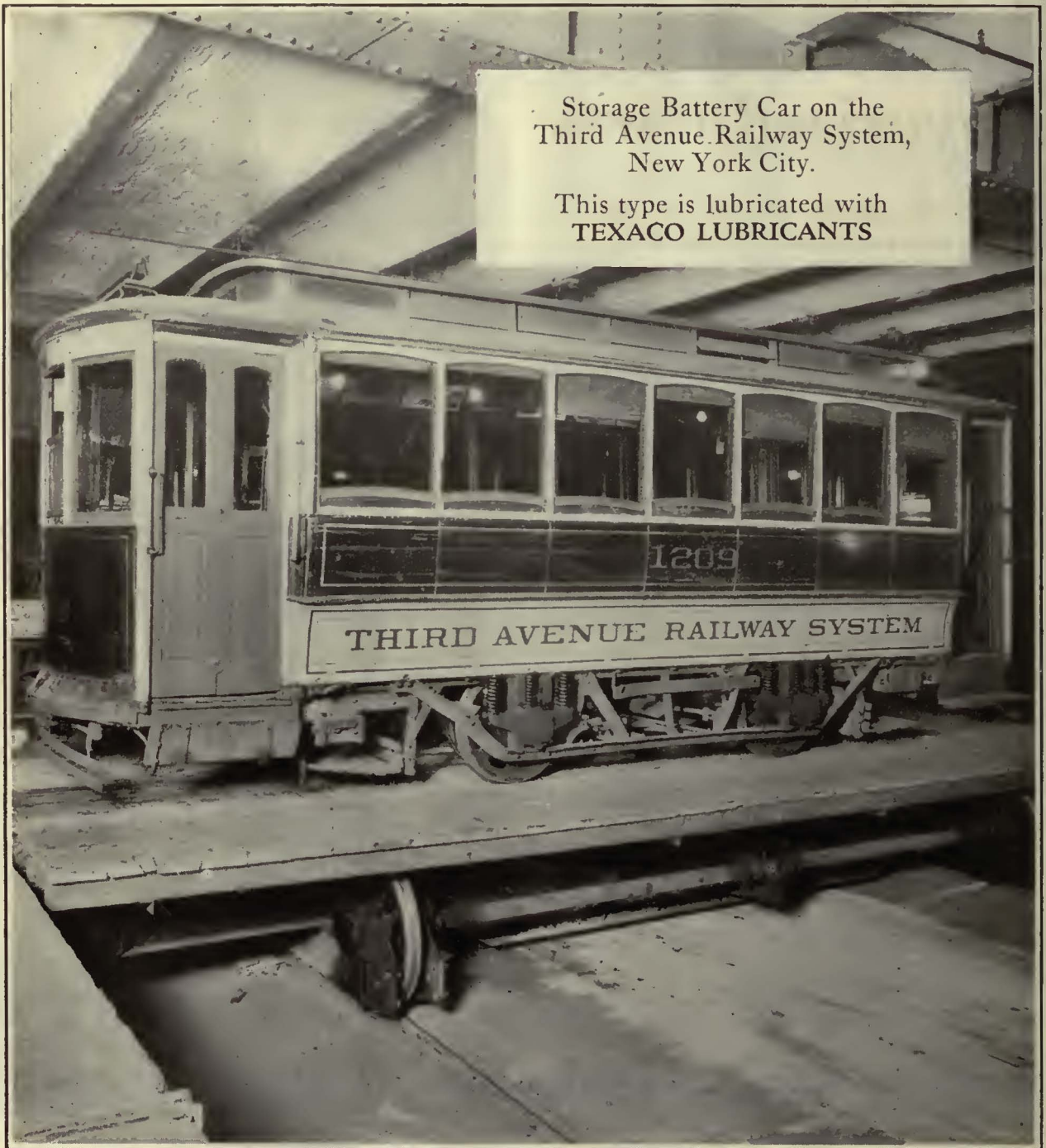
Springfield, Mass.

Representatives:

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

The
McArthur
Turnbuckle





Storage Battery Car on the
Third Avenue Railway System,
New York City.

This type is lubricated with
TEXACO LUBRICANTS

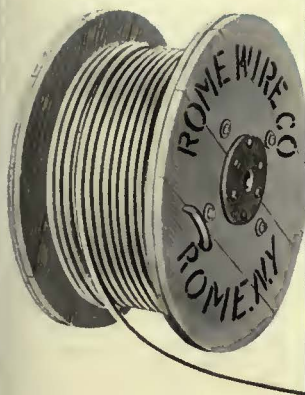
TEXACO



The Chosen Lubricant
of **ELECTRIC RAILWAYS**



The Texas Company, U. S. A., 17 Battery Place, New York City
OFFICES IN PRINCIPAL CITIES



Eliminating the idle hour

USERS of industrial power, who have given thought and study to factory wiring problems, are today insisting upon the installation of Lead Sheathed Cables where power circuits are layed underground, in damp places, or wherever severe conditions exist.

Such specifications are evidence of a desire to install only wires and cables that insure against costly shutdowns—that eliminate the idle hour.


From copper bar—through many insulation processes—into the giant lead presses, and over the inspection mirrors to finished product, Rome Lead Sheathed Cable is constantly passing.

For all Rome Wires and Cables are manufactured from copper wire bar to finished copper wire—in our mills covering 20 acres of manufacturing floor space; under the careful supervision of a trained engineering staff.

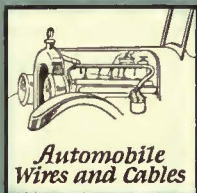
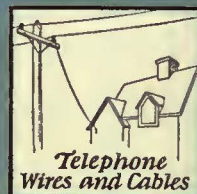
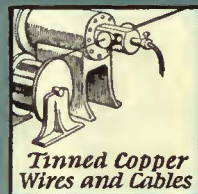
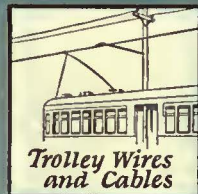
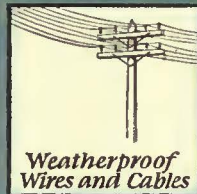
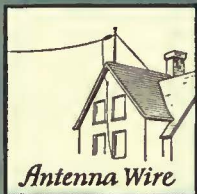
ROME WIRE COMPANY, ROME, N.Y.

ROME WIRE

FROM WIRE BAR TO FINISHED COPPER WIRE



Stranded
Rubber Covered
Lead Sheathed
Cable

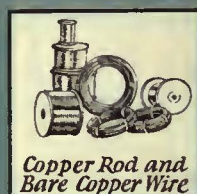
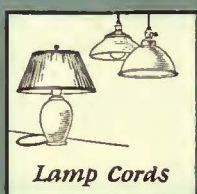
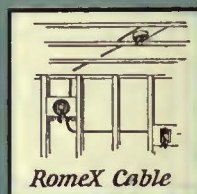
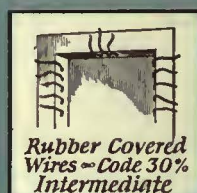
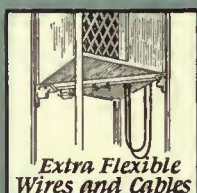
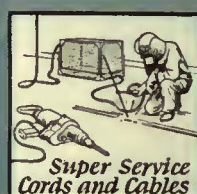
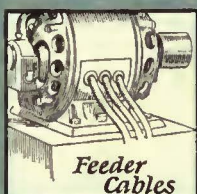
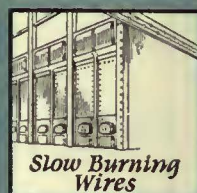


THERE is a vast difference in the appearance of the huge Lead Encased Cables, and the fine strands of copper that go to make up magnet wire. Yet, both are manufactured by the Rome Wire Company.

And, if you study the Rome products, shown on this page, you will find, between these two extremes, a variety of types, sizes, and insulations sufficient to satisfy practically any need.

All of these wires and cables are made in Rome Mills, under Rome supervision, from wire bar to finished copper wire.

If you will let us know in what wires and cables you are interested, we will be glad to send you samples, catalogs, and other information that will be of help to you.



ROME WIRE COMPANY

Mills and Executive Offices: ROME, N.Y.

Diamond Branch: Buffalo, N.Y.

New York - 50 Church Street

Boston - Little Building

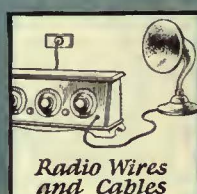
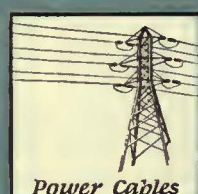
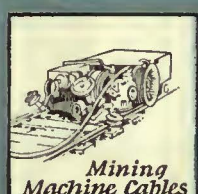
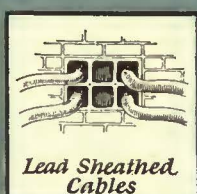
Chicago - 14 E. Jackson Blvd.

Detroit - 25 Parsons Street

Cleveland - 1200 W. 9th Street

Los Angeles - J. G. Pomeroy, Inc., 336 Azusa Street

San Francisco - J. G. Pomeroy, Inc., 51 Federal Street



A Quality Specification!

March 10, 1923

ELECTRIC RAILWAY JOURNAL

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

Details of Philadelphia Order for 576 Cars

On Jan. 22 the board of directors of the Philadelphia Rapid Transit Company authorized the lease and purchase by car trust agreement of 576 new cars of which 520 will be passenger cars. A brief note in regard to the order, which is said to be the single order for trolley cars in this country, was made in the issue of the ELECTRIC RAILWAY JOURNAL.

MANUFACTURERS OF EQUIPMENT. TOGETHER WITH TYPE FURNISHED

- Air brakes G.E. Co.
- Armature bearings Plain
- Axles Carnegie Steel Co.'s heat treated
- Bumpers Six-inch Channel reinforced
- Car signal system Brill's standard and push button contact bases—Faraday Type-E
- Car trimmings Malleable and bronze statuary finish
- Center and side bearings Brill's standard
- Conduits and junction boxes Galvanized
- Control G.E. 2-K-68 with ratchet attachment
- Couplers Drawbar pockets
- Curtain fixtures Curtain Supply Co.'s No. 88
- Curtain material Double face pantasote
- Destination signs Hunter
- Door operating mechanism National Pneumatic Co.
- Wheelguards H. B. Life Guard
- Gears and pinions Tool Steel Gear & Pinion Co.
- Headlamps Peacock staffs
- Heater equipment Consolidated Car Heating Co.'s
- Headlights Crouse Hinds semi-lens
- Bearings Plain
- Cast-iron Plain cast-iron

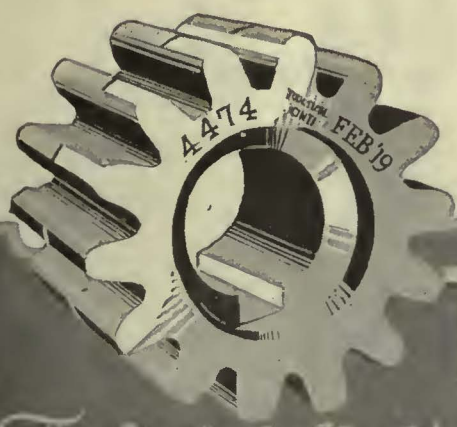
1040
"Tool Steel" gears
pinions
go on this new equipment.

A quality specification.

- 1923—1040 sets "Tool Steel"
- 1925— 200 sets "Tool Steel"
- 1926— 100 sets "Tool Steel"

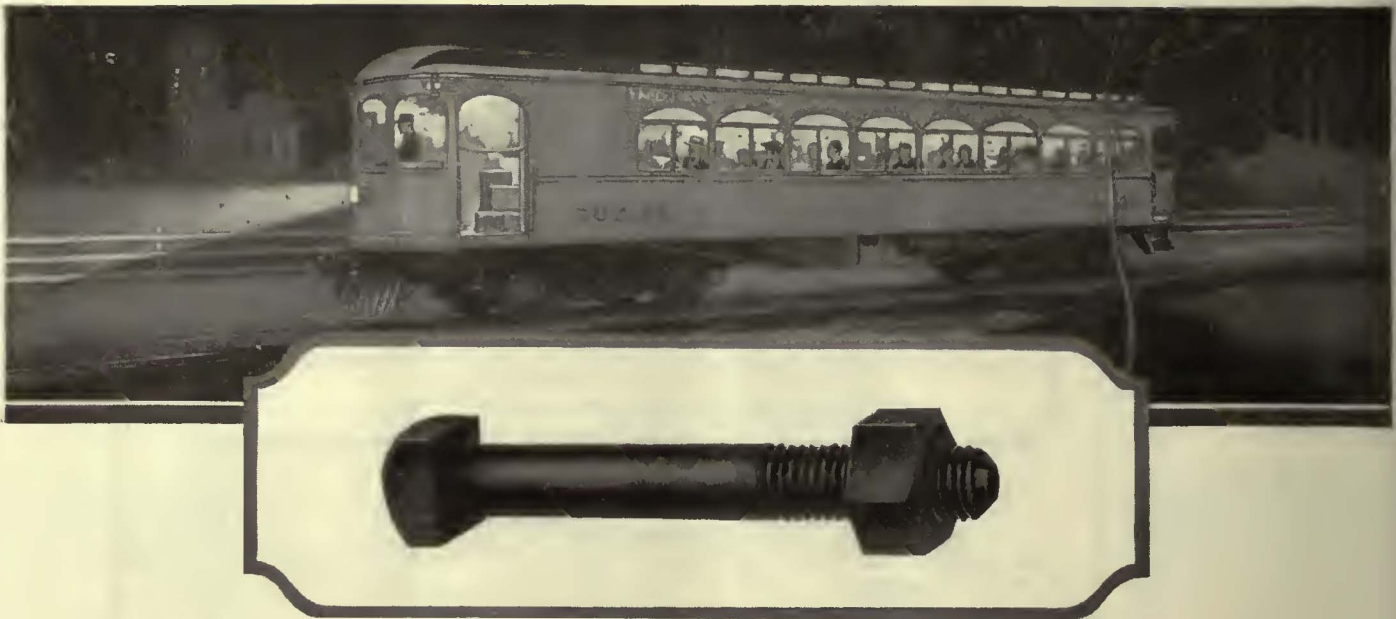
Philadelphia believes in getting the best when they buy.

The Tool Steel Gear & Pinion Company
Cincinnati, Ohio



TOOL-STEEL QUALITY GEARS AND PINIONS

The Standard of Quality



On Electric Railway or Motor Bus *The Best is the Cheapest*

Your past experience in repairs and up-keep generally must have demonstrated the uncertainty and the doubtful economy of bolts and nuts bought "at a price."

If you are expanding your lines by fleets of motor buses you must find the lesson that "the best is the cheapest" applies with redoubled force here.

Unusual speed, sudden stops, stresses of exceptional character all put a strain on

the bolts and nuts that only quality products can stand. See that your shops buy Empire bolts and nuts. They are more accurate, many degrees stronger than ordinary bolts and nuts and absolutely uniform. *Specify Empire:*

RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY
 PORT CHESTER, N.Y.

Branch Office: Struss Building CHICAGO Branch Office: General Motors Bldg. DETROIT Branch Factory: ROCK FALLS, ILL. Scripps & Collette 167 Jackson Street SEATTLE Maydwell & Harnell, Inc. 116-168 Eleventh Street SAN FRANCISCO

Makers of Bolts, Nuts and Rivets Since 1865

EMPIRE *New Process* BOLTS





(Photo by Ewing Galloway, Inc.)

ORANGEBURG

FIBRE CONDUIT

IN BRAZIL they pronounce "Orangeburg" differently but they ask for it just the same. Over 200,000,000 feet of this famous underground duct have been shipped to all parts of the civilized world.

JOHNS-MANVILLE

Sole Selling Agent for

The Fibre Conduit Company, Orangeburg, N. Y.

Johns-Manville Inc.
Branches

New York City, 292 Madison Ave.
 Philadelphia, 210 No. Broad St.
 Chicago, Michigan Ave. & 18th St.
 Cleveland, 6300 Euclid Avenue
 Boston, 55 High Street
 San Francisco, 500 Post Street
 Toronto, Can., 19 Front St., E.
 Other branches in all large cities

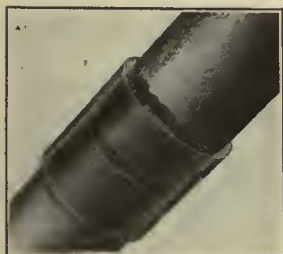


Distributors
New England

S. B. Condit, Jr., Company
261 Franklin Street, Boston, Mass.

Pacific Coast

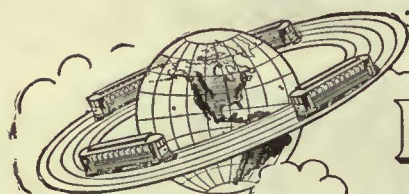
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Specify the Harrington Joint

The Harrington Sleeve Joint is more economical because it means less breakage, easier cutting and fitting, protection against seepage and electrolysis, and flexibility of line which aids in avoiding obstructions.

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CANDLER BLDG. NEW YORK

NOARK 600 VOLT FUSES

*Protect Motors
and Schedules
because they*

**"Blow on
the dot"**



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Division of Colt's Patent Fire Arms Mfg. Co.

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Noark Fuses
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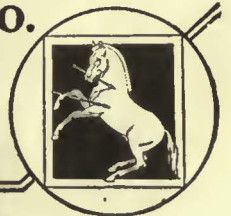
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The time your salesmen can save
would pay for it many times

"Who are the men I should talk to in the Blank Railway Company?"

You'll find the answer quickly in the 1926 Edition McGraw Electric Railway Directory. Keep a copy handy—in your desk, in your brief case. You'll need it.

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Don't waste valuable time and effort in a \$300,000,000 market by misdirecting your sales program. Save both by returning the attached coupon.

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- 1—Complete list of every recorded electric railway company in the United States, Canada, Mexico and the West Indies.
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- 6—Number and kinds of cars used.
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10th Avenue and
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N. Y.

Gentlemen:—Will you please send me:

.....copies of 1926 McGraw Electric Railway Directory, check for \$..... enclosed.

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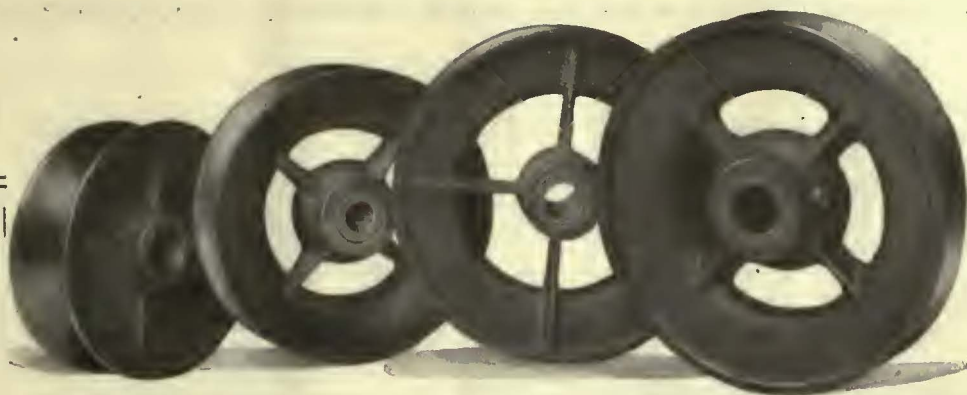
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A SPECIAL feature of the Columbia Trolley Wheel is the Bound Brook Oilless Bushing which makes lubrication “forget-proof,” and insures smooth operation.

These wheels, moreover, embody and combine the essentials of accurate balance, ample conductivity, and proper hardness to give maximum wheel mileage with least wear on wire.

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COLUMBIA MACHINE WORKS

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3303 Atlantic Avenue

Brooklyn, N. Y.

STATISTICS show that 20,000 people were killed on the streets and highways last year.

Accident prevention is a serious problem. Intelligent means taken to prevent accidents is one of the manifestations of thoroughgoing efficiency.

Eliminate accidents with your cars as far as humanly possible by equipping them with—

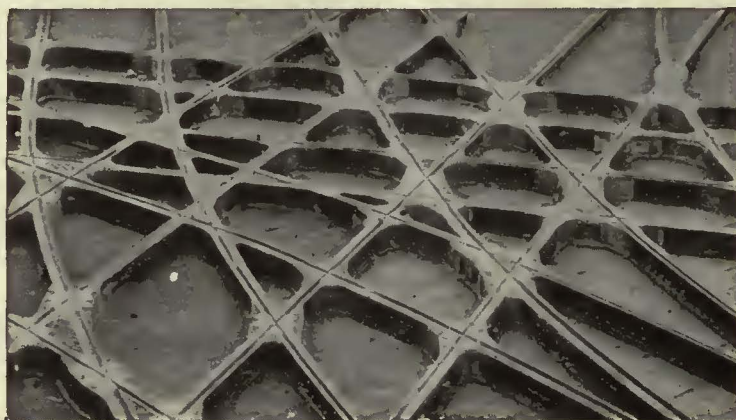
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The Consolidated Car Fender Company

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Wendell & MacDuffie Co., *General Sales Agents*
110 East 42nd St., New York, N. Y.



Forty-Five Years' Experience and the best of modern facilities are responsible for the excellence of Buda Trackwork

THE BUDA COMPANY

HARVEY, ILL.



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Clean Commutation

There is no surer way of getting clean commutation at low cost for labor and brushes than by using U. S. G. Brushes. Service records have long since demonstrated this.

Composed of pure Mexican Graphitic Carbon compounded with other low resistance carbons, these brushes are made in many different types, and the composition of each type is adjusted to meet the particular service required under actual operating conditions.

There's a type of hard, dense U.S.G. brush especially designed for the electric railway field. Clean commutation, long life, little labor attention—are characteristic of its service.

Test them on your motors.



**Brushes
fill the bill**

Manufactured by

The United States Graphite Co.

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Nuttall



NUTTALL Tapered Roller Bearing Trolley Base

Type US No. 20A

Here is the latest Nuttall Trolley Base incorporating the famous Timken Roller Bearing — a tapered double-race roller bearing which has been designed by this manufacturer especially for trolley base service.

Particularly interesting features of this new base include extreme sensitiveness, with swiveling strains evenly distributed on bearings; oil and grease reservoirs for lubrication of bearings and pole socket axle pin respectively; quick, easy lubrication only once in six months.

Full specifications on request



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Demonstrating Confidence

ELECTRIC railway men are demonstrating their confidence in the future of the industry by the purchase of modern new equipment and the maintenance of old equipment to the highest possible standard.

And they are demonstrating their confidence in HASKELITE and PLYMETL by the quantities of these structural plywood products which they are ordering for both new and old car requirements.

This confidence is based on experience. Practical railway men know that the HASKELITE—PLYMETL car is light, strong, quiet, well insulated and attractive in appearance. They know it is easy to repair a HASKELITE roof or a PLYMETL side panel but that the superior strength of these materials makes repairs few and far between.

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Recent repair orders received from Grand Rapids Street Railway, Public Service Ry. of N. J., Milwaukee Electric Ry. & Light, Duluth Street Railway, Houston Electric, West Penn Railway, Lynchburg Traction & Light, Omaha and Council Bluffs Street Railway, and Columbus Railway Power & Light.

ERJ7-17Gray

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Complete satisfaction

Operating perfectly and requiring minimum attention for maintenance and lubrication, Earll Catchers and Retrievers give genuinely satisfactory results. Their refinement of design, and mechanical superiority are summarized in the following five features, peculiar to Earll construction.

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Perfect Automatic Lubrication

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They talk for themselves

COST MORE PER BRUSH
COST LESS PER CAR MILE

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Building F, Fifteenth Street, Hoboken, N. J.

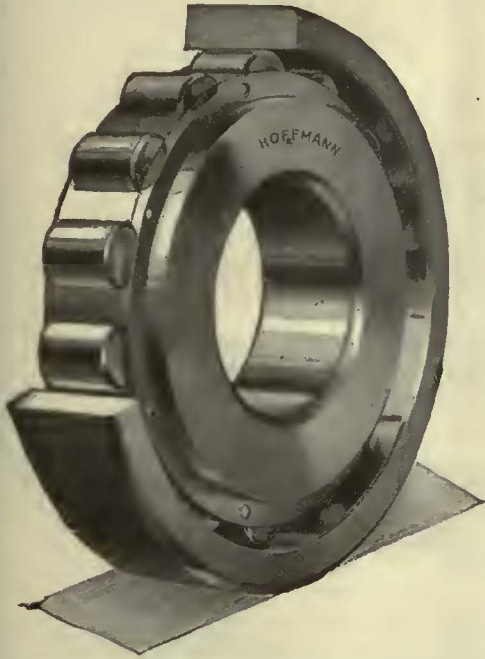
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Size for size, a "Hoffmann" has at least twice the steady load capacity of any ball bearing—and, in addition, a large temporary overload capacity to meet the demands of starting and emergency duty. Think what this means, in the way of a greatly increased factor of safety secured without any increase in dimensions of bearings.—Write for Catalog 904.

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BEARINGS CORPORATION**

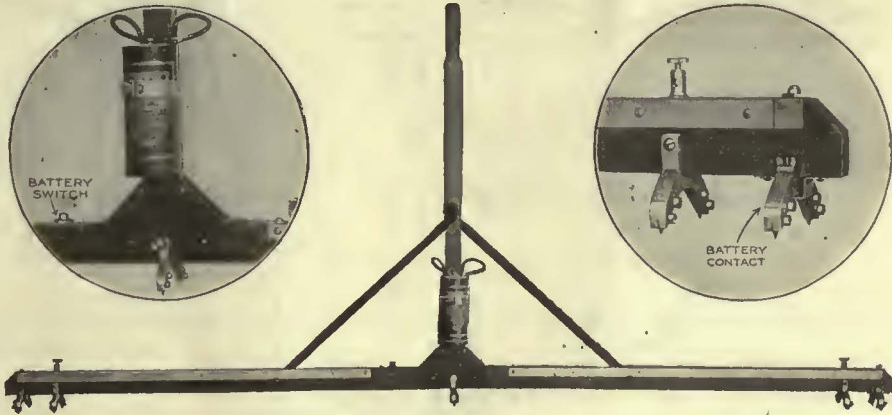
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"HOFFMANN"

Why ROLLER-SMITH BBT Bond Tester

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such a great
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It fulfilled a demand for quick, accurate, economical testing of rail bonds. That's all. In doing this, however, it dispensed with heavy, clumsy and expensive battery equipment since it uses only a No. 6 dry cell.

It dispensed also with grids and other equipment necessary to obtain current from the line.

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And, in addition, it is many times more accurate than the old device. If you are interested in bond testers fill in the coupon. We will send Bulletin G-200 giving all the details. Mail the coupon today.

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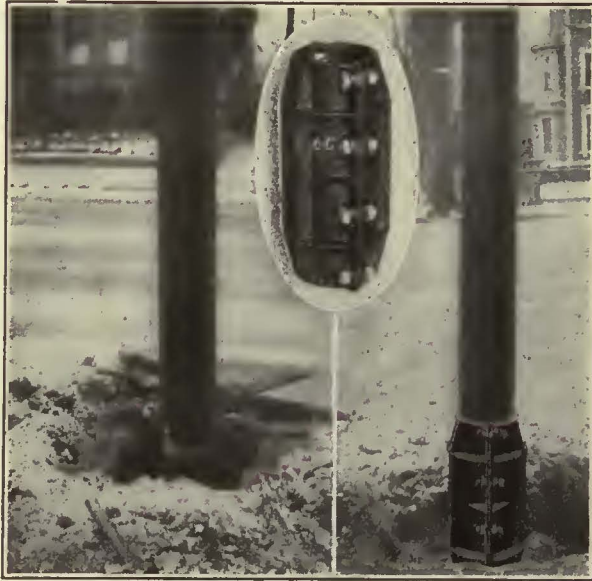
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Years can be added to the life of any iron pole which has become corroded at the ground level with our REINFORCING CLAMPS, or added height may be obtained by using the EXTENSION CLAMPS.

ALSO MOUNTS FOR WOOD POLES.

Ask for quotations on your requirements

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GRIFFIN F. C. S. WHEELS

For Street and Interurban Railways

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Cold Dinners

for *your* passengers?

Not if you use

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BABBITT for ARMATURES

keeps the rolling stock rolling



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Established 1880

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Strombos Signals for Railway Service

A pleasing sound of tremendous volume is emitted from the powerful Strombos Signal which is admirably suited for railway service. Day in, day out, it broadcasts a warning of approaching danger and promotes safe and efficient railway operation.

The Strombos Signal operates on an air pressure of 10 lbs. and over and is controlled by lever valve and cord. It uses only 1/10 the volume of air required by a whistle. It has no moving parts which might fail in the emergency.

Write us for more complete data.

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PHOENIX Electric Refrigerator Cars have proved to be at least three times as efficient as standard ice refrigerator cars in delivering perishable products on identical runs. They are continuously in active carrying service, no time being required for pre-cooling or re-icing as with ice refrigerator cars.

in operation. The apparatus is positive in action and can not easily get out of order.

The life of a Phoenix Electric Refrigerator Car is longer than that of an ice refrigerator car because it is not subject to the rapid deterioration caused by melting ice.

Continuous operation is only one of the several distinct advantages afforded by Phoenix Electric Refrigerator Cars.

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Icing stations, with consequent organization to care for them, are rendered entirely unnecessary.

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Operatives require no special skill to care for these cars as they are automatic



Builders of refrigerating Machinery since 1906



TRUCK WITH TOWER IN RUNNING POSITION

TRENTON TOWER

This 3-Section

is not only more convenient, but stronger than the older type.

The top section is reinforced by the intermediate section. The 3-section design makes it possible to raise the platform 16 inches higher and drop it 12 inches lower than can be done with the old-style 2-section tower.

We'll gladly send you details.

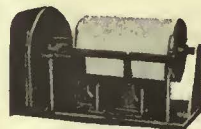
J. R. McCARDELL CO.
Trenton, New Jersey, U. S. A.



Making "selling" speed safe speed!

These days, service must be speedy to be "saleable." It must be safe too. It must be frequent.

Follow the practice of successful roads everywhere. Keep the cars on schedule with NACHOD Automatic Headway Recorders. Keep 'em moving right along with Nachod and United States Signals.

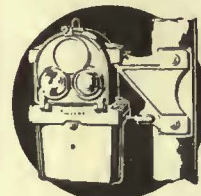


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NACHOD and United States Automatic Block Signals of every type.

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**FORD CHAIN
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2nd & Diamond Sts.
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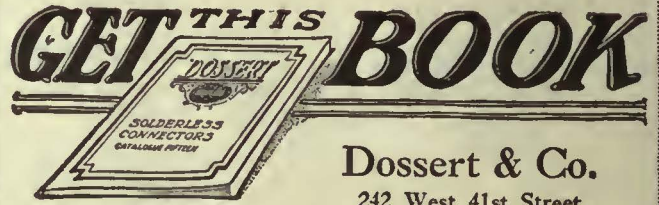


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The 20th Year Book illustrates and describes the various units that make up the line together with full data on use.

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Micanite Sheets for all purposes

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is a natural combination of silica and flake graphite. The vehicle is pure boiled linseed oil. It will not crack or peel off because of the natural elasticity of the flake graphite, while the silica furnishes the wear-resisting qualities. Because of these qualities, Dixon's Paint affords better and longer protection. By making frequent repainting unnecessary, it lowers the cost of paint upkeep. Write for Booklet 180-B

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**ELECTRIC RAILWAY
LUBRICATION**

We solicit a test of TULC
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The Universal Lubricating Co.
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Greater Service Per Dollar Invested



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More-Jones "Tiger" Bronze castings for axle and armature-bearing service was one of our early achievements. This is probably the most widely known bronze on the market. It has stood the test of time. There is nothing better for long, efficient and most economical results. Let us quote you.

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There is no substitute for Pantasote

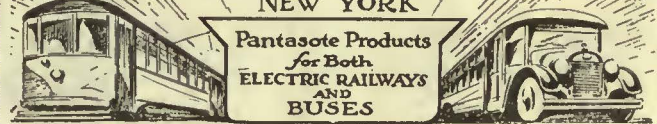
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The only homogeneous panel board

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They prevent creeping moisture and quickly drain the potticoat in wet weather, keeping the inner area dry.

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Wet 31,400, Line 10,000.

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Change a pole?



*No complicated parts
—no tools required*

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Also Bayonet Trolley Bases with the detachable Pole Clamp, Bayonet Special Trolley Wheels, and Sleet Cutters.

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Trolley Equipment

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Trackwork of superior quality, incorporating the famous Tisco Manganese Steel.

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for Accessibility and Reliability

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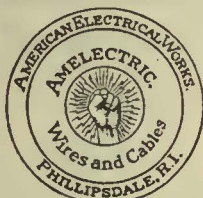
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Is the finest cord that science and skill can produce. Its wearing qualities are unsurpassed.

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Catalog complete with engineering data sent on request.

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Black and Yellow
Varnished Silk, Varnished Cambric, Varnished Paper

Irr-O-Slot Insulation Flexible Varnished Tubing
Insulating Varnishes and Compounds

Irvington Varnish & Insulator Co.

Irvington, N. J.

Sales Representatives in the Principal Cities

Instantaneous Registration by the Passenger

ROOKE of fare collection SYSTEM

Meets every condition for all types of cars and buses. The stand device, as shown, adapts it to one-man uses—making register portable or stationary, at option. Handles nickels, dimes, quarters, or metal tickets, in any combination, FLEXIBILITY with CERTAINTY.



Rooke Automatic Register Company Providence, R. I.



REDUCE OVERHEAD BY EQUIPPING WITH THORNTON Side Bearing TROLLEY WHEELS

The practical bearing of long life and endurance.

The longevity of our wheels is not due to hard metal which is destructive to the overhead but rather to the extensive bearing surface and improved method of lubrication. The bearing improves with use and many still in service have covered 100,000 miles.

Write for references

THORNTON TROLLEY WHEEL
CO., Inc.
ASHLAND, KENTUCKY.

ANACONDA TROLLEY WIRE

ANACONDA COPPER MINING COMPANY
THE AMERICAN BRASS COMPANY

Rods, Wire Cable Products

NEW YORK CHICAGO

Hale and Kilburn SEATS

Better Quality Seats
For Cars and Buses

Hale-Kilburn Co.
1800 Lehigh Ave., Philadelphia, Pa.

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.

E R J

POSITIONS WANTED

POSITIONS WANTED? Did you read the ad alongside of this? Same thing applies in your case. A Searchlight ad will introduce you to responsible officials and executives. Address "SEARCHLIGHT," Tenth Ave. at 36th St., New York City.

POSITIONS VACANT

VACANT POSITIONS? Other experienced electric railway men besides yourself will read this ad. If it described a vacancy you have to fill, some of them would be interested. Try it and see. Address "SEARCHLIGHT," Tenth Ave. at 36th St., New York City.

FOR SALE

14 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.

Saving is a good habit, BUT—

Why Save Things You'll Never Use?

WHY let Mother Nature grow grass between the wheels of replaced cars? Why pile up rails, shop equipment, power plant equipment, line equipment, car appliances, road building material, etc., etc., you will never use again?

TODAY you can turn them over at a fair price. Tomorrow they will be—JUNK. Is it not the better part of good horse-sense to dispose of them NOW?

6000 other electric railway men will see your advertisements of used or surplus equipment and materials here—in the Searchlight Section of their business paper.

Some of these men—officials or executives of other lines in other parts of the country and operating under different conditions—can use what you no longer need. For

an insignificant investment you can tell these others what you have. And they will buy.

One "Searchlight" advertiser wrote, "We can cheerfully recommend the Searchlight Section as a wonderful medium for reaching buyers of rails and equipment." Another—"The strongest proof that your 'Searchlight' finds its way to many readers is shown by the numerous letters we have received in answer to our recent ad."

Let us tell you the cost of advertising your used or surplus equipment and materials in the Searchlight Section. Just address a list of what you have to dispose of to the

Searchlight Department
ELECTRIC RAILWAY JOURNAL
 Tenth Ave. at 36th St., New York, N. Y.

Railway Equipment

- | | |
|--------------------|-------------------------|
| Car Ventilators | Universal Lanterns |
| Bus Ventilators | Classification Lanterns |
| Air Sanders | Selector Switches |
| Mechanical Sanders | Fare Box Lights |
| Indicating Signals | Water Tanks |

THE NICHOLS-LINTERN CO.
 7960 LORAIN AVENUE CLEVELAND, OHIO



FARE BOXES for BUSES

Let us tell you of this especially designed box for this class of service.

The Cleveland Fare Box Co.
 4900 Lexington Ave., Cleveland, O.
 Canadian Cleveland Fare Box Co., Ltd.
 Preston, Ontario

COIN COUNTING And Sorting Machines CHANGES CARRIERS Tokens

WHAT AND WHERE TO BUY

Advertising Agencies
Doyle Kitchen & McCormick
Advertising, Street Car
Collier, Inc., Barron G.

Air Brakes
Christensen Air Brake Co.
Westinghouse Air Brake Co.

Air Circuit Breakers
Roller-Smith Co.

Air Receivers & After-coolers
Ingersoll-Rand Co.

Ammeters
Roller-Smith Co.

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

Appraisals
American Appraisal Co.

Armature Shop Tools
Elec. Service Supplies Co.
Columbia Machine Works

Automatic Return Switch Stands
Ramapo Ajax Corp.

Automatic Safety Switch Stands
Ramapo Ajax Corp.

Axles
Bemis Car Truck Co.
Bethlehem Steel Co.
Brill Co., The J. G.
Carnegie Steel Co.
Johnson & Co., J. R.
National Railway Appliance Co.
Standard Steel Works
Westinghouse E. & M. Co.

Axles, Carbon Vanadium
Johnson & Co., J. R.

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

Axles, Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Johnson & Co., J. R.
Axles, Trailer & Motor Bus
Timken-Detroit Axle Co., The

Babbitt Metal
Ajax Metal Company
Johnson & Co., J. R.
More-Jones Brass & Metal Co.

Babbitting Devices
Columbia Machine Wks.

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

Bankers
Hornblower & Weeks
Bearings, Anti-Friction
Hyatt Roller Bearing Co.

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

Bearings, Center and Roller Side
Columbia Machine Works
Stucki Co., A.

Bearings, Roller and Ball
Hyatt Roller Bearing Co.
Norma Hoffman Bearing Corp.

Bells & Buzzers
Consolidated Car Heating Co.

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

Benders, Rail
Railway Trackwork Co.

Body Material—Haskelite & Plymett
Haskelite Mfg. Corp.

Boilers
Babcock & Wilcox Co.
Bolts, Nuts, Rivets
Russell Burdall & Ward
Bolt & Nut Co.

Bond Testers
Amer. Steel & Wire Co.
Elec. Service Supplies Co.
Roller-Smith Co.

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

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

Boxes, Switch
Johns-Pratt Co.

Brackets and Cross Arms
(See also Poles, Ties, Posts, etc.)
Columbia Machine Works
Electric Ry. Equipment Co.
Elec. Service Supplies Co.
Hubbard & Co.
Ohio Brass Co.

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

Brake Lining, Asbestos
Johns-Manville, Inc.

Brake Shoes
American Brake Shoe & Foundry Co.
Bemis Car Truck Co.
Brill Co., The J. G.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia Machine Wks.
General Electric Co.
National Brakes Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Le Carbons Co.
U. S. Graphite Co.
Westinghouse E. & M. Co.

Brushes, Graphite
U. S. Graphite Co.

Brushes, Wire Pneumatic
Ingersoll-Rand Co.

Brush Holders
Columbia Machine Works

Building Materials, Fire-Proof
Johns-Manville, Inc.

Bulkheads
Haskelite Mfg. Corp.

Bus Seats
Hale-Kilburn Co.
Heywood-Wakefield Co.

Buses, Motor
American Car & Foundry Motors Co.
Brill Co., The J. G.
Fageol Motor Co.
Graham Brothers
International Motor Co.
Mack Trucks, Inc.
Six Wheel Co.
Yellow Truck & Coach Mfg. Co.

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

Cables (See Wires and Cables)

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

Carbon Brushes (See Brushes, Carbon)

Car Lighting Fixtures
Elec. Service Supplies Co.

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

Car Wheels, Rolled Steel
Bethlehem Steel Co.

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

Cars, Gas, Rail
Brill Co., The J. G.

Cars, Passenger, Freight, Express, etc.
Amer. Car Co.
Brill Co., The J. G.
Kuhlman Car Co., G. C.
National Ry. Appliance Co.
Thomas Car Works, Perley A. Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

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

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

Castings, Gray Iron and Steel
American Steel Foundries
Bemis Car Truck Co.
Columbia Machine Wks.
Standard Steel Works
Wm. Wharton, Jr. & Co., Inc.

Castings, Malleable & Brass
Bemis Car Truck Co.
Columbia Machine Wks.
Catchers and Retrievers, Trolley
Earil, C. I.

Elec. Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Catenary Construction
Archbold-Brady Co.

Celling Car
Haskelite Mfg. Corp.
Pantaote Co., Inc.

Ceilings, Plywood Panels
Haskelite Mfg. Corp.

Cements, High Temperature
Johns-Manville, Inc.

Chairs, Parlor Car
Heywood-Wakefield Co.

Change Carriers
Cleveland Fare Box Co.

Electric Service Supplies Co.

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

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

Cleaners and Scrapers, Track
(See also Snow-Plows, Sweepers and Brooms)

Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia Machine Wks.
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

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

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

Coil Conning Machines
Cleveland Fare Box Co.

International Register Co.

Coil Sorting Machines
Cleveland Fare Box Co.

Coil Wrappers
Cleveland Fare Box Co.

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

Commutator Truing Devices
General Electric Co.

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

Componnds, Insulating
Johns-Manville, Inc.

Compressors, Air
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Tr. Br. Co.

Compressors, Air, Portable
Ingersoll-Rand Co.

Condensers
General Electric Co.
Ingersoll-Rand 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
Columbia Machine Works
Consolidated Car Heating Co.
Elec. Service Supplies Co.
Ohio Brass Co.

Controllers
American Brown Boveri Elec. Corp.

Controllers or Parts
Columbia Machine Wks.
General Electric Co.
Westinghouse E. & M. Co.

Controller Regulators
Elec. Service Supplies Co.

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

Converters, Rotary
American Brown Boveri Elec. Corp.
General Electric Co.
Westinghouse E. & M. Co.

Copper Wire
American Brass Co.
American Steel & Wire Co.
Anaconda Copper Mining Co.
Roms Wire Co.

Copper Wire Instruments
Measuring Testing and Recording
American Brass Co.
American Steel & Wire Co.
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register
American Steel & Wire Co.
Brill Co., The J. G.
Elec. Service Supplies Co.
International Register Co.
Roebling's Sons Co., J. A.
Samson Cordage Works
Silver Lake Co.

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

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

Cranes, Hoist & Lift
Electric Service Supplies Co.

Cross Arms (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossings
Ramapo Ajax Corp.
Wm. Wharton Jr. & Co., Inc.

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
Ohio Brass Co.
Westinghouse E. & M. Co.

Curtains & Curtain Fixtures
Brill Co., The J. G.
Edwards Co., Inc., The O. M.
Morton Mfg. Co.
Pantaote Co., Inc.

Denier's Machinery & Second Hand Equipment
Elec. Equipment Co.
Salzberg Co., Inc., H. E.

Derailing Devices (See also Track Work)
Derailing Switches
Ramapo Ajax Corp.

Destination Signs
Columbia Machine Wks.
Electric Service Supplies Co.

Detective Service
Wish-Service, P. Edward

Door Operating Devices
Brill Co., The J. G.
Consolidated Car Heating Co.
Nat'l Pneumatic Co., Inc.
Safety Car Devices Co.

Doors and Door Fixtures
Brill Co., The J. G.
Edwards Co., Inc., The O. M.
General Electric Co.
Hale-Kilburn Co.

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

Drills, Track
Amer. Steel & Wire Co.
Elec. Service Sup. Co.
Ingersoll-Rand Co.
Ohio Brass Co.

Dryers, Sand
Elec. Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Ears
Columbia Machine Works
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Electric Grinders
Railway Trackwork Co.

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

Electrodes, Carbon
Railway Trackwork Co.
Una Welding & Bonding Co.

Electrodes, Steel
Railway Trackwork Co.
Una Welding & Bonding Co.

Engineers, Consulting, Contracting and Operating
Allison & Co., J. S.
Archbold-Brady Co.
Beeler, John A.
Bibbins, J. Rowland
Buchanan & Layng Corp.
Day & Zimmermann, Inc.
Drum & Co., A. L.
Ford, Bacon & Davis
Hemphill & Wells
Hoist, Engelhardt W.
Jackson, Walter
Kelker & DeLew
Kelly Cooke & Co.
McGlellan & Junkersfeld
Richey, Albert S.
Sanderson & Porter
Stevens & Wood, Inc.
Stone & Webster
White Eng. Corp., The J. G.

Engines, Gas, Oil or Steam
Ingersoll-Rand Co.
Westinghouse E. & M. Co.

Exterior Side Panels
Haskelite Mfg. Corp.

Fare Boxes
Cleveland Fare Box Co.
Nat'l Ry. Appliance Co.
Perey Mfg. Co., Inc.

Fare Registers
Electric Service Sup. Co.

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

Fenders and Wheel Guards
Brill Co., The J. G.
Consolidated Car Fender Co.
Star Brass Works
Wood Co., Chas. N.

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

Field Coils (See Coils)

Finishing Materials
Egyptian Lacquer Mfg. Co.
Valentine & Co.
Flaxinum Insulators
Nat'l Ry. Appliance Co.

Floodlights
Elec. Service Supplies Co.

Floor, Sub.
Haskelite Mfg. Corp.

Flooring, Monolithic
Johns-Manville, Inc.

Floors
Haskelite Mfg. Corp.

Forgings
Brill Co., The J. G.
Carnegie Steel Co.
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
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Funnell Castings
Wm. Wharton, Jr. & Co., Inc.

Furnaces, Electric
American Brown Boveri Elec. Corp.

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

Fuses, Cartridge, Non-Refillable and High Voltage
Johns-Pratt Co.

Fuses, Cartridge, Refillable
Johns-Pratt Co.

Fuses, Refillable
General Electric Co.

Gaskets, Asbestos
Johns-Manville, Inc.
Westinghouse Tr. Br. Co.

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

Gas Producers
Westinghouse E. & M. Co.

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

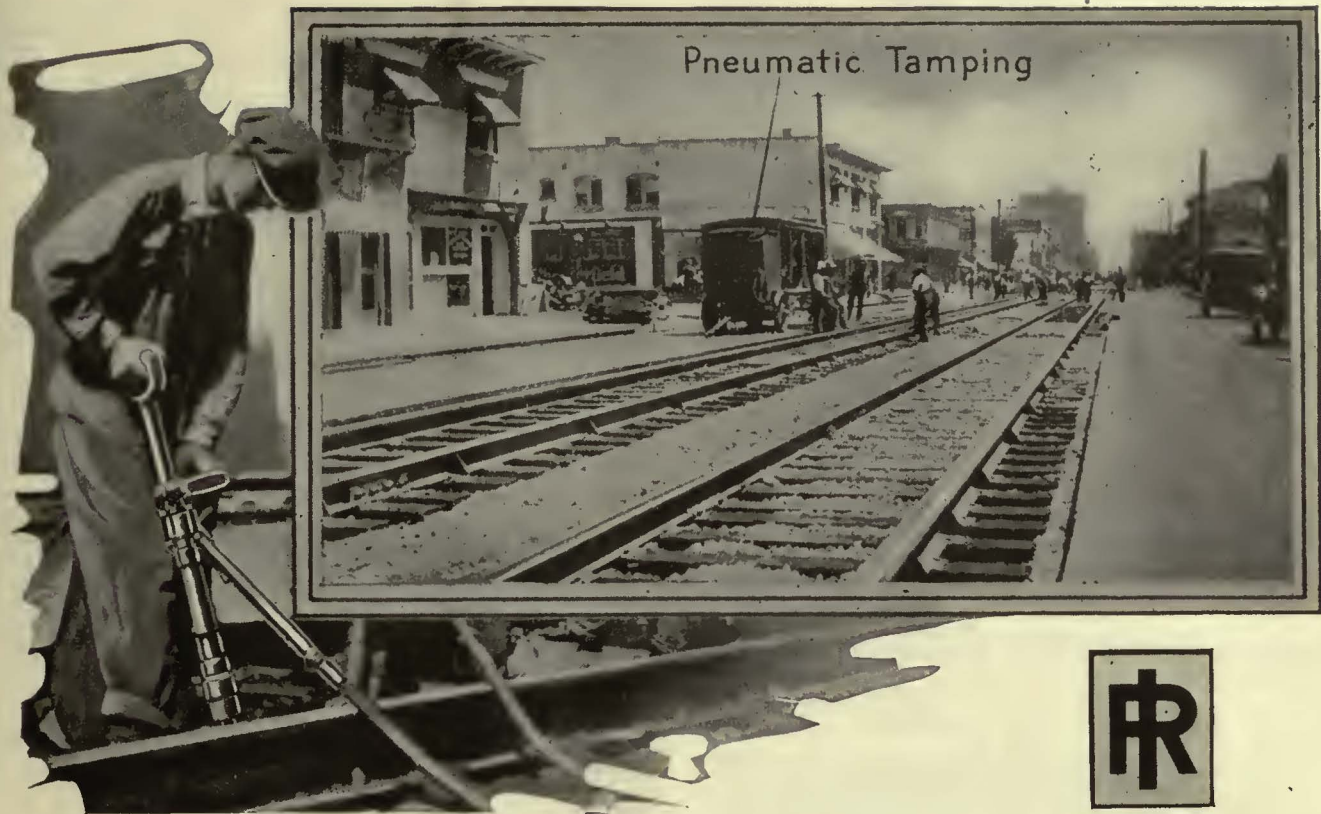
Gauges, Oil & Water
Ohio Brass Co.

Gear Blanks
Bethlehem Steel Co.
Brill Co., The J. G.
Carnegie Steel Co.
Standard Steel Works

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

Gears and Pinions
Bemis Car Truck Co.
Bethlehem Steel Co.
Columbia Machine Wks.
Electric Service Supplies Co.

General Electric Co.
Nat'l Ry. Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.
(Continued on Page 70)



Pneumatic tampers make a firmer and more permanent roadbed

More track can be tamped per day, and a more uniform roadbed obtained, when pneumatic tie tampers are used. Full tamping power is available all day long. Four men with pneumatic tampers will tamp more track per day, and do a better job, than ten to twelve men using hand methods.

An Ingersoll-Rand Portable Air Power Unit for Tie Tamping, Paving Breaking, Drilling, etc., effects a surprising reduction in the time and cost of track work. An investigation of these air power units will show many ways to reduce track costs. Ask for complete information.

INGERSOLL-RAND COMPANY-11 BROADWAY, NEW YORK CITY.

Offices in principal cities the world over.

FOR CANADA REFER-CANADIAN INGERSOLL-RAND CO. LIMITED, 260 ST. JAMES STREET, MONTREAL, QUEBEC.

226-TT

Ingersoll-Rand

Generating Sets, Gas-Electric
General Electric Co.

Generators
American Brown Boveri Elec. Corp.
General Electric Co.
Leece Neville Co.
Westinghouse E. & M. Co.

Grider Rails
Bethlehem Steel Co.
Lorain Steel Co.

Gongs (See Bells and Gongs)
Greases (See Lubricants)
Grinders and Grinding Supplies
Metal & Thermit Corp.
Railway Trackwork Co.

Grinders, Portable
Railway Trackwork Co.

Grinders, Portable Electric
Railway Trackwork Co.

Grinding Bricks and Wheels
Railway Trackwork Co.

Guard Rail Clamps
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co. Inc.

Guard Rails, Tee Rail and Manganeese
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co. Inc.

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

Hammers, Pneumatic
Ingersoll-Rand Co.

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

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

Headlining
Columbia Machine Works
Haskelite Mfg. Corp.
Pantasote Co., Inc.

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

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

Heaters, Car, Stove
Smith Heater Co., Peter

Helmets—Welding
Railway Trackwork Co.
Una Welding & Bonding Co.

Holsts and Lifts
Columbia Machine Wks.
Ford Chain Block Co.

Holsts, Portable
Ingersoll-Rand Co.

Horns, Car
American Strombos Co.

Hose, Bridges
Ohio Brass Co.

Hose, Pneumatic
Westinghouse Traction Brake Co.

Ice Machines
Phoenix Ice Machine Co.

Ignition Units
Leece Neville Co.

Instruments, Measuring, Testing and Recording
American Steel & Wire Co.
General Electric Co.
Roller-Smith Co.
Westinghouse E. & M. Co.

Insulating Cloth, Paper and Tapes
General Electric Co.
Irvington Varnish & Ins. Co.
Johns-Manville, Inc.
Mica Insulator Co.
Okonite Co.
Okonite-Callender Cable Co. Inc.
Westinghouse E. & M. Co.

Insulating Silk
Irvington Varnish & Ins. Co.

Insulating Varnishes
Irvington Varnish & Ins. Co.

Insulation (See also Palats)
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.

Insulation, Pipe & Boiler
Johns-Manville, Inc.

Insulation Slot
Irvington Varnish & Ins. Co.

Insulator Pins
Elec. Service Supplies Co.
Hubbard & 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.

Interior Side Linings
Haskelite Mfg. Corp.

Interurban Cars (See Cars Passenger, Freight Express etc.)

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

Joints, Rail (See Rail Joints)

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

Laquer Finishes
Egyptian Laquer Mfg. Co.
Valentine & 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.
Ohio Brass Co.

Lanterns, Classification
Nichols-Lintern Co.

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.)
Dossert & Co.
Electric Ry. Equipment Co.
Electric Service Sup. Co.
General Electric Co.
Hubbard & Co.
Johns-Manville, Inc.
More-Jones Brass & Metal Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Locking Spring Boxes
Wm. Wharton, Jr. & Co., Inc.

Locomotives, Electric
American Brown Boveri Elec. Corp.
General Electric Co.
Westinghouse E. & M. Co.

Locomotives, Oil Engine
Electric Driven
Ingersoll-Rand 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 Parts
Bemis Car Truck Co.

Manganese Steel Castings
Wm. Wharton, Jr. & Co., Inc.

Manganese Steel Guard Rails
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Manganese Steel, Special Track Work
Bethlehem Steel Co.
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.

Meters (See Instruments)
Roller-Smith Co.

Mica
Mica Insulator Co.

Motor Buses (See Buses, Motor)

Motor and Generator Sets
General Electric Co.

Motor Leads
Dossert & Co.

Motors, Electric
American Brown Boveri Elec. Corp.
General Electric Co.
Westinghouse E. & M. Co.

Motorman's Seats
Brill Co., The J. G.
Electric Service Sup. Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.
Wood Co., Chas. N.

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

Ohmmeters
Roller-Smith Co.
Wills (See Lubricants)

Omnibuses (See Buses, Motor)

Oxy-Acetylene (See Cutting Apparatus Oxy-Acetylene)

Oxygen
International Oxygen Co.

Packing
Westinghouse Traction Brake Co.

Paeking, Asbestos
Johns-Manville, Inc.
Paint, Iron Preservative
Johns-Manville, Inc.

Paints and Varnishes (Insulating)
Electric Service Sup. Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.
National Ry. Appliance Co.
Paints & Varnishes, Preservative
Joseph Dixon Crucible Co.
Panels, Outside, Inside
Haskelite Mfg. Corp.

Pavement Breakers
Ingersoll-Rand 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 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.
National Railway Appliance Co.

Plywood, Roofs, Headlining
Floors, Interior Panels,
Bulkheads, Truss Planks
Haskelite Mfg. Corp.

Pneumatic Tools
Ingersoll-Rand Co.

Pole Clamps
Clark-Williams Eng. Co.

Pole Line Hardware
Bethlehem Steel Co.
Electric Service Sup. Co.
Ohio Brass Co.

Poles, Metal Street
Elec. Ry. Equipment Co.
Hubbard & Co.

Pole Mountings
Clark-Williams Eng. Co.

Pole Reinforcing
Hubbard & Co.

Poles and Ties Treated
Bell Lumber Co.

Poles, Ties, Posts, Piling and Lumber
Bell Lumber Co.
Naugle Pole & Tie Co.

Poles, Trolley
Bayonet Trolley Harp Co.
Bell Lumber Co.
Electric Service Sup. Co.
Nuttall Co., R. D.

Polys, Tubular Steel
Elec. Ry. Equipment Co.
Electric Service Sup. Co.

Portable Grinders
Buda Co.

Potholes
Okonite Co.
Okonite-Callender Cable Co. Inc.

Power Saving Devices
National Ry. Appliance Co.

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

Pumps
A. S. Cameron Steam Pump Wks. (Ingersoll-Rand Co.)
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)

Pumps, Vacuum
A. S. Cameron Steam Pump Wks. (Ingersoll-Rand Co.)
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Wks.)

Punches, Ticket
International Register Co.
Wood Co., Chas. N.

Rail Braces and Fastenings
Ramapo Ajax Corp.

Rail Grinders (See Grinders)

Rail Joints
Carnegie Steel Co.
Rail Joint Co.

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

Rails, Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Rail Welding
Metal & Thermit Corp.
Railway Trackwork Co.
Una Welding & Bonding Co.

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

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

Rattan
Brill Co., The J. G.
Electric Service Sup. Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Rectifiers, Mercury
American Brown Boveri Elec. Corp.

Refrigerators, Car
Phoenix Ice Machine Co.

Registers and Fittings
Brill Co., The J. G.
Electric Service Sup. Co.
International Register Co.
Rooke Automatic Register Co.

Reinforcement, Concrete
Amer. Steel & Wire Co.
Bethlehem Steel Co.
Carnegie Steel 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.

Resistances
Consolidated Car Heating 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.

Roller Bearings
Hyatt Roller-Bearing Co.
Roofing Asbestos (Corrugated and Flat)
Johns-Manville, Inc.

Roofing, Car
Haskelite Mfg. Corp.
Pantasote Co., Inc.

Roofing and Shingles, Asbestos
Johns-Manville, Inc.

Roofs, Car & Bus
Haskelite Mfg. Corp.

Safety Control Devices
Safety Car Devices Co.

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

Sash Fixtures, Car
Brill Co., The J. G.
Edwards Co., Inc., The O. M.
Hale-Kilburn Co.

Sash, Metal, Car Window
Edwards Co., Inc., The O. M.
Hale-Kilburn Co.

Scrapers, Track (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Electric Service Sup. Co.

Sealing Materials
Brill Co., J. G.
Hale-Kilburn Co.
Haskelite Mfg. Corp.
Heywood-Wakefield Co.
Pantasote Co., Inc.

Seats, Bus
Brill Co., The J. G.
Hale-Kilburn Co.
Heywood-Wakefield Co.

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

Second Hand Equipment
Electric Equipment Co.
Salzberg Co., Inc., H. E.

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

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

Shovels, Power
Brill Co., The J. G.

Side Bearings (See Bearings Center and Side)

Signale, Car Starting
Consolidated Car Heating Co.
Electric Service Sup. Co.
Nat'l Pneumatic Co., Inc.

Signal Systems, Block
Electric Service Sup. Co.
Nachod & U. S. Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod & U. S. Signal Co.

Signals, Indicating
Nichols-Lintern Co.

Stack Adjusters (See Brake Adjusters)

Slag
Carnegie Steel Co.

Sleet Wheels and Cutters
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia Machine Wks.
Elec. Ry. Equipment Co.
Elec. Ry. Improvement 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.
Columbia Machine Wks.
Consolidated Car Fender Co.
Snow Sweeper, Rattan
Heywood-Wakefield Co.

Soldering and Brazing Apparatus (See Welding Processes and Apparatus)

Special Adhesive Papers
Irvington Varnish & Ins. Co.

Special Trackwork
Bethlehem Steel Co.
Lorain Steel Co.
Wm. Wharton, Jr. & Co., Inc.

Spikes
Amer. Steel & Wire Co.

Splicing Compounds
Westinghouse E. & M. Co.

Splicing Sleeves (See Clamps and Connectors)

Springs, Car and Truck
American Steel Foundries
Amer. Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Standard Steel Works
Sprinklers, Track and Road
Brill Co., The J. G.

Steel and Steel Products
Carnegie Steel Co.
Morton Mfg. Co.

Steel Car Doors
Morton Mfg. Co.

Steel Flooring
Morton Mfg. Co.

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

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

Stop Signals
Nichols-Lintern Co.

Storage Batteries (See Batteries, Storage)

Strain, Insulators
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Strand
American Steel & Wire Co.
Roebbling's Sons Co., J. A.

Street Cars (See Cars, Passenger, Freight, Express, etc.)

Subway Boxes
Johns-Pratt Co.

Superheaters
Babcock & Wilcox Co.
Sweepers, Snow (See Snow Plows, Sweepers and Brooms)

Switch Stands and Fixtures
Ramapo Ajax Corp.

Switchboards, Asbestos
Johns-Pratt Co.

Switches and Switchboards
American Brown Boveri Elec. Corp.
Consolidated Car Heating Co.
Electric Service Sup. Co.
General Electric Co.
Westinghouse E. & M. Co.

Switches, Safety
Johns-Pratt Co.

Switches, Selector
Nichols-Lintern Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track (See Track Special Work)

Synchoscopes
Roller-Smith Co.

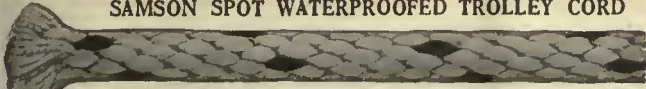
Tampers, Tie
Ingersoll-Rand Co.
Railway Trackwork Co.

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

Tee Rail Special Track Work
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

(Continued on Page 72)

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is turned out with equal care in our shops. The orders we fill differ only in magnitude; small orders command out utmost care and skill just as do large orders. CAMERON quality applies to every coil or segment that we can make, as well as to every commutator we built. That's why so many electric railway men rely absolutely on our name.
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ALPHABETICAL INDEX TO ADVERTISEMENTS

Table with 4 columns: Name, Page, Name, Page, Name, Page, Name, Page. Lists companies like Ajax Metal Co., Allison & Co., American Appraisal Co., etc., with their respective page numbers.

WHAT AND WHERE TO BUY—Continued from page 70

Table with 4 columns: Category, Name, Category, Name, Category, Name, Category, Name. Lists various equipment and services such as Telephones and Parts, Trolley Grinders, Trolley Wheel Bushings, etc., with associated company names.



Modern Light-weight Cars

in one shipment

for the

Virginia Electric & Power Co.

An excellent illustration of the spirit of progress which has dominated electric railway activities within recent months was the train of fifteen bright new cars recently shipped to the Virginia Electric & Power Co. from our American Plant in St. Louis.

Mounted on the Brill light-weight No. 177-E-1 type trucks, and equipped with air-operated automatic treadle arrangement on each platform in front of single exit door, complete safety devices and plush upholstered seats, these cars will stimulate car-riding. Modern cars attract passengers.



One of fifteen double-end Safety Cars now in service in Richmond, Va.

THE J. G. BRILL COMPANY
 PHILADELPHIA, PA.
 AMERICAN CAR CO. — G.C. KUHLMAN CAR CO. — WASON MAN'G CO.
 ST. LOUIS, MO. — CLEVELAND, OHIO. — SPRINGFIELD, MASS.



What they found —after 13 years

Commutator—In excellent condition. It has never been turned.

Bearings—Tool marks still visible.

Gearing—Scarcely any perceptible back lash.

Besides, there was no slack in bearings, connecting rods, or wrist pins.



These facts relating to the operation of one CP-27 do not mark an unusual record. They do speak convincingly of the stamina built into this line of G-E car equipment and account for the general preference for the CP-Compressor among railway men. The CP is well termed the Low-Maintenance Compressor.

This CP-27 Compressor was selected at random from among the 196 CP-Compressors on the Key System Transit Company's cars. Installed on a car that weighs 38,000 lb., it has been furnishing continuous service since Sept. 1911. In thirteen years the car operated 640,670 car-miles, which corresponds to approximately 24,000 hours of compressor operation. During this time there has been no repair nor replacement of any mechanical or electrical part.

GENERAL ELECTRIC