Statistical and Better-Service Number

ELECTRIC RAILWAY JOURNAL

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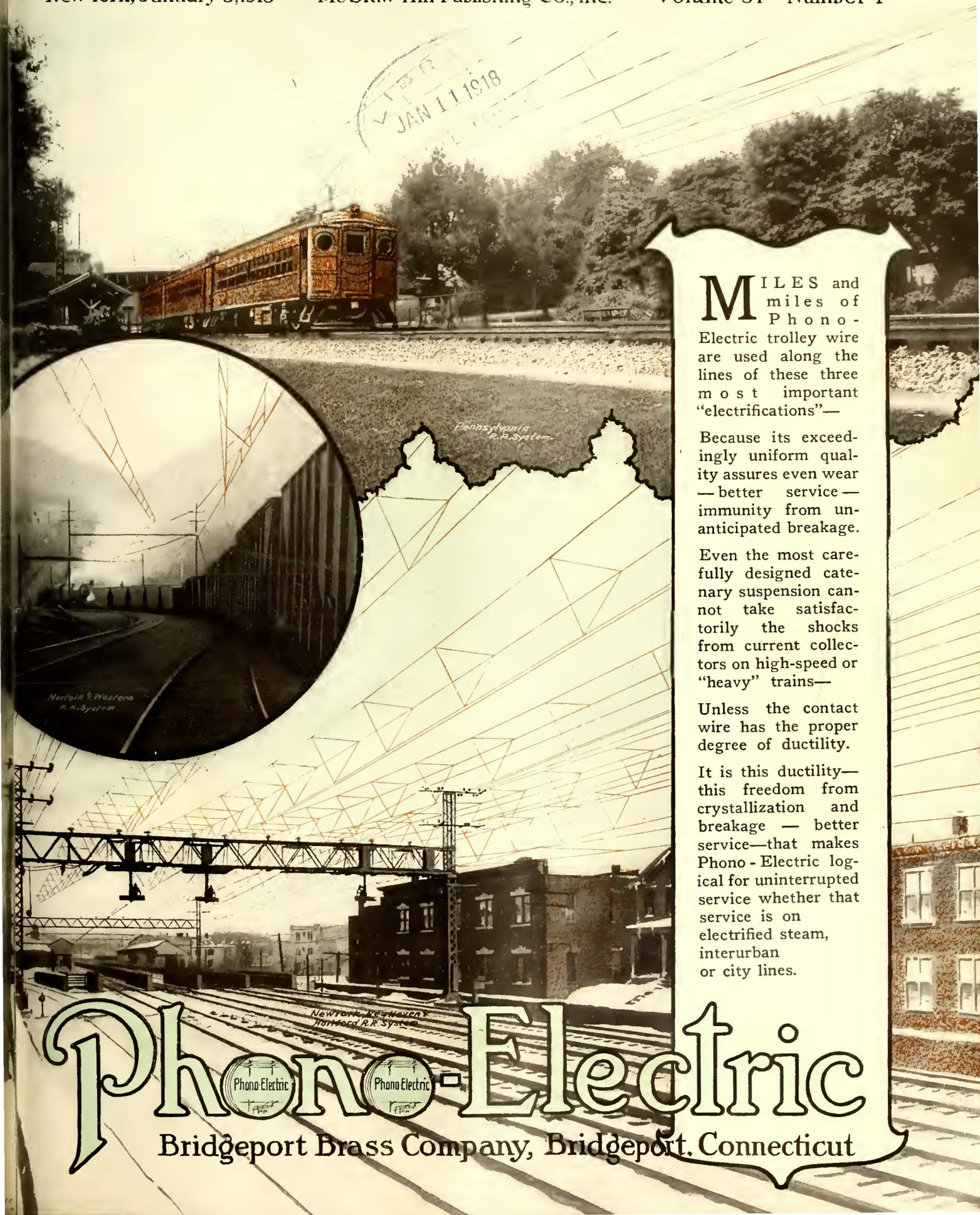


The Electric Railway Industry

A Review and a Prophecy

AS a traveler climbing a mountain will often not realize the height he has attained until, pausing, he looks back over the route he has traversed, so in any industry, if one would obtain a comprehensive view of the industry, he must pause occasionally and survey the field.

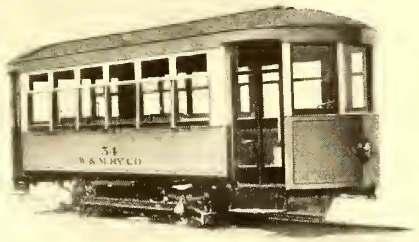
BIRNEY ONE-MAN CAR

The beginning of a new calendar year has long been accepted as a logical period for surveys of this kind and now is, therefore, an appropriate time for those engaged in the electric railway industry to pause and consider. The electric railways, in common with all the activities of our country, have been profoundly affected by the material and the sociological developments of the times and the effects of the great world war.

DOUBLE-TRUCK, ONE-MAN CAR

The spirit and effort with which this crisis is being met is a real testimonial to the character and ability of the personnel of the electric railways. Ordinarily it is a slow and laborious process for any large and complicated industry to change its fundamental habits. In endeavoring to meet the economic pressure of recent years, however, the electric railways have not merely changed their habits—they have revolutionized them, and they have done this with a rapidity that is truly astonishing.

Looking back over the past few years two developments in transportation stand out which affected the electric railways profoundly and created new ideas regarding transportation of passengers.



SINGLE-TRUCK, ONE-MAN CAR

The first was the automobile. The development of this machine established a rival for the electric railways, and this rival was in the unique position of competing with the railways as to quality of service without being obliged to compete in price. Naturally it soon took from the railways a large part of those customers to whom price was no object. Adding insult to injury, however, the "jitney" then appeared, adding new standards of speed and convenience for short-haul passengers. There was a distinct element

(Continued on next page)

The table of contents for this issue will be found on page 15

of injustice in this competition, in that equality of taxation and responsibility was lost sight of.

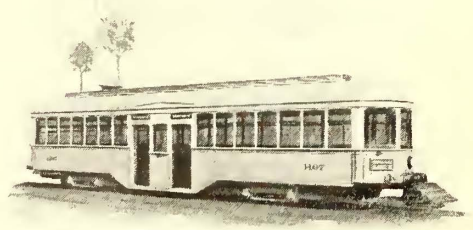
The second was the establishment, in the majority of States, of public utility commissions. In the midst of the adjustments due to the automobile and the jitney these public control bodies took the electric railways out of the class of private business, whose first duty is to secure financial returns, and made them subject to trial, condemnation and regulation. The result of these new competitors—auto and jitney—and this new commission control was to affect seriously both the income and the expense accounts of the railways.

ONE-MAN CARS IN WACO, TEXAS

The first idea that occurs to one when his income suffers is that he should reduce his expenses correspondingly and postpone expenditures for improvements. The railways reacted in the common way. Fortunately for the industry, perhaps, rapidly rising prices of labor and material soon made it evident that no adequate solution could be expected on this basis.

SOUTHERN PUBLIC UTILITIES SINGLE-TRUCK, ONE-MAN CAR

A new spirit is now in evidence among the electric railways. Pressing needs for higher revenues have awakened them to the fact that they are commercial enterprises—that their function is not merely to **run cars** but to **sell service,** and that, like any other manufacturing company, the amount of their product which they can sell depends very largely on how well its quality suits the public and how attractively it is offered. This is an entirely new attitude of mind and a new basis of doing business, and makes clear the course of action for the future.



A CLEVELAND CENTER-ENTRANCE CAR

In carrying out the plans, however, an unexpected obstacle arose—in the attitude of the regulating bodies. While it is a familiar saying that you "cannot make bricks without straw" it has not been as clearly recognized that you cannot run railways without money.

The Public Service Commissions have in many instances ordered increased service without giving due consideration to the financial problem involved. The service ordered could only be provided by depriving the stockholders of their fair and just return on their investment. While the commissions are now very generally endeavoring to be fair in their control the railways have arrived at a condition

where the great majority of the electric railways in this country must increase their revenue immediately or go into the hands of receivers.

They cannot give the service the people demand and ought to have unless help is given by the people in the form of increased revenue, reduction in taxes and other financial burdens.

Senator Underwood and other public men have told the electric railway men repeatedly that they should not blame legislators, Public Service Commissions or City Council men when they passed unjust laws or issued unfair orders, placing additional restrictions and burdens on the electric railways, because these representatives of the people were merely responding to the will of the people they represented. If the will or demands of the people were unfair or were based on erroneous assumptions, the burden of educating the people rested with the Public Utility Company and not the legislators. This responsibility the electric railways are assuming.

A SANTA BARBARA, CALIF., CENTER-ENTRANCE CAR

TRAIN SERVICE IN SCRANTON, PA.

The problem of educating the people is no easy task. The muck-raking press a few years ago established a deep-rooted prejudice against corporations, and the good as well as the bad are suffering as a result; it cannot be eradicated in a few years. The electric railway industry has spent considerable money and effort endeavoring to clear up this unfair attitude, but it is slow work. The daily newspapers, like our legislators, also reflect public opinion. They, too, realize that to ask for fair play for the street railway is unpopular. Fair play is always popular with the public when the public sees that it is fair play. There is a growing knowledge on the part of the public of the street railway business and a growing realization that co-operation and mutual help on the part of the public and its representatives with the railways is necessary.

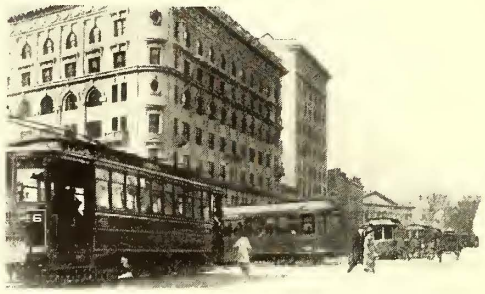
QUICK SERVICE IN DAYTON, OHIO

The splendid work of many leading railway men during the last six months is beginning to bear fruit. A number of electric railways have been granted increased fares; quite a few daily papers and magazines have published articles setting forth the true facts regarding the street railway company serving their community. The year 1918 has great promise for the better.

The manufacturers who supply cars and equipments are naturally

(Continued on next page)

very familiar with the condition of the electric railway business. Their business makes it necessary for them to keep in touch with all phases of the industry, such as physical requirements, finances, credits, etc., etc. Their sales force is mingling with the people in all communities, consequently they are in touch with the "car rider's" viewpoint also and are responding to the call of the American Electric Railway Association in doing their bit toward correcting the numerous wrong impressions that exist regarding the street railways. As a business or industry the electric railway is unique—it is fundamentally in a class by itself. Its function is to transport the people to and from business each day reliably, comfortably, speedily and courteously. This service must be performed all of the time under the critical eye of the public. The people demand this kind of service as their right and everybody agrees they are entitled to it. But all reasonable men also agree that since the people demand this as a right they should be equally insistent that their representatives be fair and just and eliminate those things which prevent the railways furnishing the right service.

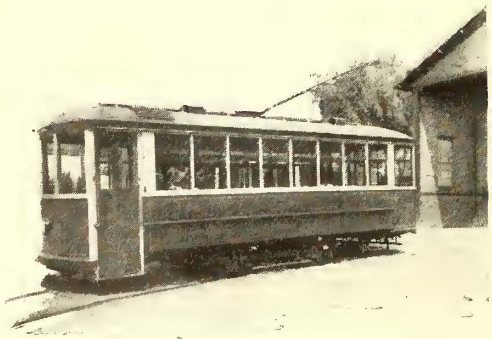


HEAVY TRAFFIC IN WASHINGTON, D. C.

The street railway is serving the great majority of the citizens of any community, therefore the street cars should have the right of way on its tracks. Frequently several thousand people are delayed by individual automobiles or other vehicles. The railway company cannot afford to take the slightest risk of accident because they know from experience that the average jury will allow exorbitant claims.

MOTOR CAR AND TRAILER, PITTSBURGH, PA.

With the ever-increasing burden imposed each year upon them, the railway managers have been kept on the griddle, endeavoring to comply with often unjust demands, and at the same time meet the continuing demands of the people for increased service and the employees for increased wages, and do it all with the same five-cent fare. Up to the war period they were doing heroic work notwithstanding these conditions. The records of the past five years show the progressive steps various railway men have taken, hoping to improve the situation by the introduction of more economical methods of operation and more economical types of cars and equipment. When the great war came, and with it the great advance of raw materials and supplies of all kinds, as well as labor, then, and not until then, did they throw up their hands and say to the people—"It cannot be done on a five-cent



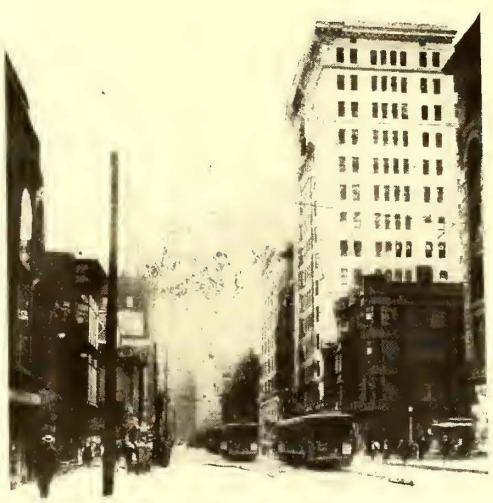
SINGLE-TRUCK, ONE-MAN CAR

fare." This led to the placing of their financial conditions before many Public Service Commissions, accompanied by a request for increased fares.

A review of what the railway men have been doing will show that scarcely anything has been overlooked that would effect economy, safety and reliability. Many properties have adopted such measures as offered the best solution for their particular requirements. For example, one railway speeded up its schedules and gave better service by using the skip stop. Another improved on this by inventing the stagger stop. A third started traffic surveys and graded its service to the needs of its patrons by "short-line" cars. A fourth reduced congestion and solved the man problem by coupling its cars in trains. A fifth built up its traffic by reducing the headway and met the expense by one-man operation. A sixth, on the other hand, secured similar results with increased headways, by publishing definite time tables and working rigidly to them. A seventh line reduced costs and increased reliability by replacing its obsolete motors, with light weight modern ones. An eighth secured partial results of some sort by taking better care of the equipment it already had. A ninth raised capital for needed improvements by selling securities to its patrons. A tenth—an interurban—established through-freight service over a connecting line. An eleventh petitioned for increased fares and presented its case, not with a whine, but in so convincing and business-like a manner that the community joined in urging that the increase be granted.

LIGHT-WEIGHT CARS IN BOSTON

INTERURBAN TRAINS IN WILMINGTON, N. C.



TRAIN SERVICE IN LOUISVILLE, KY.

Other dozens of companies did numerous other things, but it is not so much the plans adopted that concern us as the spirit which prompted them—the commercial spirit, the spirit of progress. This is the spirit which is recognizing the kinship of the entire industry. The manufacturers have responded in almost every instance to the call of the electric railway operators and have expended large sums cheerfully in developing any new apparatus which gave promise of reducing operating costs, even though the probabilities of reasonable returns were sometimes quite remote. Examples of these are the light-weight motor for 24" wheels; the "HLD" control

(Continued on next page)

for train operation on low-floor surface cars; the light weight circuit breaker; the light weight trolley; re-designing the entire line of railway motors two or three times during the past five years, each change making reductions in weight and increasing the operating efficiency.

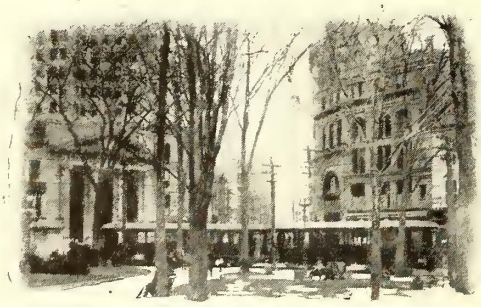
CENTER-ENTRANCE CARS IN CLEVELAND, O.

The railways, the public, the public legislative, executive and regulating bodies, the manufacturers are one and all evidencing a growing spirit of kinship—a spirit which is recognizing that they are mutually responsible for service which we must have in the transportation of passengers on our streets.

What of the Future?

While the condition of the street railway as a business, profitable to its stockholders and satisfactory to its patrons, is perhaps at the lowest point it has ever reached, profiting by the view backward, as outlined above, we are justified in saying that the future of the electric railway industry is bright. Any human endeavor is progressive and successful only through the spirit which permeates it and guides its activities. The new spirit which is prevalent throughout the industry among the street railways, the manufacturers and the public, is a guarantee that from now on the railways will perform a more valuable and adequate service; the manufacturers will undertake the necessary development of improved apparatus and the public will demand and give the railways the necessary capital to justify the improved condition. We are justified in predicting:

A BUSY SPOT IN ATLANTA, GA.



TRAIN SERVICE IN WILKES BARRE, PA.

"That the electric railway business, which is perhaps one of the most fundamental businesses of the country, will again come into its own and be a business of good repute and mutual profit to the public, the railways and the manufacturers."

The Safety Car

For 1918

And Thereafter

Two years ago the Light-Weight Safety Car was little more than a pious wish for a faster, safer, more economical and more satisfactory car unit.

Today it is the **standard** car of scores of cities—

The first car in the history of American electric railroading which has made good universally.

Won't you ask us the reasons?

SAFETY CAR DEVICES CO.

Main Office—Boatmen's Bank Bldg., ST. LOUIS

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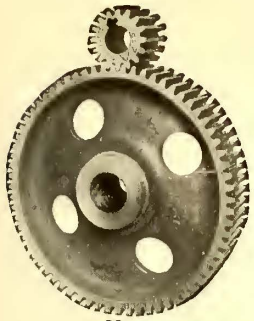
Ry. Exch. Bldg.

NEW YORK
City Invest. Bldg.

PITTSBURGH
Westinghouse Bldg.

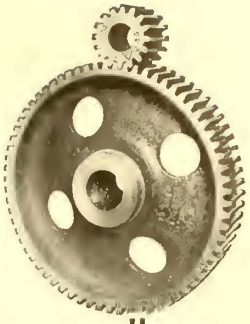


Quick-Service Gears and Trolleys

for

Economical Operation

"It is the little things that count"



Electric Railways all over the country are adopting the ***Quick-Service*** Car to reduce operating expenses. Though a great saving can be secured with this type of car, still maximum economy can only be attained through the use of equipment parts that give the greatest ultimate service.

Nuttall *Quick-Service* Gears

are particularly adapted for **Light Weight Rolling Stock,** for the following reasons

1 Lightest and Strongest *Quick-Service* Gearing.
2 Narrow Face and Reduction of Section eliminates unnecessary weight.
3 Life four times untreated cast steel
4 Denser and more refined than any other carbon steel.

Nuttall *Quick-Service* Trolleys

are Union Standard. Their accurate, well-balanced construction makes them sensitive to the slightest variation in the direction of the wire as well as equalizing the swaying motion of the car, thus minimizing the possibility of the wheel leaving the wire. Through an arrangement of the base springs any desired wheel pressure can be obtained.

Though this trolley is of light weight and minimum material it will give long, dependable service.

Let Us Know Your Requirements

NUTTALL
PITTSBURGH

New York, January 5, 1918

Electric Railway Journal

Vol. 51, *No.* 1 — *Pages* 1 *to* 68

Contents

Further Electrification of Railroads Important

Electrical equipment presents a most effective way of increasing transportation capacity. F. H. Shepard presents considerations why this is now a timely subject.....Page 4

Applying Engineering Principles to Railways

J. F. Layng discusses the present situation and its connection with the conservation of the nation's resources; of the electric railway's need for statistical and analytical data; of the economics possible with better equipment and scientific running in co-operation with regulatory bodies, and of improved relations with the men.....Page 8

How the Pay-as-You-Pass Car Was Developed

The pay-as-you-leave system, introduced first in Cleveland, prevented boarding delays, but caused congestion at important leaving terminals. Peter Witt describes how the present Cleveland car cuts down boarding and alighting time and insures collection of all fares.....Page 30

JAMES H. McGRAW, *President* — ARTHUR J. BALDWIN, *Vice President and Treasurer* — E. J. MEHREN, *Vice President* — JAMES H. McGRAW, JR., *Secretary*

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Uniformity Cuts Labor

What Is the Value of Tie Uniformity to You?

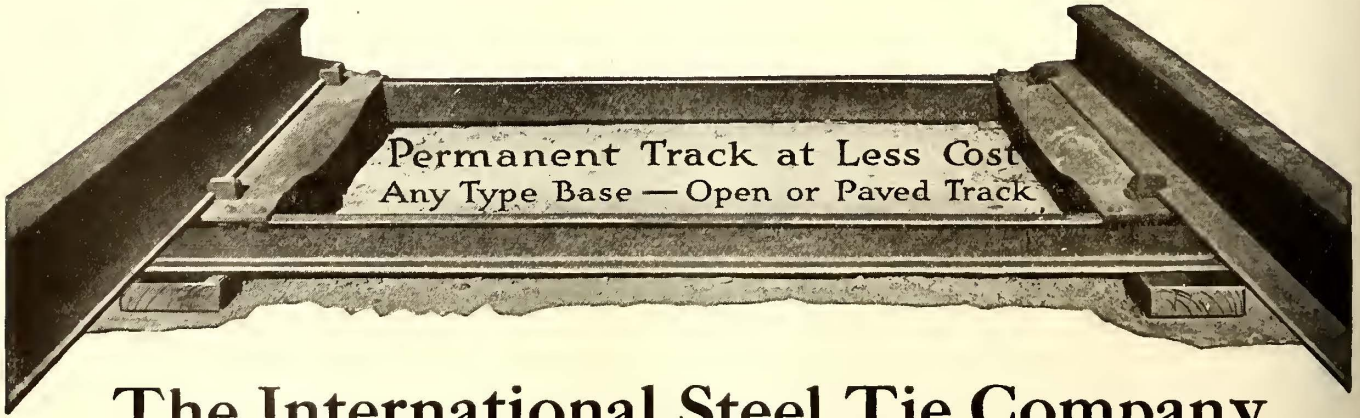
One Sixty-fourth Inch Tolerance Is the Maximum Allowance on

INTERNATIONAL®
STEEL TWIN TIES

What wooden tie will come within this specification? And your track gauge is fixed within the tie tolerance limit. Your track men have absolutely nothing to do with determining the gauge or the nicety of the fit of the rail fastenings. These are all provided for by thoroughly checked gauges in fabricating the ties. Every tie is like every other one, and every rail fastening is the same.

In the finished track the gauge is correct and the rail fastening is secure. After a track man has once been shown how to apply the clips, that's all that is necessary. Nothing need be left to the judgment of the laborer and he can't make a mistake. Steel Twin Ties are absolute insurance against construction errors. Let us show you this feature.

Prompt deliveries made from stock



The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

General Sales Office and Works: Cleveland, Ohio

REPRESENTATIVES:

Western Eng'g Sales Co., Los Angeles, Cal. San Francisco, Cal. Seattle, Wash. R. J. Cooper Co., Salt Lake City, Utah. J. E. Lewis & Co., Dallas, Texas. Maurice Joy, Philadelphia. William H. Ziegler, Minneapolis, Minn.

RICO 1910

L. B. Stillwell reported in April, 1910, to the Interborough Rapid Transit Company that it was most desirable to measure the **Coasting;**

That the accelerating difference in motormen was found to be equivalent to 40.5% coasting, or 36% saving in power;

That the braking difference in motormen was found to be equivalent to 48.5% coasting, or 35.5% saving in power;

That a reduction in time of stop from 15 to 10 seconds would save 25% in power.

Since 1911, in accordance with the recommendations of Mr. Stillwell, the New York subway and elevated lines have been completely and most successfully equipped with Rico Coasting Recorders.

1911

Stone & Webster, in January and February, 1911, made their first installation of Rico Coasting Recorder on the Northern Texas Traction Company.

They found an immediate saving of 12.7% in energy, a reduction of the acceleration period from 40.3 seconds to 20.7 seconds and of the braking period from 28.5 to 18.5 seconds.

As these initial results were constantly bettered by some six years' experience—

Stone & Webster, in 1916, made Rico Coasting Recorders standard also on the Tarrant County Traction Co., the Houston Electric Co., Houston-Galveston Interurban Ry., Columbus Electric Co., Cape Breton Electric Co., Ltd., and Houghton County Traction Company.

Time is the Essence of Railroading

1912

John A. Beeler, Consulting Engineer, as vice-president and general manager Denver Tramway Company, in 1912, was the next big operator to see the value of the Rico Coasting Recorder.

Within one year after installation, the coasting had been raised to 29.6% and the consumption of energy cut down 17.2%.

This was equivalent to a saving of about **$60 a day in the coal bill alone!**

In 1915 Mr. Beeler reported that the energy saving had gone up to 25%, the coasting raised to 38%, front-end accidents decreased 41% and armature life increased over 50%!

Denver has been using the Rico Coasting Recorder with splendid results for some six years.

1913 RICO

Sir Albert H. Stanley, when managing director London Electric Railway, authorized the installation of Rico Coasting Recorders.

The first tests on the Hampstead Tube, made during 1913, raised the general average of coasting to 37.1%, and the maximum to 47.4%.

The average increase in coasting was 14.6% and the reduction in energy requirements, 18.4%.

Sir Albert, therefore, was an **efficient fuel administrator** before Great Britain needed so much more coal for the needs of herself and her Allies.

The entire tube system of London has been served by Rico Coasting Recorders for nearly five years with the same success as on American railways.

Time is the Essence of Railroading

RICO 1914

W. R. Alberger, vice-president and general manager, San Francisco-Oakland Terminal Railways, was responsible for that company's adoption of the Rico Coasting Recorder.

In the preliminary tests on this system, the lowest man's coasting had been raised from 2.9 to 33.5%; the highest man's coasting from 16.6 to 53.6%; the average coasting from 8 to 43.8%!

Between June 30, 1914, and June 30, 1916, this company **saved $118,681 in power cost** alone; and the savings now exceed **$125,000 a year.**

At present prices for power, the savings for 1917 will be greater still.

1915

United Gas & Electric Corporation installed Rico Coasting Recorders on its Knoxville lines in 1915.

Among the advantages of Rico Coasting Recorders noted by the management in addition to the 18.5% decrease in energy were the following:

Fewer flat wheels; decreased accidents; immediate knowledge of defective armatures and motormen's valves; automatic daily report of efficient and inefficient motormen; elimination of unnecessary layovers at terminals; and

Use of fewer cars (as three for four on one line) without decrease in mileage.

Time is the Essence of Railroading

1916

Paul Shoup, president Pacific Electric System, authorized, in 1913, trial of the Rico Coasting Recorder on the heavily traveled Pasadena Lines.

These tests showed that with the use of the Recorder alone, the motormen could save 11.2% in energy.

In 1916 the entire Pacific Electric System was equipped—600 Recorders in all—for all classes of service.

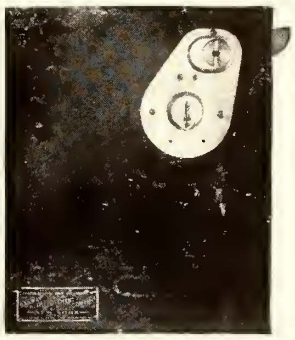
And the results under the able management of this great railway are constantly improving, both in saving of fuel and in speeding up of schedules.

1917

Horace Lowry, President, Twin City Rapid Transit Company, operating in St. Paul and Minneapolis, after exhaustive investigation, authorized the installation of 1100 Rico Coasting Recorders.

The decision of this well-managed, conservative railway, and of its consulting engineers, **A. L. Drum & Company,** was another significant endorsement of the Rico Coasting Recorder as the best possible device for

Saving power, decreasing car maintenance, improving operation and obtaining the most economical schedule speed.



Time is the Essence of Railroading

Fuel Administrator Garfield's Appeal Nation's Crisis by the use of

Recorders

by the Public. The Rico Coasting Recorder offers the without diminishing the Revenue from Riding.

Time is the Essence of Railroading

These electric railways are answering for Coal Economy in the Rico Coasting

Cold Cars and Reduced Service are not well received by the Public. The Rico Coasting Recorder offers the Simplest and Quickest Way to secure Real Economies without diminishing the Revenue from Riding.

Time is the Essence of Railroading

Fuel Administrator Garfield's Appeal Nation's Crisis by the use of Recorders

Time is the Essence of Railroading

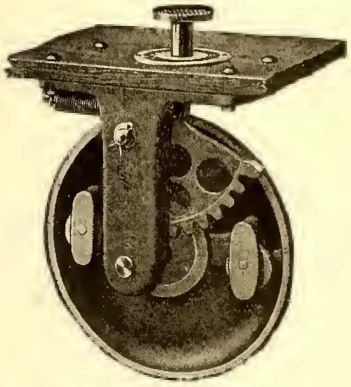
To make money, save time, reduce stops and promote safety—Use these Keystone Specialties

Faraday Car Signal Systems

Operates from line voltage—no batteries. Faraday Push Buttons, Buzzers and Resistances furnish an Ideal, failure-proof car signal system.

Illuminated Car Signs

With these signs destination names can easily be changed and cars rerouted. Well labeled cars make more money. They eliminate the unnecessary stop caused by the intending rider being unable to decipher the destination name within braking distance. They eliminate unnecessary car stops.



Keystone Rotary Gongs

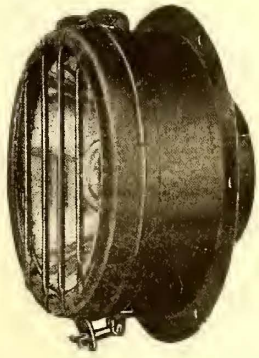
A louder gong and more continuous to meet requirements resulting from modern, heavy, noisy traffic in cities. Cuts down accident claims.

Safety Car Lighting Fixtures

To light up your cars scientifically, efficiently and safely. To save you money. A rapid creator of good public relations.

Keystone Motorman's Seats

For the motorman or conductor. A real collapsible, safe and durable seat. They make operators more contented.

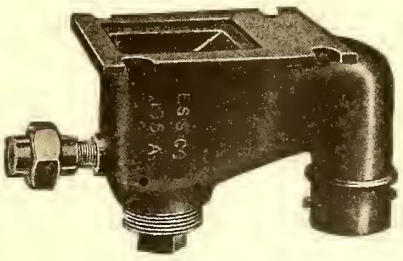


"Golden Glow" Headlights

To light up a path of safety for your cars. Only their famous reflectors can project the distinctive "Golden Glow" light.

Keystone Trolley Catchers

To protect your overhead construction from "flying" poles, thus preventing delays and tie-ups.



Keystone Air Sanders and Valves

To automatically sand your tracks by compressed air. A real device for safety and accident prevention.

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material and Electrical Supplies

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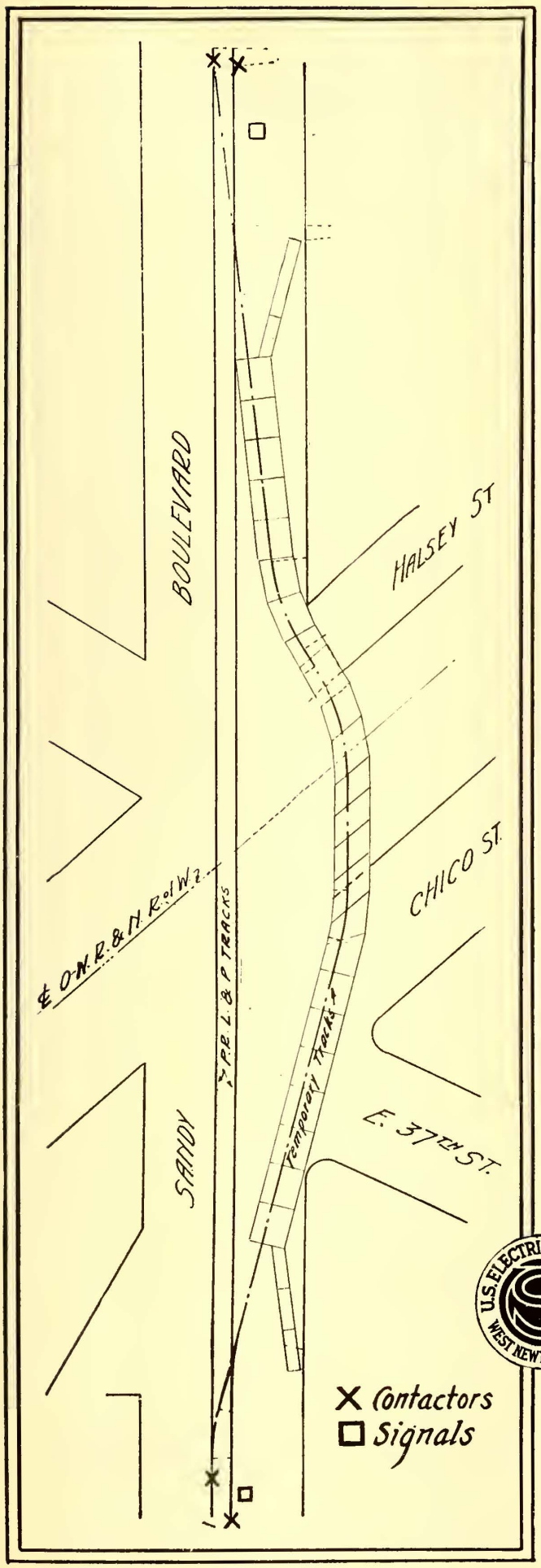
Canadian Distributors: Lyman Tube & Supply Co., Ltd., Montreal, Toronto, Winnipeg



An interesting Two-Track Service over a one track trestle with "U. S." Electric *Type G-I Signals*

To eliminate a grade crossing, the City of Portland, Oregon, is raising the level of Sandy Boulevard, while the Oregon-Washington Railway and Navigation Company is lowering its right-of-way.

In the meantime, the double track line of the Portland Railroad, Light & Power Company has been shifted to a temporary trestle.

This trestle is so narrow that the tracks and trolley wires are gauntleted 7 in. centers, giving in effect a single track.

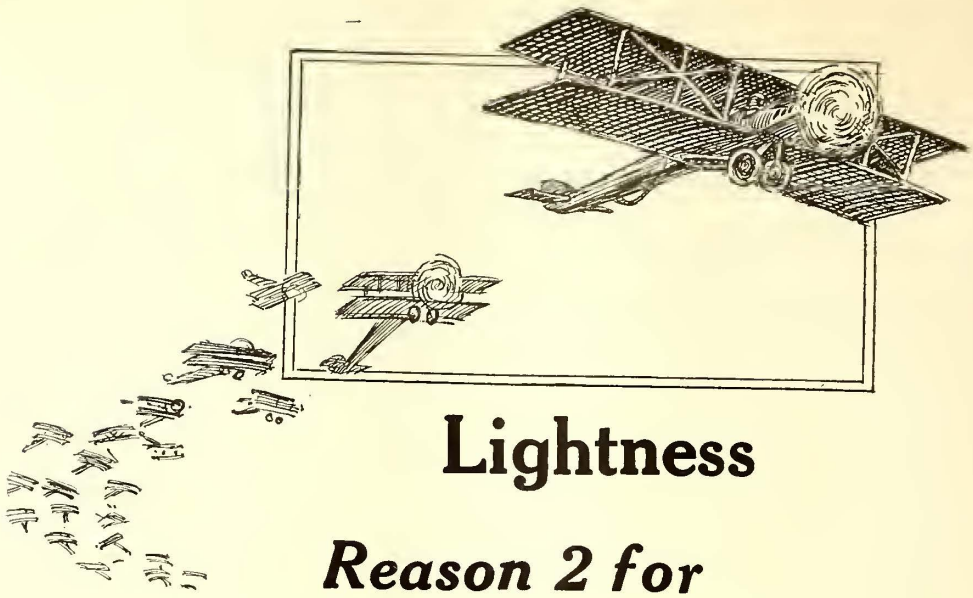
Note how readily safe operation over this temporary structure was secured by using four contractors and two U. S. Electric Signals.

Follow Portland's example of keeping several sets of U. S. Electric Signals on hand for special service.

It insures the safety of all of your passengers all of the time.

United States Electric Signal Company

West Newton, Mass.



Lightness

Reason 2 for

"COPPERWELD" TROLLEY WIRE

"Copperweld" trolley wire weighs 7 to 10 per cent less than copper of equivalent section, so that fewer poles, span wires, hangers, insulators and other fixtures are required.

In these days of extraordinarily high prices, it is worth knowing that the lower cost of "Copperweld" trolley wire itself when compared with copper wire is made still more conspicuous by the savings in the equipment required to carry this trolley wire.

With 40-ft. chestnut poles at $10 each, cedar poles at $13 and tubular poles still higher in price, a saving of 10 per cent in the number of poles would in itself be a worthwhile economy.

Fewer poles, span wires, hangers, insulators and other parts also mean a saving in labor and maintenance as well as in first cost.

General Sales Office
Page Steel and Wire Co.
30 Church St., New York

Western Sales Office
Steel Sales Corporation
Chicago, Illinois

Made from the product of the Copper Clad Steel Co., Pittsburgh, Pa.
Drawn and sold exclusively by

PAGE STEEL AND WIRE COMPANY

MONESSEN, PA.

ESTABLISHED 1883

Your Spring Drive

on Bonding Troubles

Must Be Made with FEWER Men

Uncle Sam's needs are first these days:

His call for men who know how to handle railway equipment is especially insistent.

That means you are going to be short-handed—that four men will have to do the work of eight, two the work of four, one the work of two.

The Erico Portable Welder

Will enable you to meet this shortage. Its equipment is so easily handled and its application of the Erico Welded Bond so simple, that in emergencies one man could do the work.

The Erico Portable Welder, exclusive of the resistor, consists simply of a furnace box faced by a graphite plate which is pressed against the bond terminal by means of a suitable mounting. The carbon electrode which enters the rear of this box during the operation draws an arc on this graphite plate. The furnace box and electrode is surrounded by a magnet which focuses the arc on to the graphite plate, producing the desired spread of the heat necessary for the welding of the terminal. This arc is so enclosed that it is not visible to the eye nor does it strike the bond or rail.

The positive control of the heat of the arc made possible by this construction assures an absolutely uniform homogeneous welding of the bond terminal.

ERICO

THE LINE OF LEAST RESISTANCE

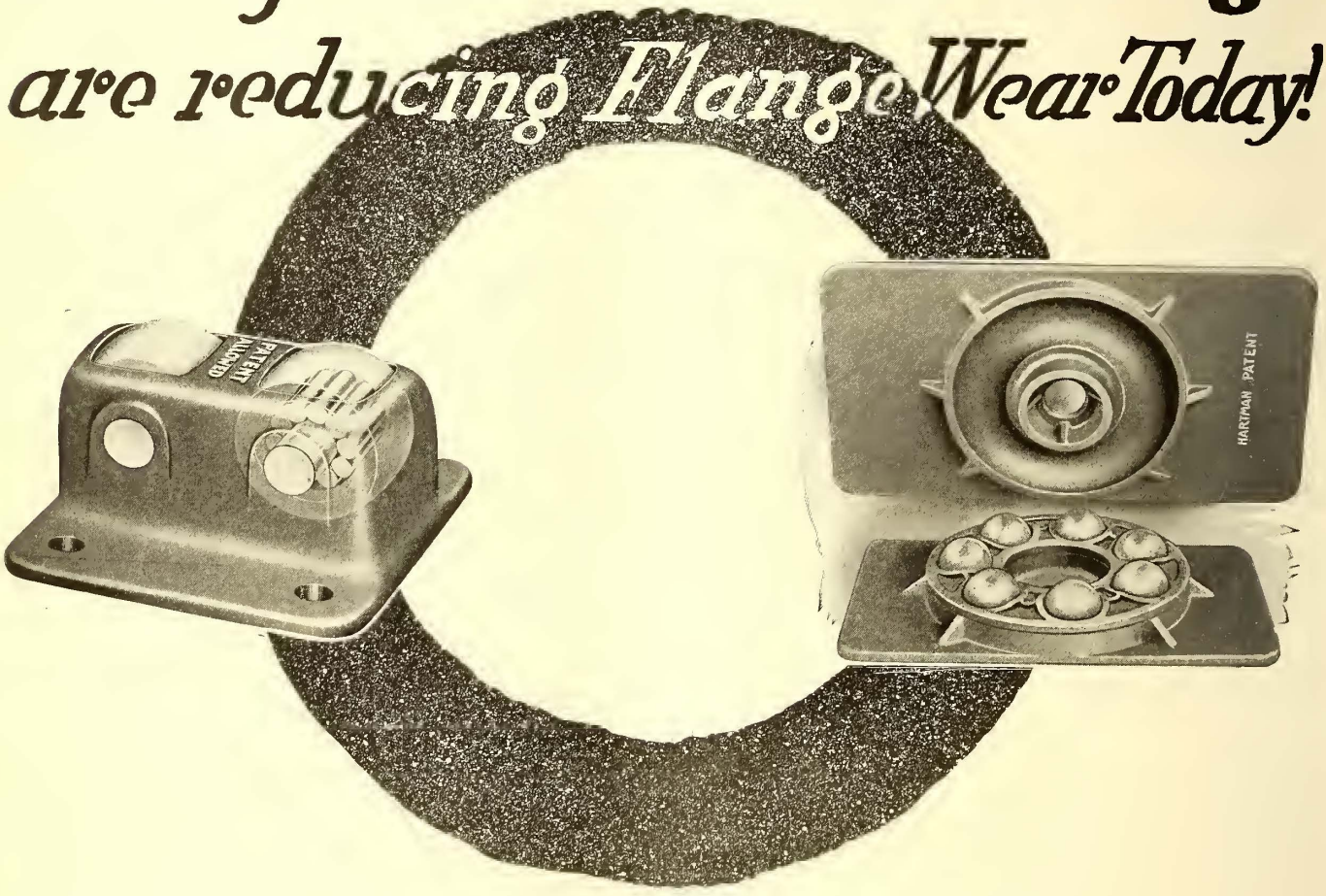
The Electric Railway Improvement Co.

Cleveland

200,000

Perry-Hartman Bearings

are reducing Flange Wear Today!



Double the life of your wheels—cut your pull-ins for wheel renewals by fifty per cent, decrease nosing, lessen flange and rail wear, reduce power consumption on curves and eliminate curve lubrication costs by using Perry-Hartman Bearings.

Ninety-five railways of the United States and Canada are securing these results today on both old and new equipment—their constant repeat orders are forcible testimony.

Send us sketches of your bolsters, present center plates or bearings and we will show you how Perry-Hartman Bearings can be quickly and economically applied —and without obligation on your part.

Holden & White Inc.

Electric Railway Distributors for the Joliet Railway Supply Company

1508 Fisher Building, Chicago

National Railway Appliance Co., New York and Washington; Grayson Railway Supply Company, St. Louis; C. E. A. Carr Co., Toronto; W. M. McClintock, St. Paul; Alfred Connor, Denver; O. H. Davidson Equipment Co., Salt Lake City; F. F. Bodler, San Francisco; S. I. Wailes, Los Angeles; W. F. McKenney, Portland, Ore.

"We've just ordered another carload of Davis Steel Wheels," says the Superintendent of Power and Equipment on the Chicago, Lake Shore and South Bend Railway.

Their 55-ton equipment hits 60 miles per hour in stretches on the sandy south shore of Lake Michigan. They are getting the mileage, *with safety*, from Davis One-Wear Manganese Steel Wheels.

Uniform wheel diameter is important in their A.C. motor operation. By eliminating expensive re-turning of treads and flanges they obtain a better power factor —more economical operation.

The testimony of the South Shore lines warrants your serious thought.

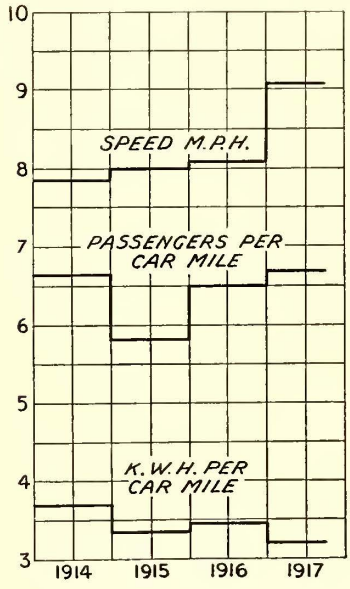
The Standard
for
Electric Railway Service

AMERICAN STEEL FOUNDRIES

1100 McCORMICK BUILDING CHICAGO

Meter the Car Energy

Note what they did in



Showing the Reduction in Power Consumption Accomplished by the Tri-City Railways after Installing Economy Meters on their Cars

It's one thing to spasmodically cut down power consumption. It's quite a different thing to hold that gain over a period of years. That's the real test!

And that's what they did in Davenport—made the gain and held it!

In June, 1915, the Tri-City Railways installed ECONOMY METERS on their cars. A reduction in power consumption was apparent at once.

In November, 1917, the company had not only held the saving, but materially increased it.

The accompanying chart, taken from the ELECTRIC RAILWAY JOURNAL of Dec. 15th, shows the downward trend of the energy consumption curve, notwithstanding an increase in schedule speed.

The Journal article, describing the Tri-City Railways' experience with meters, says in part:

"The records covering the entire Illinois and Iowa electric railway properties for the last four years and averaged over all the lines for each year, show an increase in passengers, per car mile, of .9 per cent and per car hour of 15.9 per cent and, despite these increases, a decrease in energy consumption per car mile, of 13 per cent. * * * *

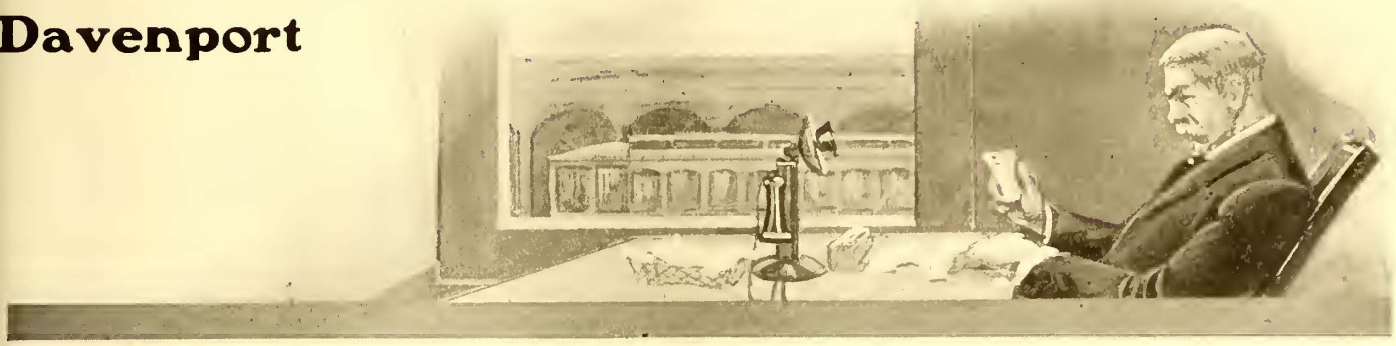
"Other than the installation of meters, there has been no change in particular on the system which would tend to better the energy consumption."

METER THE ENERGY—That's What You Want to Save

ECONOMY ELECTRIC DEVICES CO.
Exclusive Sales Agent Sangamo Economy Railway Meters
Old Colony Bldg. Chicago, Ill.

—and Save the Fuel!

Davenport



This device on your cars will start paying for itself AT ONCE.

It posts the motorman on the least wasteful method of using the motive power.

It shows him how he wastes energy by failing to accelerate quickly enough.

It points out to him the cost to his company when he continually "fans" the brakes.

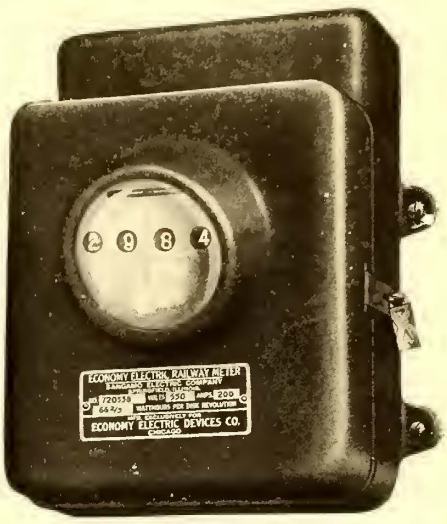
It proves to him that proper coasting saves energy and improper coasting wastes it.

It teaches him how to safely handle his car in the most economical manner and stimulates him to greater efficiency in competition with his fellow workers "on the front end."

It enables electric railways to effect generous savings at the coal pile.

We shall be pleased to supply you with any desired technical data and to quote you on your requirements.

The Economy Meter promotes more economical use of energy in car operation. It is easily installed by connecting in series with the car circuit breaker. It displays the car motor energy consumption on cyclometer dials like a fare register. These readings are the basis for checking the performance of motormen. Comparison of the records induces sustained effort to excel. Thus energy is saved.



The ECONOMY Meter

"The Watchdog of Your Power"

RUGGED
TIME-TRIED
EASILY INSTALLED
Low in First Cost
Low in Maintenance

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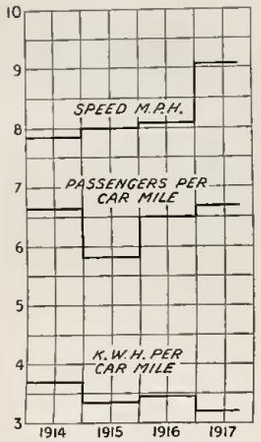

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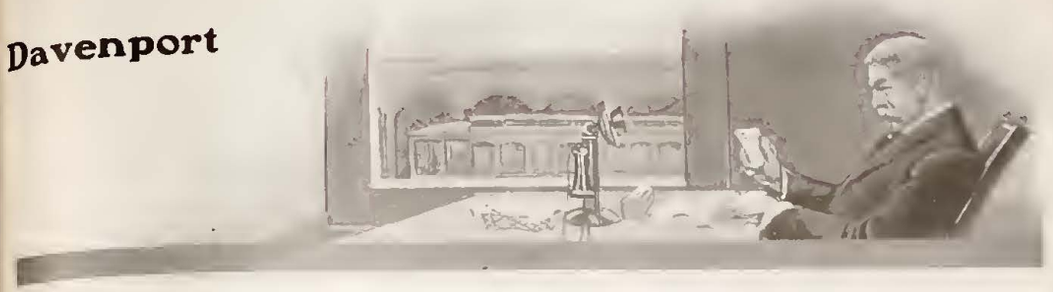
Exclusive Sales Agent Sangamo Economy Railway Meters
Old Colony Bldg. Chicago, Ill.

—and Save the Fuel!



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Exclusive Sales Agent Sangamo Economy Railway Meters
Old Colony Bldg. Chicago, Ill.

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Conductresses on National Pneumatic Cars In Modern New York

National Pneumatic Door and Step Control

SPEEDS THE CAR

Perhaps, when your conductor is just beginning his day's work—and has nothing else to divide his attention—he can operate the door and step mechanisms by hand practically as fast as by means of air.

But on a schedule of eight stops per mile, eighty stops an hour, eight hundred stops a day, Mr. Conductor or Miss Conductress would soon have to slow up and lose one second or more at every stop.

Whereas the operation of doors and steps by air—

Is just as snappy, just as speedy and just as safe at the crest of the rush hour—

As it was for the first stop made out of the carhouse.

Almost Every Peter Witt Car in Use Is Equipped with National Pneumatic Door and Step Control

NATIONAL PNEUMATIC COMPANY

50 Church St. New York

515 Laflin St. Chicago

A Motoress on a Car In Ancient Rome

National Pneumatic Door and Step Control

GETS THE FARES

One of our shrewdest electric railway men said lately that air brakes would pay for themselves if they did no more—

Than remove the temptation of the motorman to skip intending passengers.

Exactly the same reasoning holds for the use of air-operated doors at either end of the car—

Because the operators of front-entrance cars will accept every person who offers to ride—

While the conductors of rear-entrance cars will be much more likely to re-open the doors for the last-second customer.

The Safety Cars Equipped by the Safety Car Devices Company Include National Pneumatic Engines

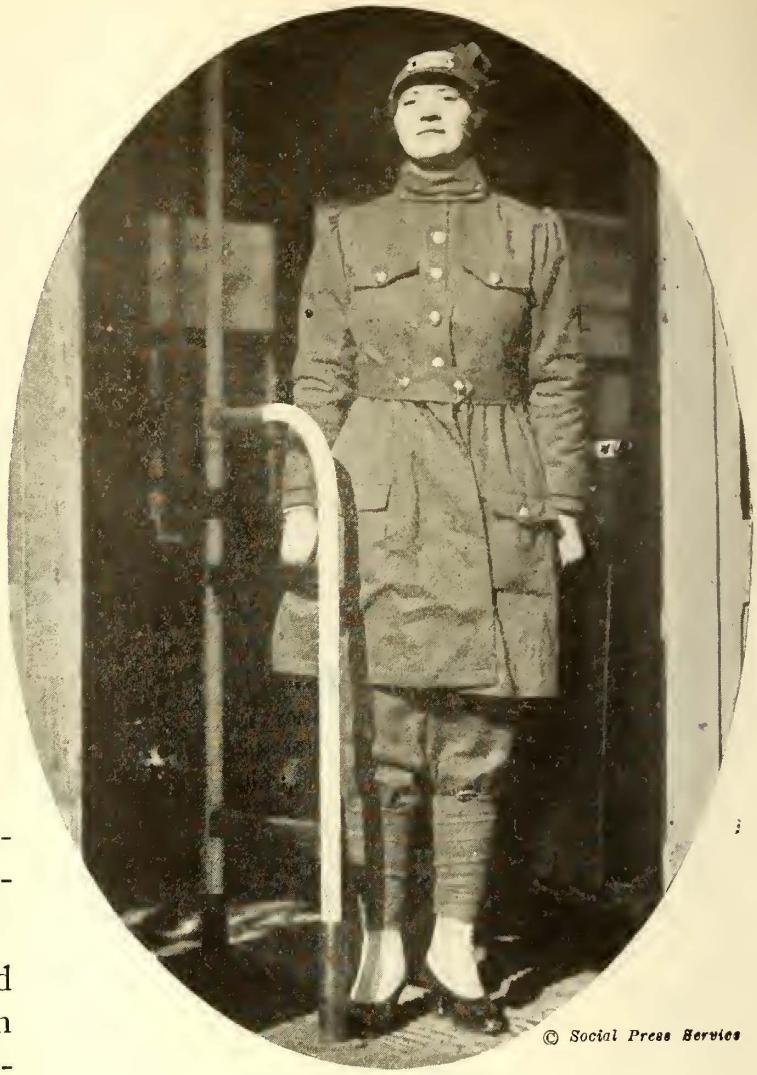
NATIONAL PNEUMATIC COMPANY

50 Church St. New York

515 Laflin St. Chicago

National Pneumatic Door and Step Control

HOLDS THE EMPLOYEES



© *Social Press Service*

The first conductress on the New York Railway's center entrance cars, which are equipped with National Pneumatic Door Engines

It costs $50 to $100 each to examine, investigate, train and accept a platform recruit.

And until this employee has had at least three years' service, an average accident charge of several hundred dollars must be added.

To reduce these expenses and also to enjoy the public relations advantages of experienced employees, it is necessary to make platform service more attractive.

The operation of doors and steps by air not only makes this service attractive to a larger number of men, but even makes platform employment entirely feasible for women.

Women Are Now Operating Both City and Rapid Transit Cars Equipped with National Pneumatic Control

NATIONAL PNEUMATIC COMPANY

50 Church St. New York — 515 Laflin St. Chicago

© *International Film Service*

The First Woman Guard on the New York Municipal Railway's Rapid Transit Cars, 250 of which have National Pneumatic Door Engines

National Pneumatic Door and Step Control

PLEASES THE PATRONS

Unfailing obedience to the patrons' desire to board the car, together with the—

Rapid opening and closing of doors with gratifying speed, absolute safety and minimizing of the "door-open" interval in winter—

Are the immediate **outward** proofs of satisfactory service to the public.

Deeper, though less apparent to the eye, is the development of a more courteous attitude by the platform employees who, freed from the fatigue of physical effort, find the time to—

Think of the Passenger as a Customer because assisted by National Pneumatic Control

NATIONAL PNEUMATIC COMPANY

50 Church St. New York — NPC — 515 Laflin St. Chicago

Save the seconds to Improve Service Increase Revenue

Time is Money

to carrier and carried

Especially in city car operation

Where the many small leaks of time may be

Big enough in the aggregate to cause

Poor service with low returns

Instead of

Good service with increased returns.

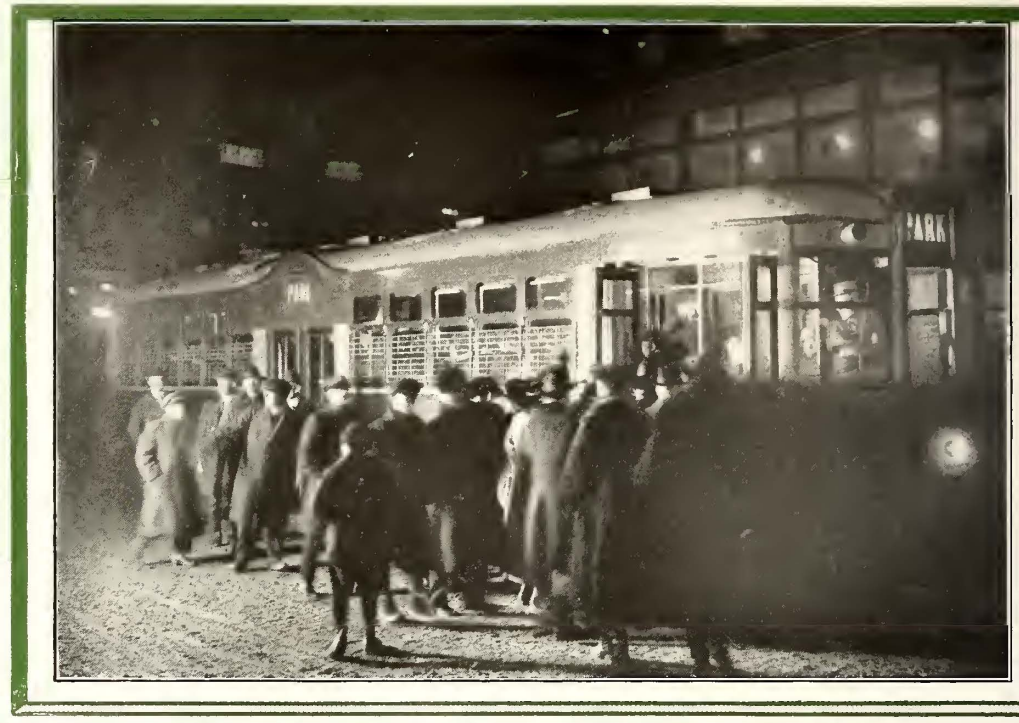
Modern G-E Equipment saves time

The following pages tell how

General Electric Company

General Office: Schenectady, N. Y.

Sales offices in all large cities



Low Rate of Acceleration

The Loss

After making a certain traffic survey, a leading engineer stated that one of the principal things the railway could do to reduce downtown congestion was to accelerate its cars at 2 m.p.h.p.s. instead of 1 to 1½ m.p.h.p.s.!

And this change would also save money as against the expense of rerouting.

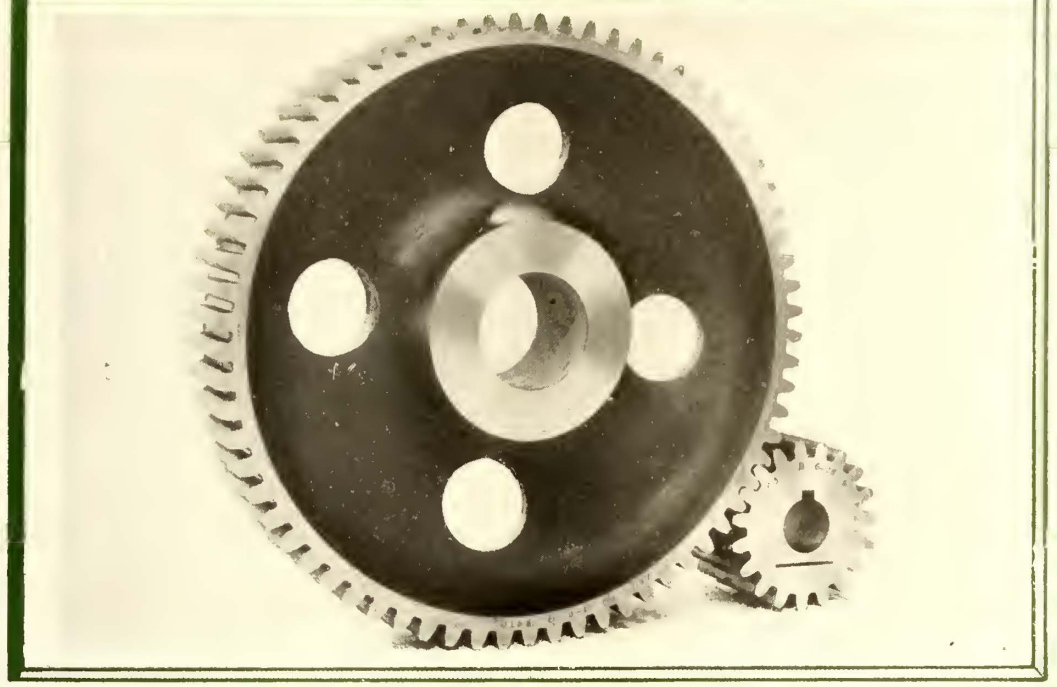
One second wasted per stop does not seem important. But consider the aggregate loss on a car with 8 stops per mile, at 10 m.p.h. schedule speed and 12 hours daily use of the car for 360 days a year.

Eight seconds a mile, 1 minute 20 seconds an hour, 16 minutes a day, 5760 minutes a year or

Eight Days Lost Per Car Per Annum

General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities



Low Rate of Acceleration

The Remedy

G-E equipment offers two ways to secure the time and money-saving advantages of high rates of acceleration.

A Change of Gearing

Your present motors with proper gear ratios may be able to make the desired schedule speeds with the least use of energy. In offering you its gearing the General Electric Company will consider your problems from both the mechanical and traffic standpoint.

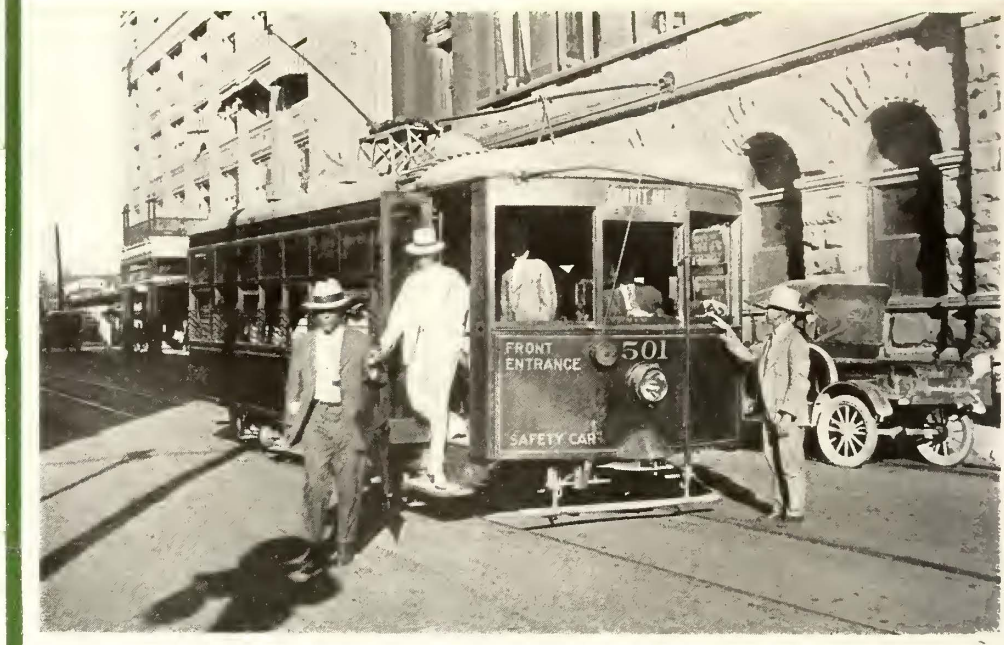
G-E Motors and G-E Gearing

The electrical characteristics of modern G-E Motors and their high capacity relative to weight are permitting on light-weight safety cars

The Most Efficient Rates of Acceleration

General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities



Low Rate of Braking

The Loss

Entirely aside from its inferior ability to prevent accidents, a low rate of braking means costly loss of time—often as much as

10 Per Cent Difference in Schedule Speed

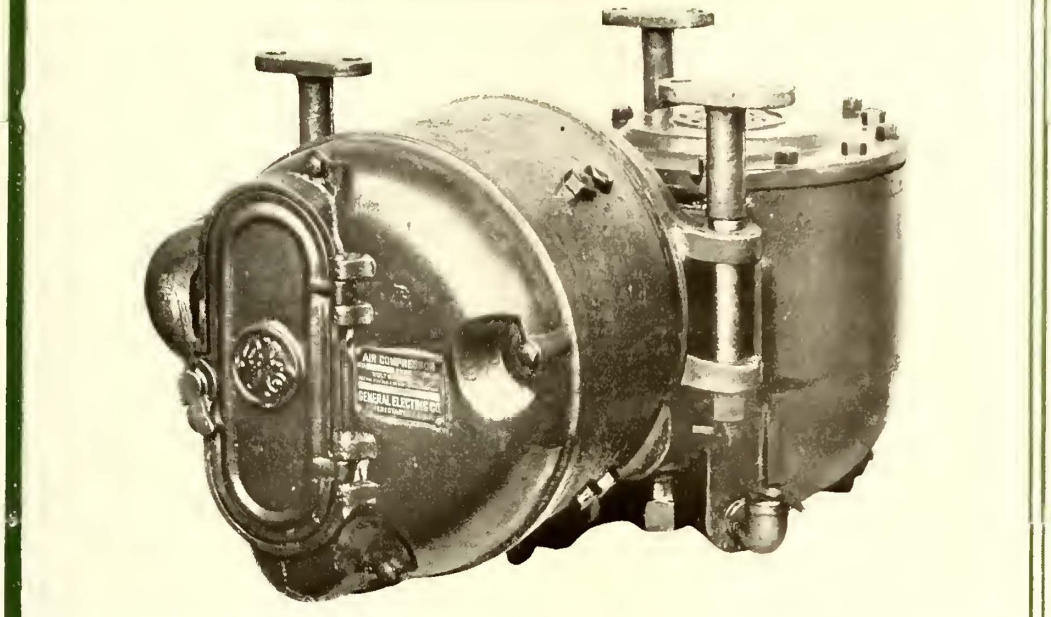
It follows that because of its lower rate of retardation in making normal stops—particularly when the motorman is tired—the handbrake should be used only often enough to insure its reliability when needed.

Every car, no matter how light, should have an air brake to insure the safe, satisfactory and efficient service that can be obtained only through the use of an

Unvaryingly High Rate of Braking

General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities



Low Rate of Braking

The Remedy

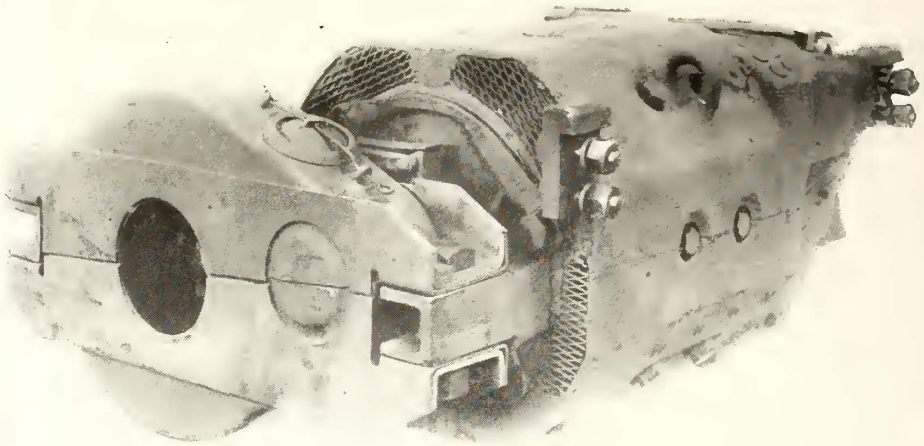
The C P Type Compressors are noted for low maintenance because of such features as a practically uniform thrust which prevents uneven wear of bearings; continuous, positive lubrication and center gear drive free from dirt. These compressors cover the entire field of modern electric railroading.

The General Electric Company offers an air-brake system complete in every operating detail from compressor to motorman's valve.

G-E Compressors and Air Brake Equipment

General Electric Company

General Office: Schenectady, N. Y. **Sales offices in all large cities**



The G-E 247 (40 HP.) Railway Motor

High Floors and Steps

The Loss

There can be no question about the loss of time caused by high steps.

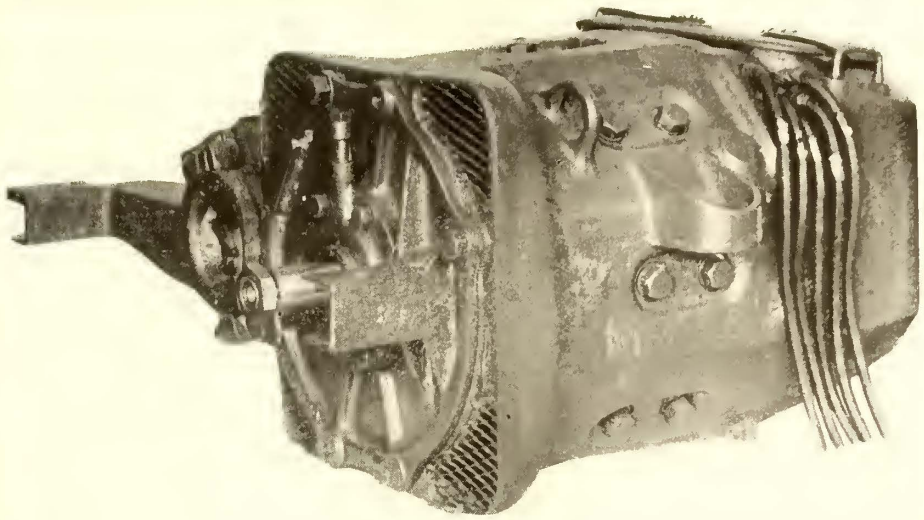
When we see a conductor leave the car to lift a child on or off or observe the deliberate movements of the parcel-laden passenger, the loss of time is evident.

It is a fact that even the most active passenger lengthens the standing time of a car because a high floor means an extra step. At a loss of time of say half a second per step—a car carrying 60 passengers from terminal to terminal would lose 30 seconds and add

One More Minute Per Trip

General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities



The G-E 258 (25 HP.) Railway Motor

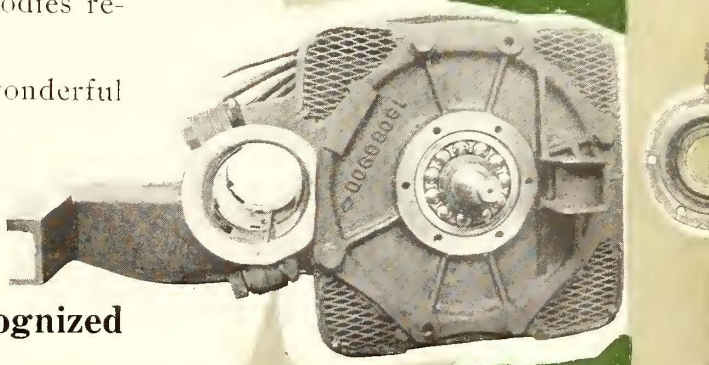
High Floors and Steps

The Remedy

The G-E 258 and G-E 247 Motors are the answer to the elimination of time losses due to high floors and steps.

These motors are of dimensions which permit them to be used with 24 or 26 inch wheels, whereas motors previously available under the same car bodies required 30 inch wheels.

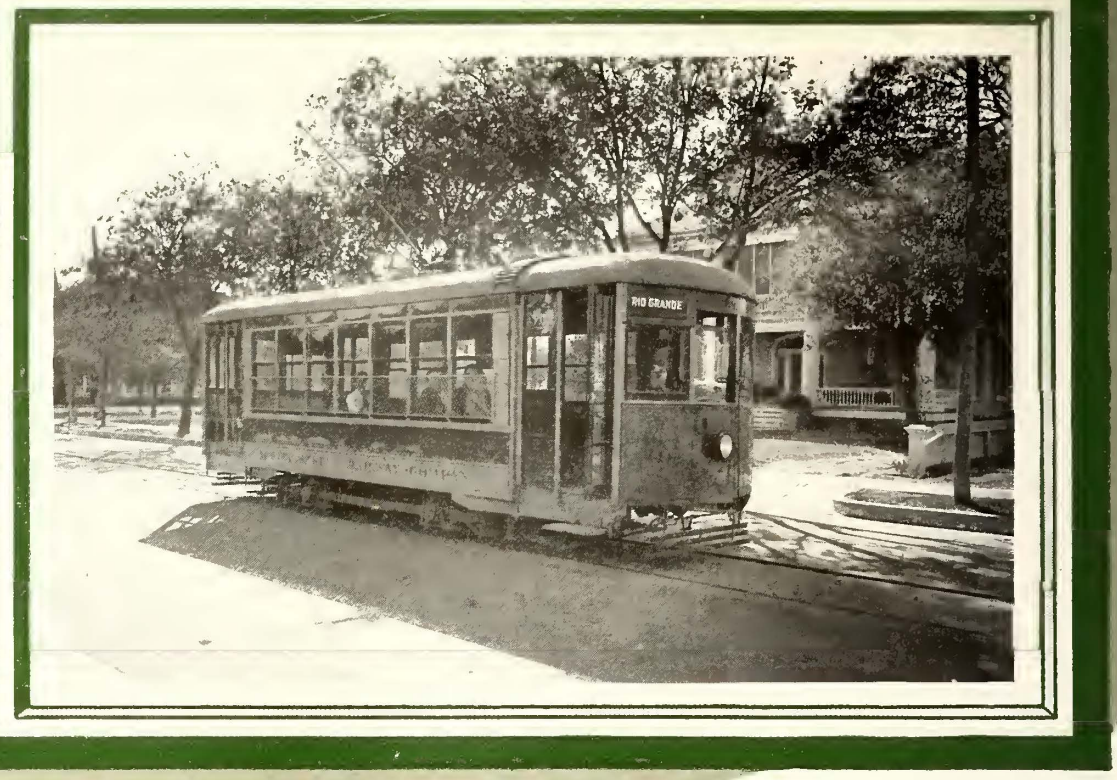
Operated in pairs, the G-E 258 has proved a wonderful success under the lightweight safety car; and operated in quadruple sets, both the G-E 258 and G-E 247 have proved equally adapted to the largest low-floor city cars of the day.



G-E 258 and G-E 247 Motors Are the Recognized Standards for Low-Floor City Cars

General Electric Company

General Office: Schenectady, N. Y. **Sales offices in all large cities**



Hand-Operated Doors and Steps

The Loss

The air-brake on city cars was once considered a luxury for the motorman.

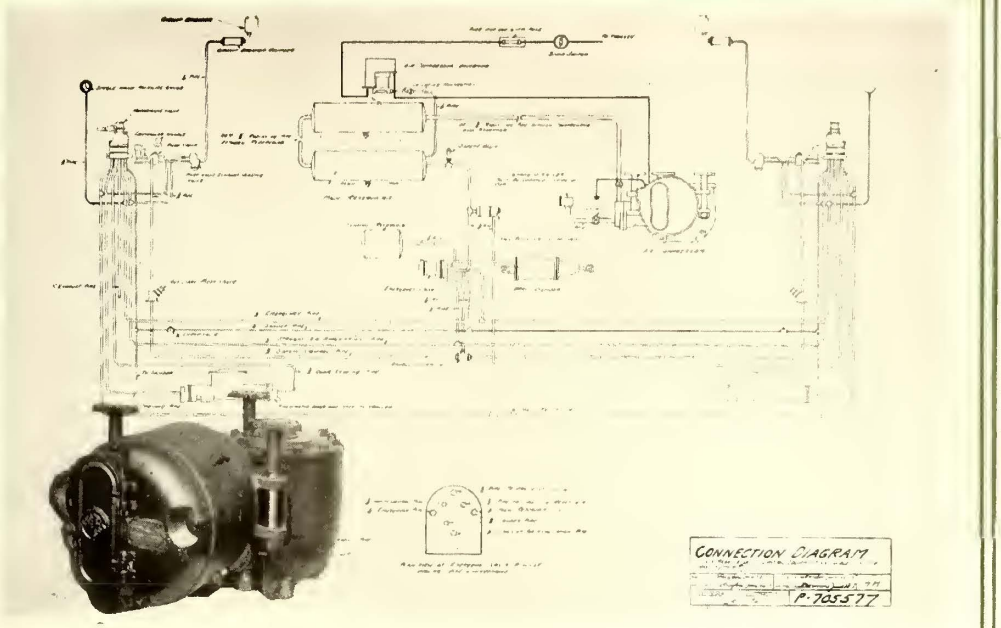
Now we know that in speeding up schedules, the air-brake lowers operating costs and betters service.

So is it proving with air-operated doors and steps.

Hand operation of doors and steps slows down the schedule.

Nor does hand operation encourage the motorman of a prepayment car to open his doors quickly for exit—but he will do this promptly and as a matter of course with pneumatically-operated doors. By reducing opposing streams of travel

Air Operation Saves Many Seconds Per Trip



Hand-Operated Doors and Steps

The Remedy

In the combination of control, braking, door and step devices operated by air, we see the most efficient use of the time elements of acceleration, braking and stops.

But in **any** car with air-operated doors and steps so much responsibility centers upon the compressor and governor that their reliability is of extraordinary importance.

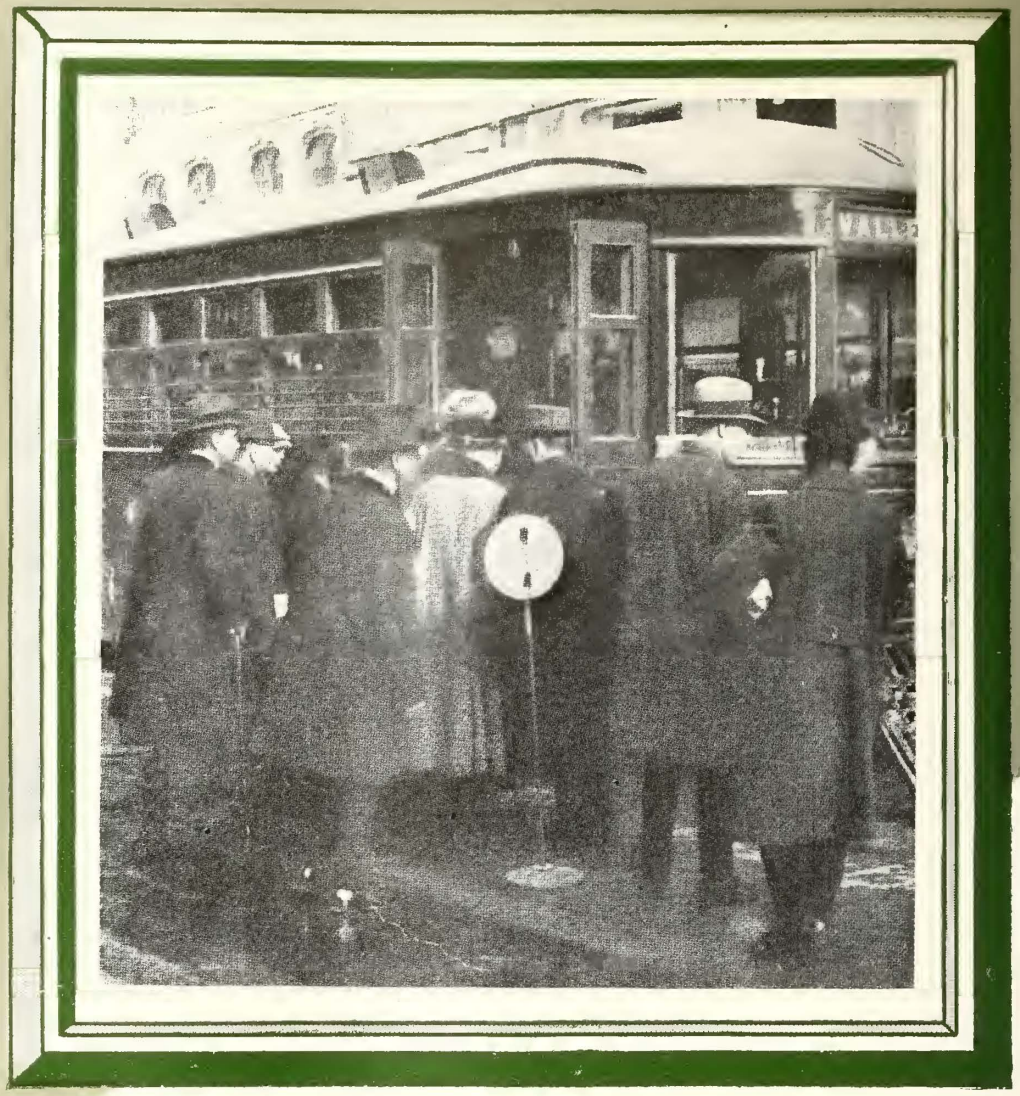
Ease of upkeep actually is vital to operators with limited shop facilities.

Early recognition of these requirements is responsible for the wide sale and successful use of the

CP-25 Air Compressor and ML Governor

General Electric Company

General Office: Schenectady, N. Y. **Sales offices in all large cities**



Bulky Platform Equipment

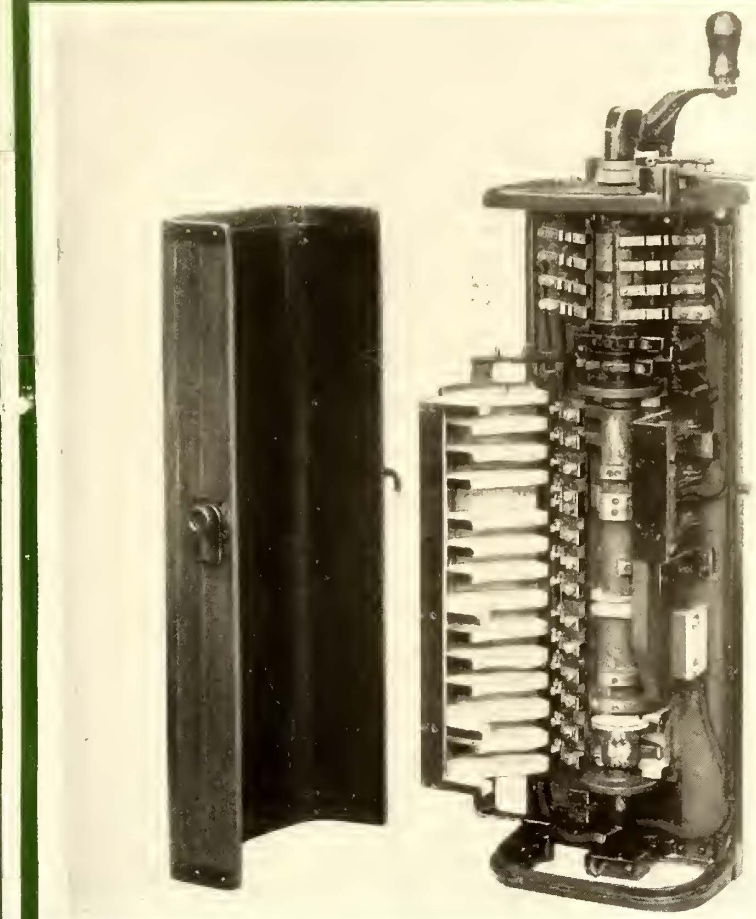
The Loss

Less tangible than some of the other factors discussed has been the loss of time due to bulky equipment on the platform.

Recent developments have given this factor still greater importance. For example, on one-man cars, and many other types of cars, a single platform which receives all entering passengers must serve for control, brakes, door and step mechanisms, fare box, operator's stool and the operator himself—

Hence under these congested conditions it is more important than ever before to

Install Platform Equipment That Is Compact and Reliable



The
K-63
Controller

Bulky Platform Equipment

The Remedy

The General Electric Air Brake system and air-operated doors and steps will go a long way toward clearing the platform since they eliminate the need for long brake and door-operating handles.

In addition to this is the exceptionally light and small controller—the K-63—designed for equipments up to two 40 h.p. 600 volt motors.

Sprague-General Electric P. C. Control is still another solution of the congestion problem. In addition, it provides automatic acceleration which promotes the highest possible schedule speed; most economical use of energy; absolute protection against abuse of equipment; insurance against throwing passengers by jerky manipulation and relief of motorman from detail attention to controller notching, thus allowing him to

Take Advantage of Every Opportunity to Make Time Safely

General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities

The principal manufacturing plants of the General Electric Company are located at Schenectady, N. Y.; Lynn and Pittsfield, Mass.; Harrison, Newark and Watsessing, N. J.; Cleveland, Ohio; Erie, Pa.; and Fort Wayne, Ind. The total floor space is nearly 15,000,000 square feet.

To insure correspondence against avoidable delay, all communications to the Company should be addressed to the sales office nearest the writer.

THE SALES OFFICES OF THE GENERAL ELECTRIC COMPANY ARE AS FOLLOWS:

Atlanta, Ga.	Third National Bank Building
Baltimore, Md.	Lexington Street Building
Birmingham, Ala.	Brown-Marx Building
Boston, Mass.	84 State Street
Buffalo, N. Y.	Electric Building
Butte, Montana	Electric Building
Charleston, W. Va.	Charleston National Bank Building
Charlotte, N. C.	Commercial National Bank Building
Chattanooga, Tenn	James Building
Chicago, Ill.	Monadnock Building
Cincinnati, Ohio	Provident Building
Cleveland, Ohio	Illuminating Building
Columbus, Ohio	Columbus Savings & Trust Building
*Dallas, Texas	Interurban Building
Dayton, Ohio	Schwind Building
Denver, Colo.	First National Bank Building
Des Moines, Iowa	Hippee Building
†Detroit, Mich.	Dime Savings Bank Building
Duluth, Minn.	Fidelity Building
Elmira, N. Y.	Hulett Building
*El Paso, Texas	500 San Francisco Street
Erie, Pa.	Marine National Bank Building
Fort Wayne, Ind.	1600 Broadway
Hartford, Conn.	Hartford National Bank Building
*Houston, Texas	Third and Washington Streets
Indianapolis, Ind.	Traction Terminal Building
Jacksonville, Fla.	Heard National Bank Building
Joplin, Mo.	Miners' Bank Building
Kansas City, Mo.	Dwight Building
Knoxville, Tenn.	Bank & Trust Building
Los Angeles, Cal.	724 S. Spring Street
Louisville, Ky.	Starks Building
Memphis, Tenn.	Randolph Building
Milwaukee, Wis.	Public Service Building
Minneapolis, Minn.	410 Third Ave., North
Nashville, Tenn.	Stahlmann Building
New Haven, Conn.	Second National Bank Building
New Orleans, La.	Maison-Blanche Building
New York, N. Y.	120 Broadway
Niagara Falls, N. Y.	Gluck Building
*Oklahoma City, Okla.	Terminal Building
Omaha, Neb.	Union Pacific Building
Philadelphia, Pa.	Witherspoon Building
Pittsburgh, Pa.	Oliver Building
Portland, Ore.	Electric Building
Providence, R. I.	112 Turks Head Building
Richmond, Va.	Virginia Railway and Power Building
Rochester, N. Y.	Granite Building
Salt Lake City, Utah	Newhouse Building
San Francisco, Cal.	Rialto Building
Schenectady, N. Y.	G-E Works
Seattle, Wash.	Colman Building
Spokane, Wash.	Paulsen Building
Springfield, Mass.	Massachusetts Mutual Building
St. Louis, Mo.	Pierce Building
Syracuse, N. Y.	Onondaga County Savings Bank Bldg.
Toledo, Ohio	Spitzer Building
Washington, D. C.	Evans Building
Youngstown, Ohio	Stambaugh Building

† General Electric Company of Michigan
*Southwest General Electric Company
For Hawaiian business address
Catton Neill & Company, Ltd., Honolulu
For all Canadian business refer to
Canadian General Electric Company, Ltd., Toronto, Ont.

For business in Great Britain refer to
British Thomson-Houston Company, Ltd., Rugby, Eng.

General Foreign Sales Offices: Schenectady, N. Y.; 120 Broadway, N. Y. City; 83 Cannon St., London, E. C. Eng.

FOREIGN OFFICES AND REPRESENTATIVES

ARGENTINA: Cia. General Electric Sud-Americana, Inc., Buenos Aires; AUSTRALIA: Australian General Electric Co., Sydney and Melbourne; BRAZIL: Companhia General Electric do Brazil, Rio de Janeiro; CENTRAL AMERICA: G. Amsinck & Co., New York, U. S. A.; CHILE: International Machinery Co., Santiago, and Nitrate Agencies, Ltd., Iquique; CHINA: Anderson, Meyer & Co., Shanghai; COLOMBIA: Wesselhoeft & Wisner, Barranquilla; CUB:A Zalso & Martinez, Havana; ENGLAND: General Electric Co. (of New York), London; INDIA: General Electric Co. (of New York), Calcutta; JAPAN and KOREA: General Electric Co. and Bagnall & Hilles, Yokohama; Mitsui Bussan Kaisha, Ltd., Tokyo and Seoul; MEXICO: Mexican General Electric Co., Mexico City; NEW ZEALAND: The National Electric & Engineering Co., Ltd., Wellington, Christchurch, Dunedin and Auckland; PERU: W. R. Grace & Co., Lima; PHILIPPINE ISLANDS: Frank L. Strong Machinery Co., Manila; SOUTH AFRICA: South African General Electric Co., Johannesburg, Capetown and Durban.

7556

General Electric Company

GENERAL OFFICES SCHENECTADY, N. Y.

The market for good transportation service at fair prices is greater today than ever

THE peculiar conditions now surrounding the traction business present striking examples of the inexorable working of the law of compensation.

In the face of a "sellers' market" for nearly every other commodity, the purveyor of traction service faces a "buyers' market."

In almost every general line of business the seller is delivering what, when and how, it pleases him to deliver, at almost any price it pleases him to charge.

The electric railway company is being forced to deliver a constantly better product with a constantly mounting cost at a price which the buyer fixes.

Under these circumstances it is not surprising that the electric railway industry forgets that during many years, when other lines of business were struggling for meager profits, the electric railway industry was having everything its own way, the sellers of transportation were enjoying absolute domination of the market, the buyer (the public) was eagerly accepting whatever service it could get on any terms the seller chose to name.

Those days of joyous opulence and arrogance for transportation sellers have been gone now these many years and the dominant spirit of electric railway companies today is one of superior service and strict economy for a rate that will yield a fair return on investment.

Had the progress in the changing of the old order of things been simultaneous throughout the whole industry and had it been accompanied by the vigorous continuous education of the public, it is highly probable that the complexion of things would now be vastly more satisfactory and profitable for the electric railway industry as a whole.

Unfortunately, this progress was "spotty," halting, and the element of the education of the buyer was and still is sadly neglected.

The buyer, still finding a few instances of the reactionary tendency, looks with suspicion on the goods deliv-

ered and the prices charged and in the absence of full and sufficient information as to the real facts harbors the ancient suspicion and grudge.

It seems then manifest that what is frequently called "the trouble with the electric railway industry" is simply a state of mind.

First a state of mind of some operating companies which are not perfecting service and achieving economies to the full extent of possibility; and second, a state of mind of the public due to ignorance and prejudice which the industry has not yet taken sufficiently vigorous means to remove.

Here is no place for pessimism, doubt, or foreboding.

What is needed is vigorous, concerted, continuous action.

Great strides have been made in rendering better service at lower costs of operation.

The public is learning, and is getting a clearer vision of traction problems and a more thorough idea of the true relation of the electric railway to the public.

Both of these elements in progress can be tremendously speeded up. Action to that end is the most pressing and important business of every company, every manufacturer, and every educational factor in the field.

Much of encouragement for such action exists in the tendency toward fare increases, as shown by the rulings of various public service commissions. As such increases are granted they will afford the opportunity for better service to the public.

Not less important, from the standpoint of earning power, is the great opportunity for development of freight business which now confronts the industry.

The market for transportation service is greater than it ever was and is constantly growing. The opportunities for the exploitation of that market on a sound, economic, business-like basis are continually growing. If the latent energy of the industry is used to anything like its possible power, this present cloud of ignorance and prejudice will quickly pass, the chill of inertia will melt away and the electric railway industry will come into the broad sunshine of prosperity.

The deadliest policy the electric railway company or the manufacturer serving the field can adopt is a policy of drifting.

"It is always easy to get unanimous consent to do nothing."

Electric Railway Journal

Tenth Avenue at 36th Street

New York

Member Audit Bureau of Circulations

Peacock Improved

On the Peter Witt Cars at Buffalo

The one hundred new Peter Witt cars at Buffalo will make a hit because they promote the **quick** handling of passengers.

The Peacock Improved Brakes on these one hundred cars will make a hit because they promote the **safe** handling of passengers.

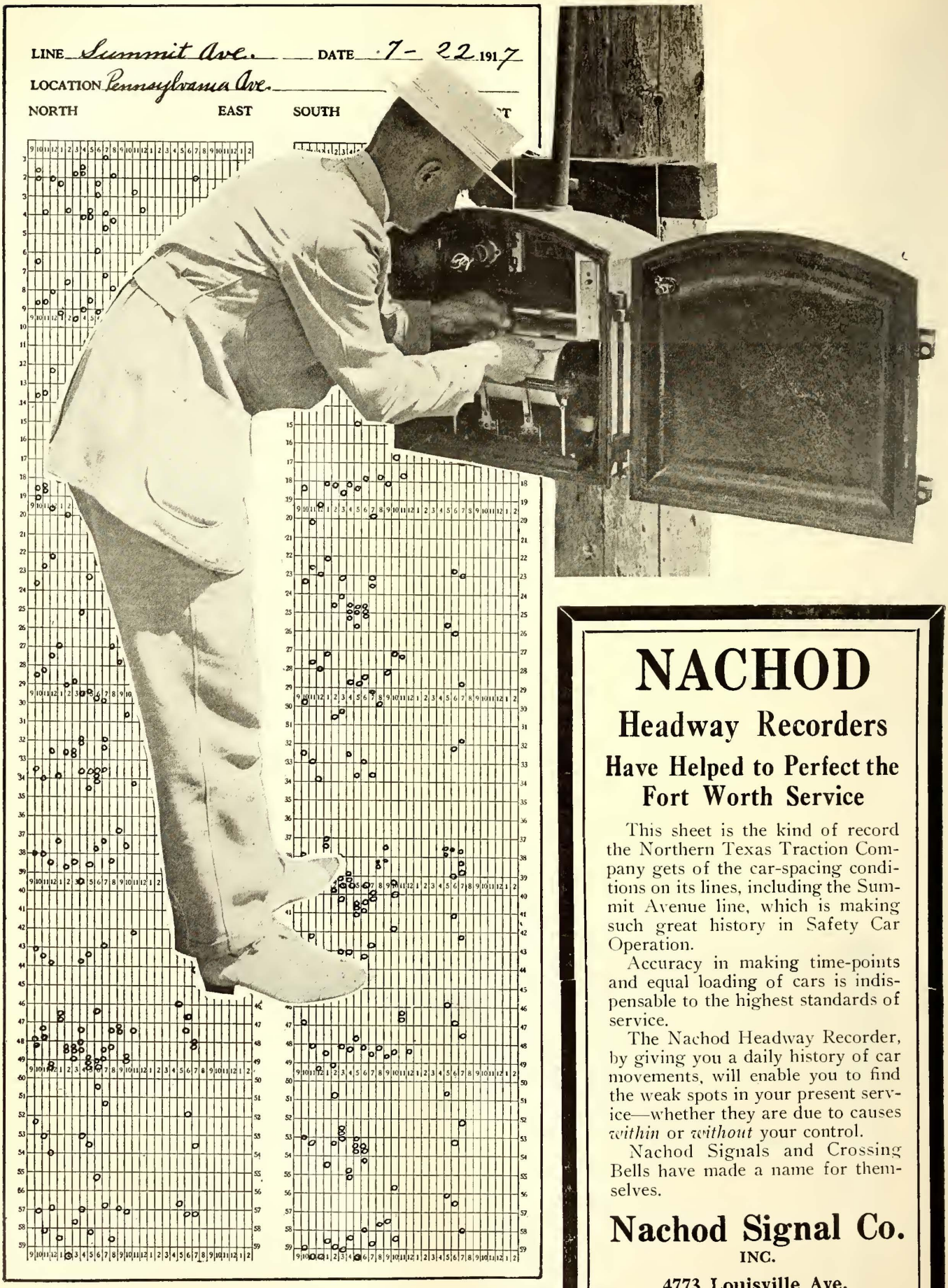
The Peacock Improved is excellent for any front-entrance car because of its compactness.

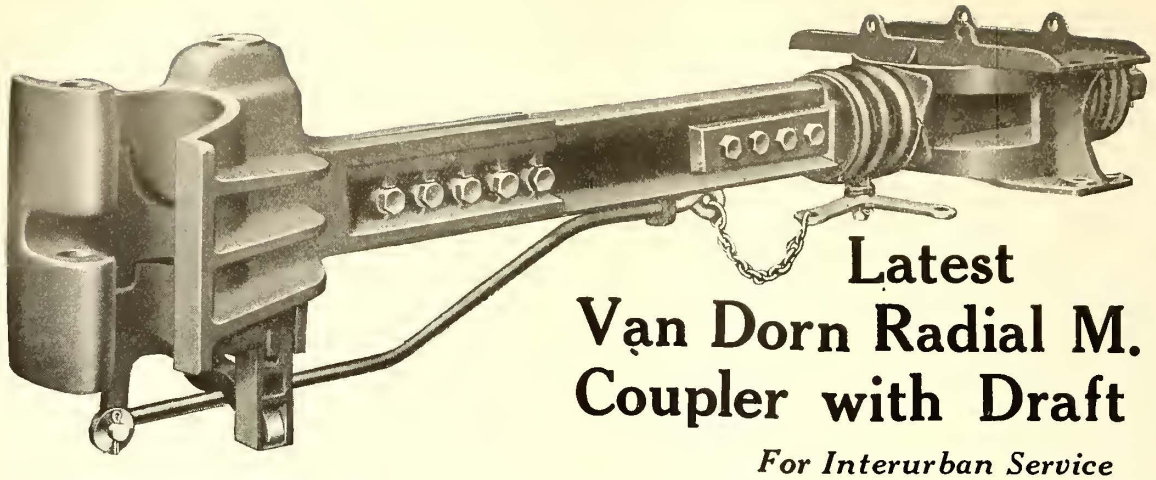
There is a Peacock for any and every character of electric railway car. Let us help you pick just the right one for your service.

National Brake Company

Ellicott Square, Buffalo, N. Y.

Bankers and Engineers





Latest Van Dorn Radial M. C. B. Coupler with Draft Gear

For Interurban Service

THE VAN DORN No. 880 M. C. B. COUPLER WITH DRAFT GEAR as shown above is well balanced and has the greatest strength possible for its weight.

COUPLER HEAD

Has positive locking, unlocking, and knuckle throw positions.

Has extended guard arm and butting wall which greatly facilitate coupling and prevent buckling in train operations.

Couples by impact and is uncoupled from the outside of the car.

The deep knuckle permits wide, free vertical movement.

DRAFT GEAR

The draft gear is very effective in absorbing shocks. It allows a free radial swing of over 120 degrees, which insures operation without binding on short radius curves.

This equipment is especially adapted to low interurban cars.

VAN DORN COUPLER COMPANY, 2325 South Paulina Street, Chicago

When Peace is Signed

THE nations of the world will embark upon the most extensive scheme of reconstruction ever inaugurated in the history of the world. Railways, steamers, factories and agricultural implements will be needed at short notice in quantities that stagger imagination. Raw materials will change hands in thousands of tons where formerly 1000 lb. orders were a fair average.

The demand will be sudden; it will be overwhelming.

The only manufacturers to benefit will be those whose names and products are *known,* and who are *now* announcing their abilities to fill large orders.

THE specialized field covered by this magazine will be second to none when the great drive for trade conquest begins—and the advertiser whose name appears regularly in its pages will be a few jumps ahead of his competitors whose names are strangers to it.

Do the big purchasing agents know you? Have they card-indexes of your ads, your catalogs?

If you are a regular advertiser in Electric Railway Journal you may be sure that they know all about you and your product when the moment comes for placing those rush orders!

Electric Railway Journal

Member Audit Bureau of Circulations

The Truly Continuous

THERMIT

Promotes Both Efficient Line Voltage

Whatever we have said in the past concerning the elimination of waste in the return circuit applies with multiplied force in these days of fuel cost and fuel scarcity.

You would not tolerate leaks in a boiler.

Then why tolerate leaks in track?

Every joint in your track is an actual or potential leak of energy that can be prevented permanently only by making the rail truly continuous.

This continuity has been achieved to a most successful extent with the Thermit Insert Weld at Los Angeles, San Antonio, Youngstown, Pittsburgh, Dallas, New York and other cities.

You can secure the same results in your city regardless of temperature and traffic conditions.

Read the Following Record of Th ese Idealswith

GOLDSCHMIDT

120 BROADWAY,

329-333 Folsom St., San Francisco

7300 So. Chicago Ave., Chicago

The Truly Continuous

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120 BROADWAY,

329-333 Folsom St., San Francisco
7300 So. Chicago Ave., Chicago

Rail Obtained With

WELDS

and Comfortable Passenger Car Service

The Thermit Insert Weld has made the mechanical joint an **unnecessary** evil.

When you use Thermit Insert Welds you do not have to worry about the inevitable arrival of the dished joint despite most careful grinding and matching up at the installation of new rails.

You **begin** with a smooth and truly continuous track, and you **keep** it.

The pounding that so quickly breaks up your paving and sub-structure is thus made negligible.

But above all this is the fact that a truly continuous rail means more comfortable riding for your passengers and less maintenance for your cars.

How One Railway is Attaining Thermit Welds

THERMIT CO.
NEW YORK
103 Richmond St., W., Toronto, Ont.
1427-1429 Western Ave., Pittsburgh, Pa.

This Record of

On the Third Avenue Railway System

Thermit Welds Made Good

The first Thermit Welds were made by our own men during 1914 on the busy Third Avenue Line between Fifty-sixth and Fifty-ninth Streets to the number of fifty in new 7-in. rail section 429. Half of these welds were made with inserts and half without inserts in accordance with the design of E. M. T. Ryder, Engineer of Maintenance of Way, Third Avenue Railway System. **Neither** class of Thermit Weld has developed any breaks to date.

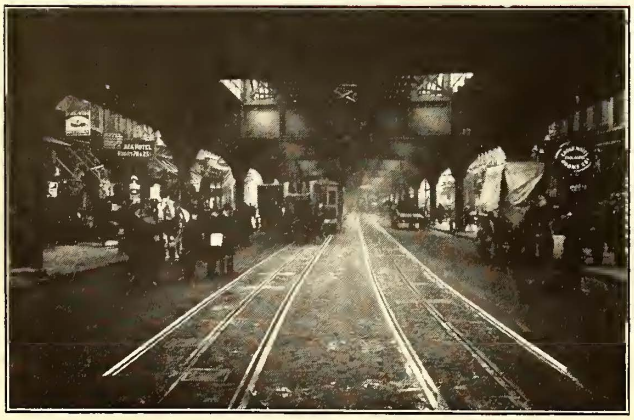
A Thermit Weld Modification for Conduit Track Makes Good

The Ryder modification was developed to meet a condition peculiar to slot-rail conduit construction. New rails come drilled every 2.5 ft. for tie-rods which pass through the slot-rails so that the running rails cannot be conveniently moved to provide a ¾-in. gap for an insert weld. Therefore, a butt weld is made as follows:

The rails are left in contact end to end, but the lip is cut off to obtain a symmetrical section and the base and web are also cut away with oxy-acetylene for a gap of ¾ in.

The second order of Thermit Welds was installed by our own men in 1914 during severe winter weather (10 deg. above zero) and at night. Some twenty-five welds were made under these conditions in old rail section 404 on the Bowery between Chatham Square and Bayard Street. There have been no breaks to date.

Continue the Installation



Bowery, Between Chatham Square and Bayard St.

Broadway, Between 45th and 59th St.

THERMIT
TRADE MARK REG. U.S. PAT. OFF. GOLDSCHMIDT PATENTS

GOLDSCHMIDT

120 BROADWAY,

329-333 Folsom St., San Francisco

7300 So. Chicago Ave., Chicago

Thermit Welds

of New York Explains the Reorders in Old Rail and New

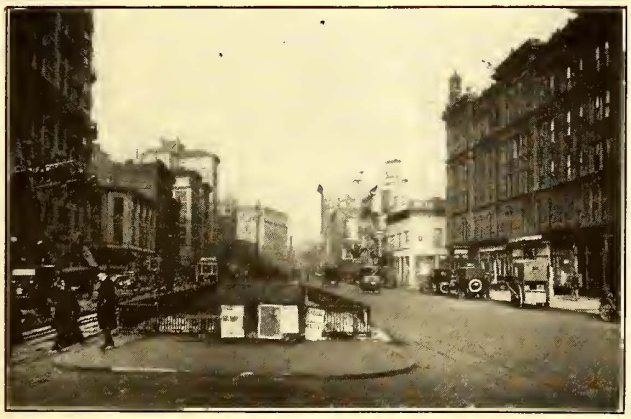
The third order of Thermit Welds was installed in 1915 by the railway's employees on Broadway between Forty-fifth and Fifty-ninth Streets, also in old rail section 340. Here some 50 to 100 welds were made on 5 ft. "dutchmen" to replace severe breakage of cast-welded joints. From this extremely busy section only two breaks are reported.

The fourth order, placed in 1916, covered 400 to 500 Thermit Welds on Third Avenue between Thirty-fourth and Fifty-sixth Streets in rail section 429. On this job, made by Third Avenue men under a Thermit supervisor, only two breaks are reported to date.

The fifth order of Thermit Welds comprised 355 Welds made in 1917 and divided in two installations, both of which were made by the railway's own men.

One was in new high-carbon rail section 493 on Broadway between Seventy-second and Ninety-sixth Streets; the other was in section 494 on the Union Railway's Southern Boulevard line between 149th and Baretto Streets. Exclusive of failures due to poor workmanship, so few breakages have been reported that the Third Avenue Railway System intends to

of Thermit Welds



Broadway, Between 72d and 96th St.

Southern Boulevard, Between 149th and Baretto St.

THERMIT CO.

NEW YORK

103 Richmond St., W., Toronto, Ont.

1427-1429 Western Ave., Pittsburgh, Pa.

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NEW YORK

103 Richmond St., W., Toronto, Ont.

1427-1429 Western Ave., Pittsburgh, Pa.

THERMIT

These three pictures

show the application of

Gailor Welded Joints

(Patented)

on standard track construction.

In applying the Gailor Welded Joint, the plates are welded to the head and base of the rails by drawing a carbon arc along the upper and lower edges of the plates.

The current for welding is furnished by an 1100 lb. dynamotor, not a wasteful resistor. This dynamotor converts the line voltage to proper welding voltage with an efficiency in excess of 80 per cent. The power consumption per joint approximates 5 kw.-hours. Perfect Welds more than ½ in. deep are made at the remarkable speed of 6 in. per minute.

by the forces of the Railway Company itself

We can reduce your arc welding costs. Write us for details.

ATLANTIC WELDING COMPANY
30 CHURCH STREET
NEW YORK

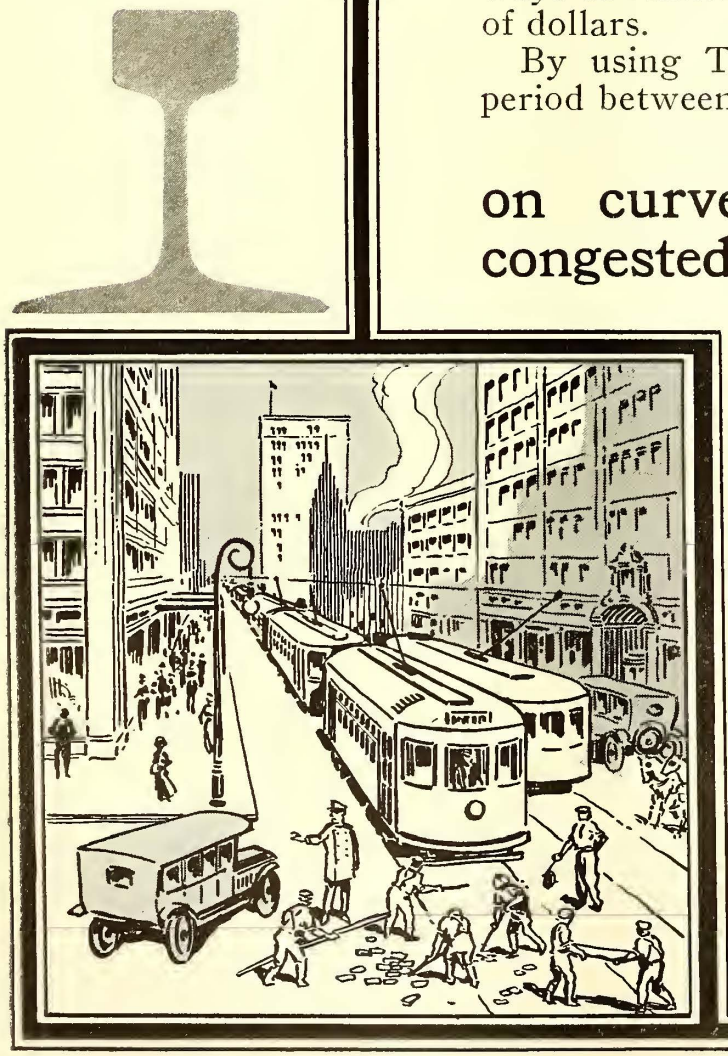
TITA

Titanium Treatment diminishes your paving and Rail Replacement Burden

For paving replacement alone, the electric railways of America pay an annual tribute of millions of dollars.

By using Titanium-treated rail to extend the period between replacements, particularly

on curves, special work and congested track



where the ordinary rail often wears out in **months** rather than years, our customers are not only enjoying important savings in reduced rail and paving replacement charges—

But are also minimizing delays to traffic at the very places where such delays are most disturbing and most costly.

TITANIUM
Manufacturing
Niagara Falls,

FERRO CARBON Reg. U.S. Pat. Office Trade Mark F.C.T. TITANIUM

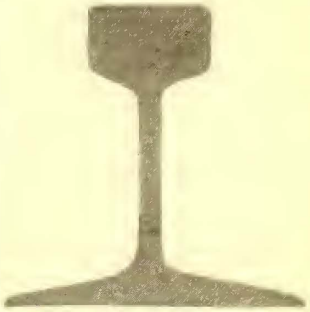
— Brooklyn — Boston — Kansas City — Los
Francisco — Washington (*Capital Traction*
TITANIUM-Treated Rail

NIUM

Titanium Treatment costs relatively less as RAILS GROW DEARER

T-Rail is being quoted now at $60 a ton and girder rail at $70 a ton.

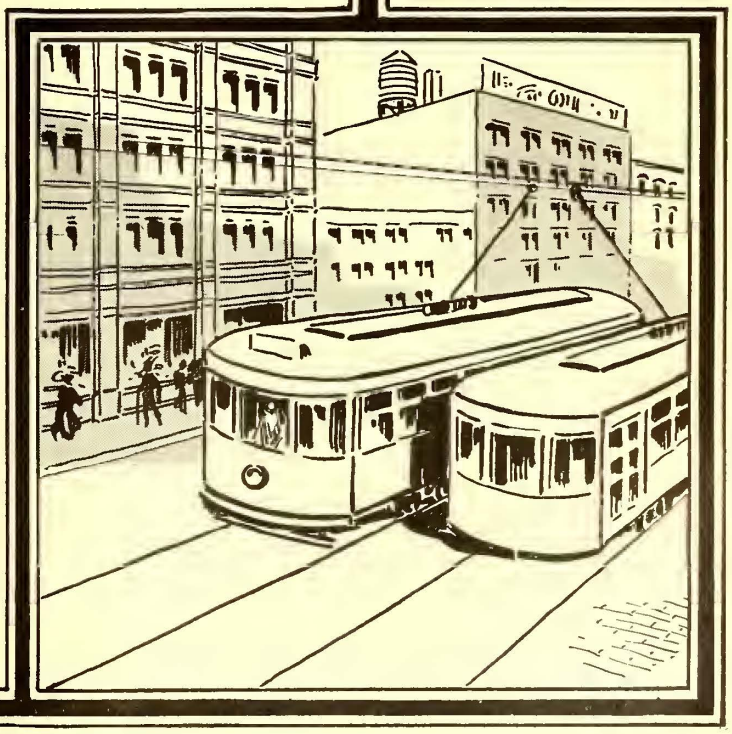
This means that at $2 a ton Titanium insurance for longer, safer life and more reliable transportation is less than 3 per cent of the cost of the rail, whereas it was 5 to 7 per cent of the rail cost in 1913.



If Titanium was worth a premium of 5% then it's surely worth 3% now

Considering also, that steel rails, because of present war and future rehabilitation demands, are very unlikely to drop in price—

The inescapable conclusion is that every hard-wear rail ordered today should be Titanium-treated to avoid paying further excess prices before normal conditions are restored.



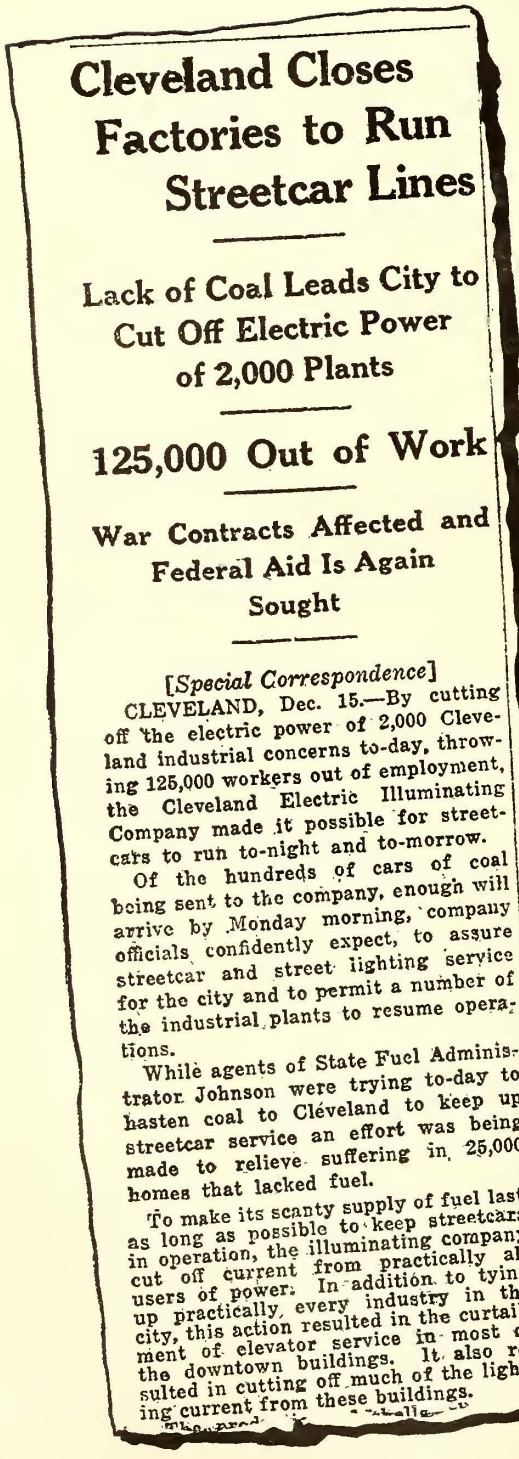
ALLOY
Company
N. Y.

Angeles — Philadelphia — Pittsburgh — San *Co.*) are among the contented users of —won't you ask them?

FERRO CARBON
Reg. U.S. Pat. Office
TRADE MARK
F.C.T.
TITANIUM

Use Lincoln

For Less Coal at the Plant and Less Labor on the Track



Cleveland Closes Factories to Run Streetcar Lines

Lack of Coal Leads City to Cut Off Electric Power of 2,000 Plants

125,000 Out of Work

War Contracts Affected and Federal Aid Is Again Sought

[*Special Correspondence*]

CLEVELAND, Dec. 15.—By cutting off the electric power of 2,000 Cleveland industrial concerns to-day, throwing 125,000 workers out of employment, the Cleveland Electric Illuminating Company made it possible for streetcars to run to-night and to-morrow.

Of the hundreds of cars of coal being sent to the company, enough will arrive by Monday morning, company officials confidently expect, to assure streetcar and street lighting service for the city and to permit a number of the industrial plants to resume operations.

While agents of State Fuel Administrator Johnson were trying to-day to hasten coal to Cleveland to keep up streetcar service an effort was being made to relieve suffering in 25,000 homes that lacked fuel.

To make its scanty supply of fuel last as long as possible to keep streetcars in operation, the illuminating company cut off current from practically all users of power. In addition to tying up practically every industry in the city, this action resulted in the curtailment of elevator service in most of the downtown buildings. It also resulted in cutting off much of the lighting current from these buildings.

N.Y. Tribune Dec. 16, 1917

This clipping may be gratifying to electric railway men in proving that street car transportation is regarded as the most important activity in a modern city.

But electric railways will soon have to *prove* to Fuel Administrator Garfield that they are not wasting any of the fuel received under this preferential arrangement.

There are many possible technical and human wastes of power—and therefore of coal—on any railway. The technical waste that can be detected most easily and removed most quickly is the poorly bonded rail joint.

To correct this permanently and economically you can use nothing better than the Lincoln Welded Bond.

The Lincoln System does not merely stick a bond to the rail. It so coalesces bond and rail that they are as *one* electrically and mechanically.

The Lincoln System is consistent and efficient in its use of power for applying the bond—it doesn't waste energy in undertaking to save it.

The Lincoln System is also so conveniently portable that one or two men can work efficiently without calling for a transportation crew and without holding up traffic—even on pretty busy city lines.

The application of Lincoln Welded Bonds would be well worth while if it did no more than cut down your coal needs.

But high voltage is even more important to your transportation department.

The Lincoln

636 Huron Road

AGENTS:

Lewis Roth Co., 1012 Liberty Bldg., Philadelphia, Pa., 519 W. 38th St., New York, N. Y.

Charles N. Wood Co., 14 Federal Street, Boston, Mass.

W. H. Elliott, Chattanooga, Tenn.

Use Lincoln

For Less Coal at the Plant and Less Labor on the Track

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The Lincoln Bonding Company

636 Huron Road

Cleveland, Ohio

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Charles N. Wood Co., 14 Federal Street, Boston, Mass.

W. H. Elliott, Chattanooga, Tenn.

Use Lincoln Welded Bonds

For Higher Schedule Speed and Less Labor for the Cars

Lincoln Welder on Worcester Consolidated Street Ry.

You can see readily enough how low voltage affects car lighting, but it's not so apparent to the eye how low voltage affects schedule speed.

For example, a drop of 50 volts with six stops per mile means a loss of 0.8 miles per hour, or say 6 per cent increase in car hours.

Extra car hours cost a lot more than the Lincoln Welded Bonds that would eliminate them.

Consider the fact that this loss in schedule speed is also an equivalent loss in car capacity and is at its worst during the rush hours, at the very time that you need all the car capacity you can get.

So there can be only one conclusion.

Get the Lincoln Welder and Lincoln Welded Bonds *and get them quick!*

The Lincoln Bonding Company

Cleveland, Ohio

AGENTS:

Holden & White, Inc., Fisher Bldg., Chicago, Ill.

W. C. Burdick, First National Bank Bldg.,

The Electrical Engineering & Mfg. Co., 1st Nat. Bank Bldg., Pittsburgh, Pa.

Milwaukee, Wis.

FULL CIRCLE SWING THEW POWER SHOVELS

Offered in sizes and combinations to meet various requirements. Operated by steam, gasoline and electricity. Write for circular "E" and list of electric railways now using Thews.

Over 300 Yards per Eight-Hour Day

HARD, unblasted concrete sub-base being removed at the rate of over 300 yards per eight-hour day at the intersection of Mason and Broadway Streets, Milwaukee, Wis.

The shovel is owned by The Arrow Engineering Co., of that city, and has been in continuous service for eight months. We quote them as follows:

"We cannot speak too highly for the results obtained with the Thew, we can readily say there is no other 15 Ton shovel that can do the work this Thew 'is doing.'"

This company owns another Thew which they have had in operation for the past five years, and their expression of results obtained therewith is equally convincing.

Thew Electric Railway Shovels offer the distinct advantages of the other types of Thew shovels. All classes of work required on city and interurban lines is play for the Thew, whether it's deep or shallow cuts, track trenching, grading road beds, tearing up track and ballast, removing old ties and rails, the rugged Thew walks through.

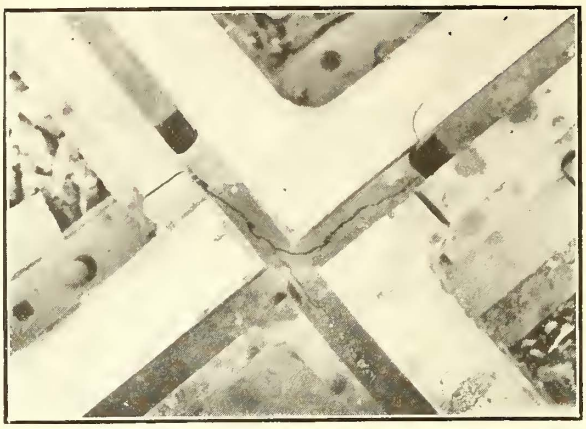
"Thews Are Everywhere"

The Thew Automatic Shovel Company

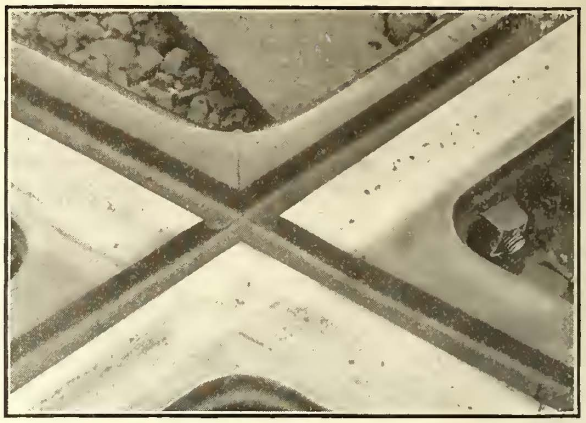
Lorain, Ohio

Sales outside of the United States and Canada handled through the ALLIED CONSTRUCTION MACHINERY CORPORATION, New York, U.S.A.

New York Office:
30 Church Street



What Happens to a Solid Work Crossing



How a Balkwill Crossing Behaves

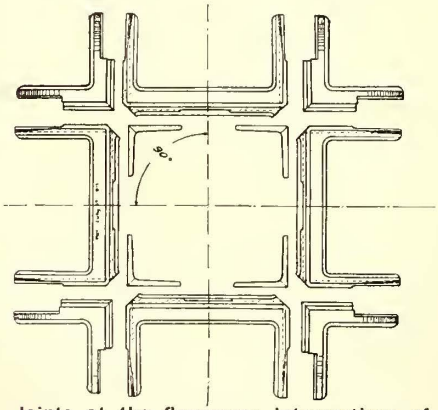
Why Balkwill Articulated Cast Manganese Crossings Are Superior to Rolled Rail Crossings

This picture at the left shows where breaks in the main steel filling or backbone of a rolled rail crossing are usually found.

These breaks are unavoidable because of the lack of flexibility of the rolled steel filler at the flangeway intersection.

In the Balkwill articulated cast-manganese crossing the difficulty is corrected by placing scientifically designed joints at the very places where breakage formerly occurred.

The lower first cost of a rolled rail crossing is therefore not a lower overall cost because it takes several rolled rail crossings to equal the life of one Balkwill crossing. Therefore the Balkwill crossing is the cheapest in the long run. It gives



Joints at the flangeway intersections of Balkwill Crossings positively eliminate breakage

MORE WEAR PER DOLLAR THAN ANY OTHER CROSSING YOU CAN BUY

It saves interruptions to traffic, makes less demand on labor, which is now so scarce, and also reduces the cost of making replacements frequently.

Write us for data on existing installations. If your special work manufacturer cannot get prompt deliveries of manganese castings or has not taken out a license to manufacture these crossings, DON'T ACCEPT A SUBSTITUTE but write us direct and we will see that your requirements are taken care of.

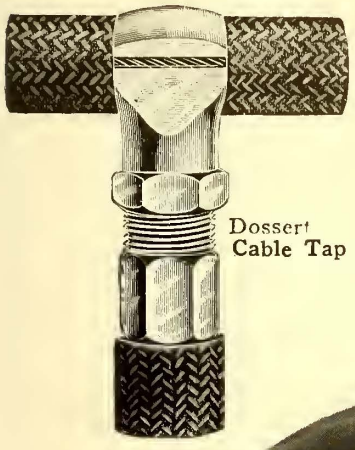
Order Balkwill Crossings
Direct from Your Special Work Manufacturers

The Balkwill Manganese Crossing Co.

506 Williamson Building, Cleveland, Ohio

Dossert Connectors

at the 74th Street station of the Interboro



Dossert
Cable Tap

2,000,000
C. M.
DOSSERT
CONNECTORS

DOSSERT Connecting leads from Westinghouse Rotary Converter to positive, negative, and neutral, 2,000,000 cir. mil BUS CABLES at the 74th Street station of the Interboro.

A good example of DOSSERT Service, on leads where an unimpeded flow of current is essential.

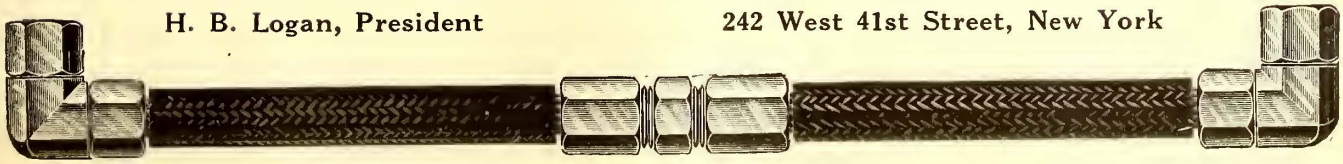
The DOSSERT solderless way eliminates liability of rubber spoilage by the heat of soldering.

Cost of jointing heavy conductors is cut to the bone when you replace elaborate preparation and skilled workmanship by the simple tightening of two nuts.

Our Catalogue tells the Dossert way.

DOSSERT & COMPANY

H. B. Logan, President 242 West 41st Street, New York



Sleet Days Are Here!

Delay No Longer—
Get a Full Supply of

Columbia Trolley Wheels

In addition to our standard solid trolley wheels for general service, we direct your attention to the

Columbia Sleet Cutting Wheel

The ideal trolley wheel for insuring uninterrupted collection of current during the prevalence of hail, sleet, snow or ice. Does its work effectively without the aid of auxiliary sleet-cutting devices.

Columbia trolley wheels of both types in diameters of 4-in., 5-in. and 6-in. are in stock ready for immediate shipment. You can meet many other of your wants by ordering from this general list of Columbia products.

Here are some Columbia-made specialties conveniently listed:

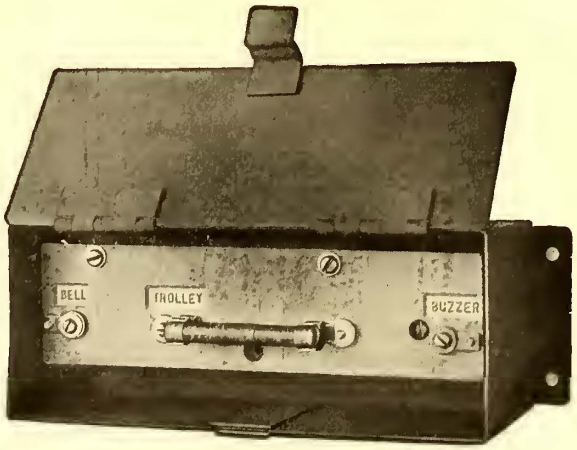
TOOLS	CAR EQUIPMENT
Armature and Axle Straighteners	Armature and Axle Bearings
Armature shaft straighteners	Armature and field coils
Armature buggies and stands	Bearings (Axle and Armature)
Babbitting molds	Brush-holders and brush-holder springs
Banding and heading machines	Brake, door and other Handles
Car hoists	Brake forgings, riggings, etc.
Car Replacers	Car trimmings
Coil taping machines for armature leads	Commutators
Coil winding machines	Controller handles
Pinion pullers	Forgings of all kinds
Pit jacks	Gear cases (steel or mall. iron)
Signal or target switches	Grid resistors
Tension stands	Third-rail shoe beams and accessories
	Trolley poles (steel) and wheels

Columbia Machine Works & Malleable Iron Co.

Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

W. R. Kerschner Co., Inc., N. Y. Holden & White, Inc., Chicago F. F. Bodler, San Francisco

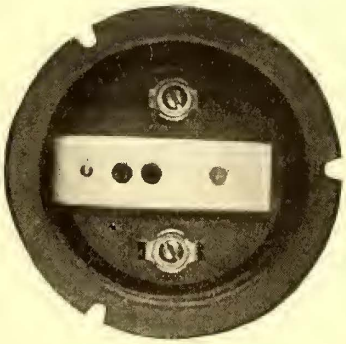
The New Consolidated Buzzer



—the last word in simplicity and economy

A child can take it apart and put it together again

No Wearing Parts
Special Resistance
Trifling Current Operates It
Circuit Opened and Closed in Interrupter—Not in Buzzer
No Sparking at Push Button
Approved by Nat. Board of Fire Underwriters

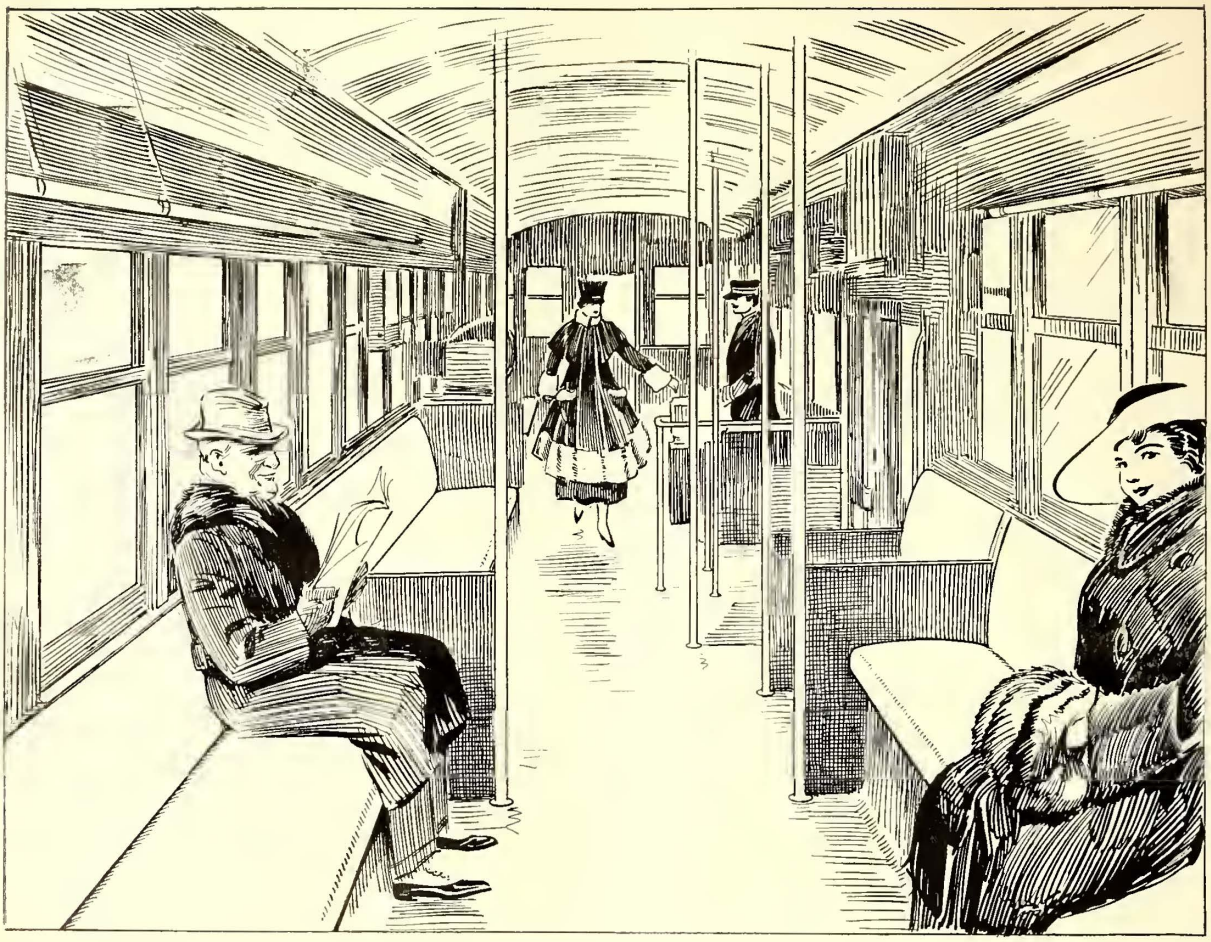


The Consolidated way of placing the overhead power supply at the command of the passenger in order to signal a stop is not only more logical than to depend upon a battery, but also far more satisfactory. To you a battery means a continuing expense for replacement and upkeep; while to your passengers it means exasperation when the battery fails to convey their wishes to the motorman.

Consolidated Buzzers will give your patrons the pleasant feeling of having their intentions promptly understood and promptly obeyed, while your men will have the satisfaction of avoiding arguments with passengers and of maintaining their schedules with greater ease.

CONSOLIDATED CAR-HEATING CO.

ALBANY NEW YORK CHICAGO



No Matter What Type of Car You Are Running

At no time in the history of electric railroading has so much thought been given to making car riding attractive than now.

This attractiveness lies largely in three things: More Service, Greater Schedule Speed and Better Seating.

Better Seating comprehends as a matter of course the design of shapes and use of materials best suited for each class in that wide range of electric railway service which extends from the frequent-stop city car to the palatial interurban. But seen in a broader way, *Better Seating* also includes the

Relation of Seating to Service and Speed

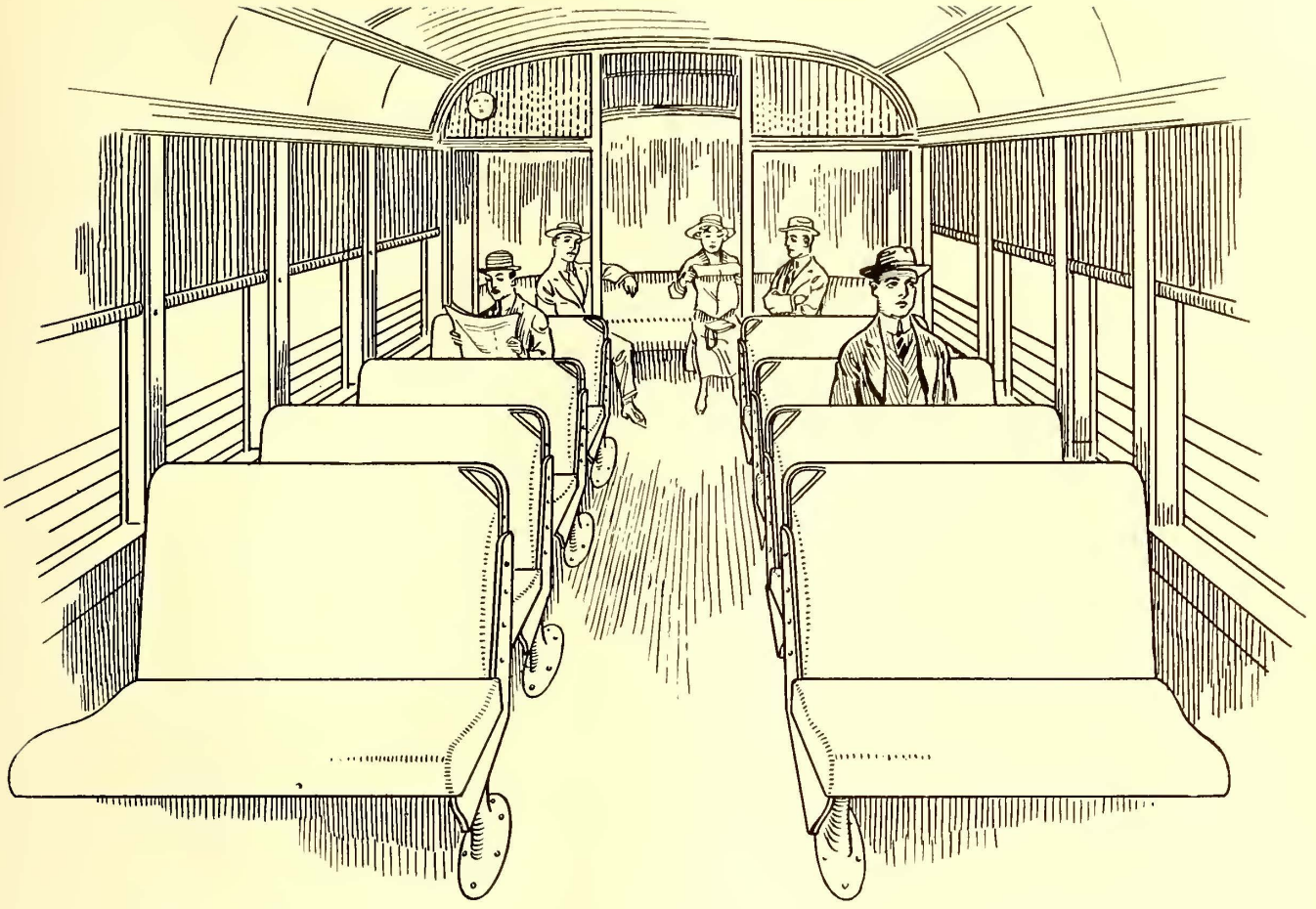
Thus in several Hale and Kilburn types for city use certain features like the set-in back construction mean a respectable increase in the car capacity or *service* offered.

Our specialized experience in seating layouts enables us to co-operate effectively with you to make the seating help instead of hinder the

Quickest Rate of Passenger Interchange

Hale and

Philadelphia New York
Washington Atlanta



Hale and Kilburn Seats Will Build Business for You

Hale and Kilburn alertness to the tendencies of the times is proved by examining the types of seats already in use on modern one-man safety and pay-as-you-pass cars.

For the one-man type, there is, for example, the No. 108, in which simplicity, durability and convenience seemingly can go no further.

The No. 108 has only four parts: The steel aisle wall end support, the hardwood framed rattan cushion and the hardwood framed rattan back.

The waste of carrying needless dead weight in iron castings is eliminated, for the No. 108 weighs but one-half of designs made without our special steel-pressing machinery.

Also on many Peter Witt Pay-As-You-Pass Cars

Hale and Kilburn seating service is helping to make these cars the fastest ever designed for the rapid handling of passengers.

Both the all-longitudinal seat cars and those with transverse and circular seats in the rear are made to give

Comfortable Riding for High-Acceleration, High Braking Service

Kilburn Co.

Chicago
San Francisco
Detroit
Louisville

WALKOVER

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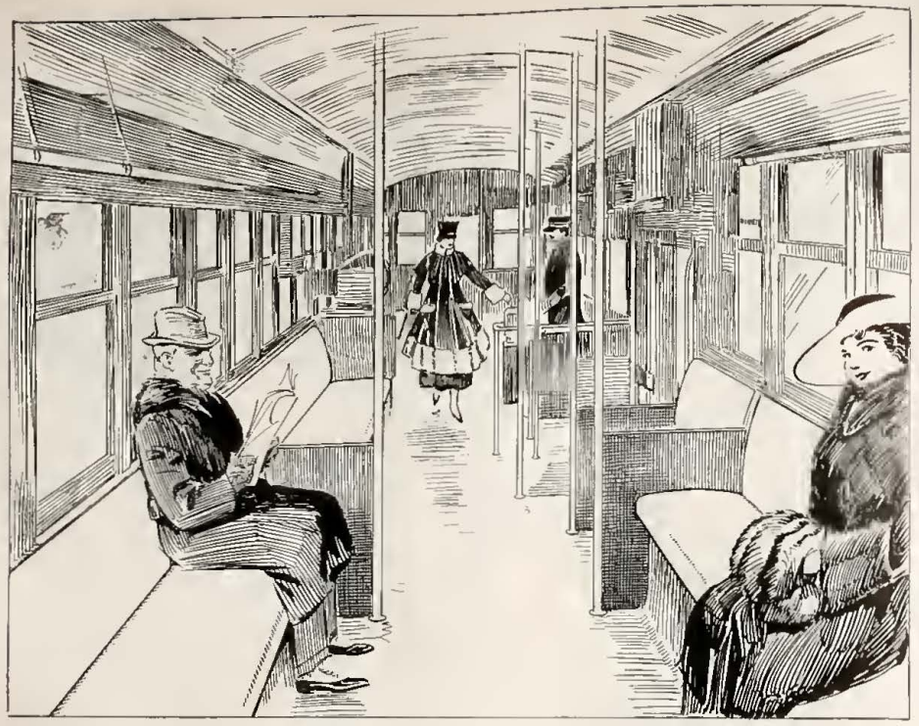

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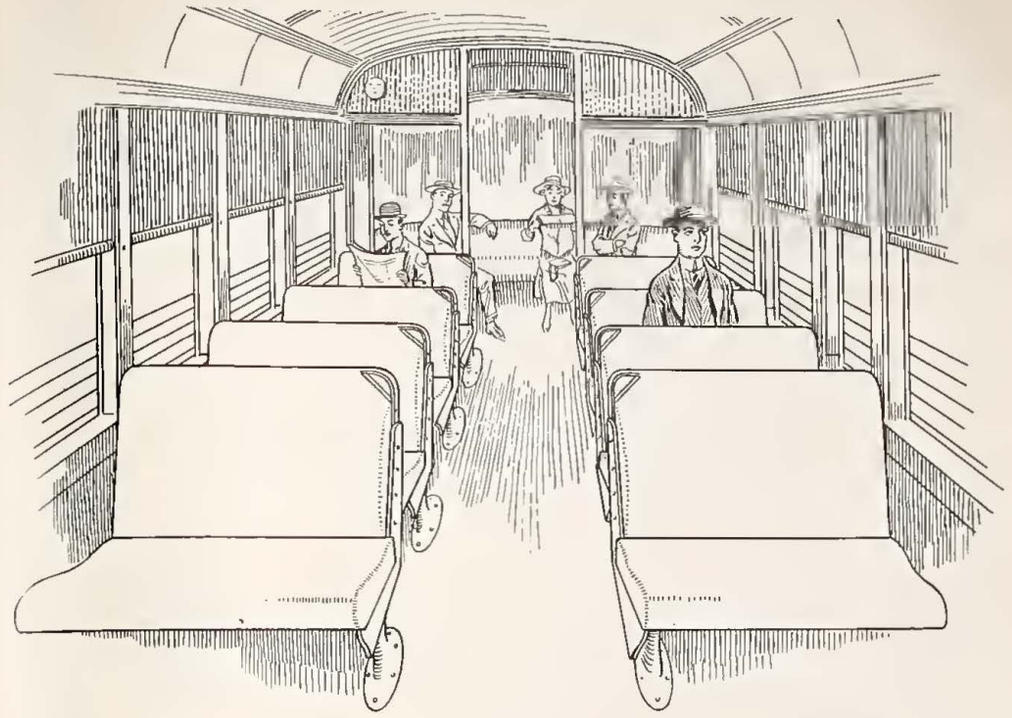

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Comfortable Riding for High-Acceleration, High Braking Service

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Chicago Detroit
San Francisco Louisville

EVERYTHING THAT YOU NEED—IF IT'S ELECTRICAL—IN ONE BOOK—THE

Western Electric YEAR BOOK

Keep it within reach when you are making up your estimates and requisitions for new construction and maintenance work.

The one uniform set of list prices—the one basic discount—makes for ease in preparing estimates.

One source, too, for all your supplies means the one uniform, high standard that is characteristic of the line of Western Electric Quality Products.

Consult our Year Book—then our nearest house.

SAVE TIME AND FREIGHT

DYNAMOS-MOTORS CABLES-TELEPHONES-SUPPLIES WESTERN ELECTRIC COMPANY

TELEPHONE OUR NEAREST HOUSE

Western Electric Company
INCORPORATED

New York	Atlanta	Chicago	St. Louis	San Francisco
Buffalo	Savannah	Cleveland	Cincinnati	Oakland
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EQUIPMENT FOR EVERY ELECTRICAL NEED

MEMBER OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT INC NEW YORK SERVICE ECONOMY SAFETY

"DO-IT ELECTRICALLY"

How a big man played an up-hill game and WON!

When E. M. Paget took charge of the Sales Department of the Iliff-Bruff Chemical Company, Chicago, the problem was to market the product of a new concern in an already crowded field and at a time of great business depression.

It was freely predicted that he would fail within six months. But this man's back was to the wall. It was strictly up to him. He had to make good—How?

The determination to win was there all right. But Mr. Paget realized that he had to have a broader business training to carry his determination thru.

An enrolment for the Modern Business Course and Service of the Alexander Hamilton Institute was the answer to this question.

So Mr. Paget enrolled.

With the unfolding of this vast fund of business knowledge, he applied the first principles he thus acquired to his own business needs.

Slowly but surely one and all of the obstacles were overcome.

His knowledge was sound

And. Mr. Paget now says—"I look back at the lean months we had experienced, and when I contrast the wonderful business we are now doing, I know it is not enough to simply have a superior product, a well-managed factory and a loyal organization fired with push and energy.

"One *must* understand the great business fundamentals. He must know how and why certain methods have led to success, while others, many of which we are prone to almost unconsciously adopt, spell only failure."

He says further: "If the total cost of the Sales Department in any other line were figured against the total cost of my department, it would probably be found that we are operating at a smaller percentage of expense than the average sales department.

"This is due to methods, a great part of which was gathered from your Course."

What results training brings

Here was one Sales Manager—one of thousands—who won out by absorbing basic facts—by getting down to the bare fundamentals of business and fitting them to the job he had to do.

And, the answer? When Mr. Paget took charge of the Sales Department, his salary was $3,600 per year. His earnings have now reached a point attained by few Sales Managers.

This man only one of many

The same business information which this man applied so successfully to his business is available, too, to you. If you own a business—if you are an executive—if you hope to be an executive—you need this Course.

The Alexander Hamilton Institute gives you the best thought and experience of thousands of successful business men—brings it to you in the most practical, most interesting, easily readable form for absorption in your leisure time.

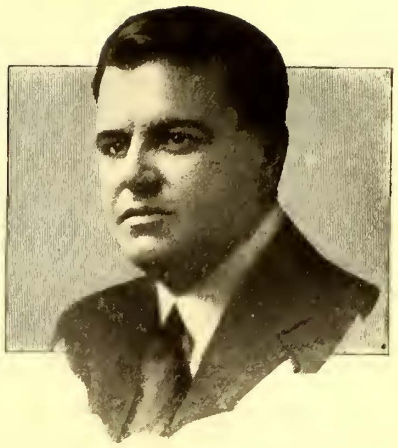
In the final analysis you and every other man in business are selling one thing—service.

Every source that can be drawn on for the improvement of self—for the betterment of that product—is worthy of the little time, the little effort, you are obliged to give.

This same material which has helped hundreds of other men to success will be yours to use as a guide to certain business growth.

The kind of men enrolled

Presidents of big corporations are often enrolled for the Modern Business Course and Service



along with ambitious young men in their employ.

Among the 65,000 subscribers are such men as A. T. Hardin, Vice-President of the New York Central Lines; E. R. Behrend, President of the Hammermill Paper Co.; N. A. Hawkins, Manager of Sales, Ford Motor Co.; William C. D'Arcy, President of the Associated Advertising Clubs of the World; Melville W. Mix, President of the Dodge Manufacturing Co., and scores of others equally prominent.

In the Standard Oil Company 291 men are enrolled in the Alexander Hamilton Institute; in the United States Steel Corporation, 450; in the National Cash Register Company, 194; in the Pennsylvania Railroad Company, 108; in the General Electric Company, 300—and so on down the list of the biggest concerns in America.

Advisory Council

Business and educational authority of the highest standing is represented in the Advisory Council of the Institute.

This Council includes Frank A. Vanderlip, President of the National City Bank of New York; Judge E. H. Gary, head of the United States Steel Corporation; John Hays Hammond, the eminent engineer; Jeremiah W. Jenks, the statistician and economist, and Joseph French Johnson, Dean of the New York University School of Commerce.

"Forging Ahead In Business"

A careful reading of the interesting 112-page book, "Forging Ahead in Business," which we will send you free, will show you how to prepare for the increasing number of business opportunities that are bound to come during the next few years.

Every man and woman with either a business or a career to guide to bigger, surer success, should read this book. Simply fill out and send the coupon below.

Alexander Hamilton Institute
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Send me "FORGING AHEAD IN BUSINESS"—Free

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Business Address .....

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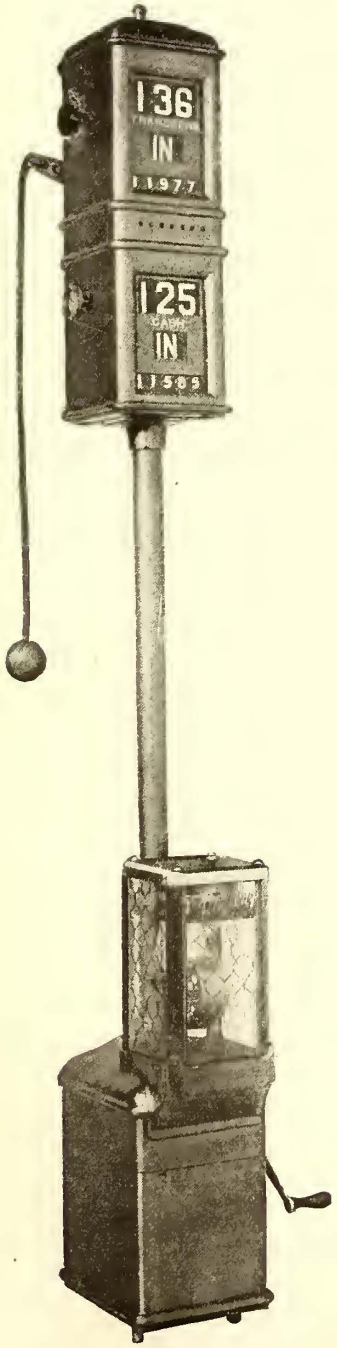
International Fare

On One-

Make 100 Per Cent Fare Col



Type C21 Combination Coin and Transfer Register

Two of the most pressing things that electric railways must do today is to

Increase the **income** by getting **more** fares and getting full collection of fares; and

Lower the **outgo** by cutting platform expense without cutting individual wages—which means the handling of more passengers per operator either with one-man cars or trains.

With the coming of odd fares and zone fares it will be harder than ever for the conductor to

Keep the Car Moving at High Schedule Speed

And yet give proper attention to fare collection, unless he is provided with every available mechanical aid to reduce labor.

For straight 5-cent fares on one-man double-end cars you may like best the International C16 Fare Box if the service is light and a separate register is available for use in connection with the box.

On single-end cars where frequent removal of coin registers from end to end of the car is not required the International C15 Coin Register is preferable, because the operator does not have to work two different machines or worry about consequent discrepancies between Box and Register readings. The C15 furnishes in one machine both visible and audible registration.

Type C15 Coin Register

The International Register Company,

Collection Devices

Man Cars

lection a Physical Possibility

For One-Man Cars on Short Headways

The International C26 Coin Register with motor drive, which greatly lightens the duties of the conductor, is still better, as then only will it be possible to combine the collection of all fares with little or no loss of schedule speed. The motor-driven type avoids loss of car hours just as well as it avoids loss of fares.

Type C16 Fare Box

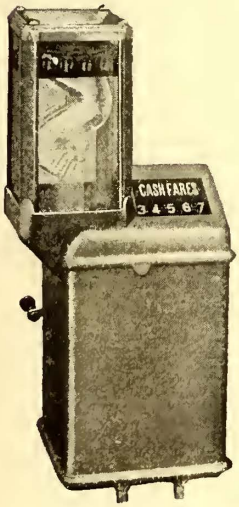
For One-Man Cars with Mixed Fares

Such as cash and transfers, or cash and tickets, the International C21, hand-operated, will fill the bill for light service, and the C26, motor-operated, for heavy service.

For one-man cars using cash and metal ticket fares, the International Type C17 Fare Box, or the International Type C14 Metal Ticket and Coin Register is available, either hand or motor-operated, and if transfers are used, the Type C20 International Coin, Metal Ticket and Transfer Register.

Finally, on light runs where a small percentage of paper tickets are received, a combination of counting Fare Box and non-counting ticket receptacle is in use on one-man prepayment and postpayment cars.

The motor-driven machines are especially advantageous on single-end cars (or double-end cars operated over loop terminals), as such cars make unnecessary the duplication of the motor part or the carrying of the equipment by hand when changing ends.



Cash Side Type C17 Coin and Metal Ticket Fare Box

Type C14 Coin and Metal Ticket Register

15 South Throop Street, Chicago, Ill.

International Fare

On One-

Make 100 Per Cent Fare Col

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The motor-driven machines are especially advantageous on single-end cars (or double-end cars operated over loop terminals), as such cars make unnecessary the duplication of the motor part or the carrying of the equipment by hand when changing ends.

Type C14 Coin and Metal Ticket Register

15 South Throop Street, Chicago, Ill.

International Fare Col

On Two-Man Cars

Make 100 Per Cent Fare Collection

On the electric railway of the early future we may expect to see new two-men cars only on lines which are extremely busy in themselves or which operate in large part over congested routes. Further, wherever possible, such busy lines will be operated in connection with

Prepayment Stations and Motor-Driven Registers

Because practically perfect fare collection, and enormous saving in time and reduction in track congestion are thus assured, as proved by the Boston Elevated Railway's success with International motor-driven station registers.

It was also Boston that proved that where the fares must be collected on cars of heavy traffic the only satisfactory way to do so is to use International motor-driven coin registers because

Motor-Driven Registers on the Car Give Maximum Revenue Collection and Maximum Mileage Revenue

Hitherto International motor-driven registers have been available only in the Boston C 25 and 26 coin and transfer types and the cash and metal ticket types named in connection with one-man cars. Now we are prepared to announce the early installation of an entirely new type, the C 29.

Type C20 Coin, Metal Ticket and Transfer Register

Motor-Driven Type C25 Coin and Transfer Register

The International Register Company, 15 Sou

lection Devices

or Trains

a Physical Possibility

Three Hundred International Motor-Driven Registers to Handle Cash, Paper Tickets and Transfers

Toledo Railways & Light Company

In this International machine specially designed to meet the most exacting demands of efficient fare collection on short headways:

The same hopper receives both cash and paper tickets—hesitation and mistakes by passengers are therefore eliminated.

The cash is counted on the totalizer and registered on the register **automatically** whereupon it is available to the conductor for change.

The tickets are mechanically separated from the coins in a motor-driven drum. An endless belt prevents choking or stoppage no matter how rapidly the tickets are deposited. Tickets are registered by operating a pedal. After mutilation they enter a locked compartment.

The ticket compartment is protected with both a cylinder lock and a glass signature seal. A separate box in this compartment receives any quarters and half dollars that may be deposited by mistake; also all pennies deposited.

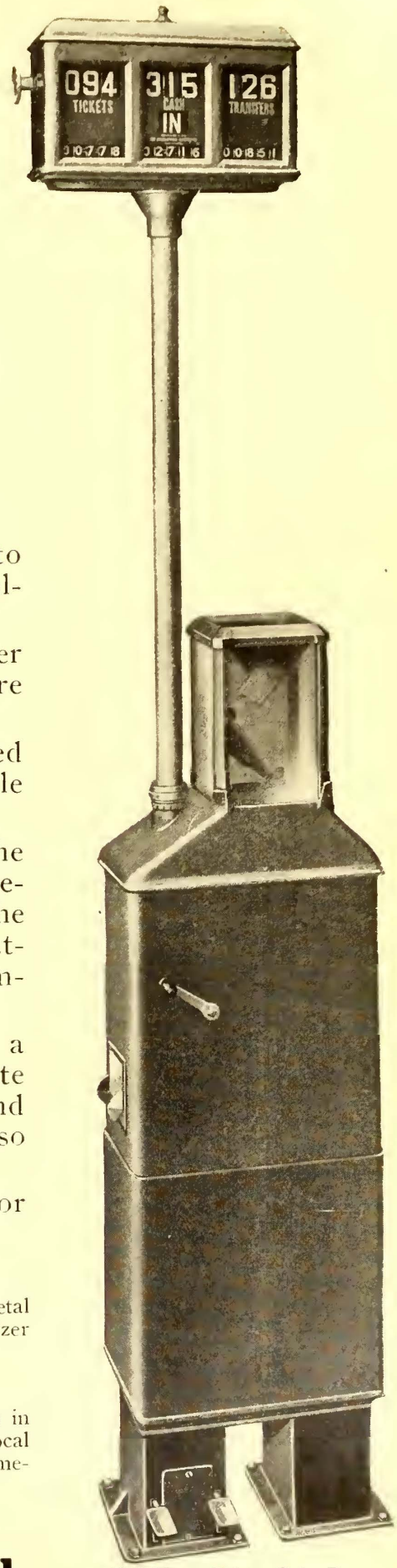
The transfers are collected directly by the conductor and registered by means of a separate pedal.

Metal Tickets May Also Be Motor-Counted

In this machine by making certain changes whereby **all** cash and metal ticket fares would be shown on the cash register but a separate totalizer would permit **classification.**

From One-Man Car to City Trains

Comprehends a wide range of service, but for practically every step in that range there is an International device which meets exactly your local combination of fare and traffic factors. If not, we are ready to make something that will.



C29 Motor-Driven Coin, Paper Ticket and Transfer Register

th Throop Street, Chicago, Ill.

International Fare Collection Devices

On Two-Man Cars or Trains

Make 100 Per Cent Fare Collection a Physical Possibility

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The transfers are collected directly by the conductor and registered by means of a separate pedal.

Metal Tickets May Also Be Motor-Counted

In this machine by making certain changes whereby all cash and metal ticket fares would be shown on the cash register but a separate totalizer would permit **classification.**

From One-Man Car to City Trains

Comprehends a wide range of service, but for practically every step in that range there is an International device which meets exactly your local combination of fare and traffic factors. If not, we are ready to make something that will.

C29 Motor-Driven Coin, Paper Ticket and Transfer Register

The International Register Company, 15 South Throop Street, Chicago, Ill.

Month	Day	Train	Div.	Total Cash Psgrs.	Total Psgrs.
12	07	53	3	19557	44398

On	Off	Miles	Cash
1	45	22	4 44
1	45	22	4 44
1	45	22	
1	61	30	
1	71	35	
1	71	35	6 70
1	71	35	6 70
1	21	10	20
1	9	4	8
1	27	13	26
1	27	13	26
1	45	22	4 44
1	45	22	4 44
9	61	26	4 52
9	61	26	
9	61	26	
9	71	31	
9	71	31	
9	33	12	24
21	61	20	3 40
21	61	20	3 40
21	45	12	
21	45	12	24
21	71	25	
21	71	25	
21	71	25	4 50
21	33	6	12
21	33	6	12
27	45	9	
27	45	9	18
33	71	19	3 38
33	61	14	28
33	61	14	45
33	61	14	
33	45	6	12
33	45	6	
33	45	6	

12	07	53	3	19579	44435
L. S. Hume				22	37
			Miles	685	

Cash 7.46
War Tax .45
Total Charge to Conductor $7.91
Tickets 6.24
Total Revenue $ 13.70

Every Kilowatt-Hour of Electrical Energy You Save Means

4 LBS. OF COAL SAVED!

That means not only FUEL CONSERVATION, but

$63.00 SAVED

ON EVERY STANDARD CITY CAR PER HEATING SEASON

if the electric heaters are regulated by means of UTILITY Thermometer Control.

And the saving on smaller cars will be in proportion.

WRITE FOR DETAILS

Railway Utility Company

151 West 22nd Street CHICAGO, ILLINOIS

Interior view of one of 26 new cars just put into service by the South Covington & Cincinnati Street Railway. Note the smooth, neat surface of the headlining.

Nevasplit Headlinings

"Nevasplit" is, first of all, a wood fibre.

It won't warp or shrink, it has no grain, so will not split or "check." Its smooth, even surface takes paint readily.

"Nevasplit" is waterproof and of minimum conductivity. It is absolutely uniform in texture. "Nevasplit" is NOT veneered lumber but wood fibre in the highest form of refinement, possessing constructional features and beauty of appearance that make its use an essential for headlining, insulation roofs and interlining of cars.

To specify "Nevasplit" means a positive saving of money.

Let us send samples of "Nevasplit" so you can see with your own eyes the advantages of this material for YOUR cars.

The Keyes Products Company

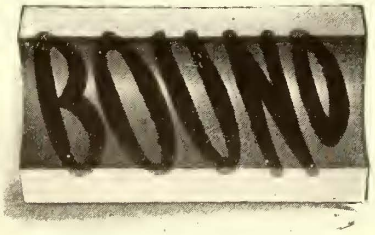
120 Broadway, New York

NEW YORK	CHICAGO	SAN FRANCISCO	ITALY
W. R. Kerschner Co., Inc., 50 Church St.	J. E. Simons Fisher Bldg.	Ford & Geirrine Merchants' Exchange Bldg.	American Traffic Co. Via Capuccini, No. 4, Milano, Italy

ARE *YOU* GETTING FULL BOUND BROOK Trade-Mark OIL-LESS BEARINGS Reg. U. S. Pat. Office

Here is a table of the wheel and bushing mileages obtained by various users of Bound Brook Bushings, which shows a most astonishing range of life despite the fact that Bound Brook Graphited Oil-less Bushings are absolutely uniform and are noted for the consistent individual mileage they give for any one combination of service characteristics.

	Wheel Dia., Inches	Wheel Miles	Bushing Miles	Tension Pounds	Amperes Carried	Composition, per Cent
Railway No. 1—City	4	8,600	8,600	25	200–250	89 Cu; 10 Tin; 1 Anti.
Sub.	6	8,600	8,600	30	400–500	89 Cu; 10 Tin; 1 Anti.
Railway No. 2.	6	29,000	10,900	22	200–400	Special
Railway No. 3.	....	9,000	98% outlast the wheel	20	500	88 Cu; 10 Tin; 2 Zn.
Railway No. 4.	5	15,000	15,000 or more with better inspection	22–25	400	Special
Railway No. 5.	4½	6,500	Equal with better inspection	20–24	300	Special
Railway No. 6.	4	27,633	27,633	25	.....	Special



Bound Brook Oil-less Bear

MILEAGE OUT OF *YOUR* GRAPHITED FOR TROLLEY WHEELS

All of the railways in this table operate at practically the same speeds except where suburban service is noted. Yet observe that

Bushing life ranges from a minimum of 8,600 to a maximum of 27,633 miles or more; and it would seem from the other factors noted that peripheral speeds, currents and tensions are not determining factors.

It seems significant, however, that those railways which are using short-life composition trolley wheels also get a short life for the bushing; while those using long-life wheels find the bushing perfectly capable of lasting as long as the wheels.

Isn't part of the answer to be found in the application of better maintenance of line and of current-carrying equipment on the car? We should be glad to have similar records from you because—

We don't want Bound Brook Oil-less Bearing service to stop with our delivery of the product to you. We want to know just what results you are getting and under what conditions of operation, so that we can help you to get more miles per bushing on your property and perchance improve the bushing for all properties.

ing Co., Bound Brook, N. J.

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Trade-Mark
Reg. U. S. Pat. Office

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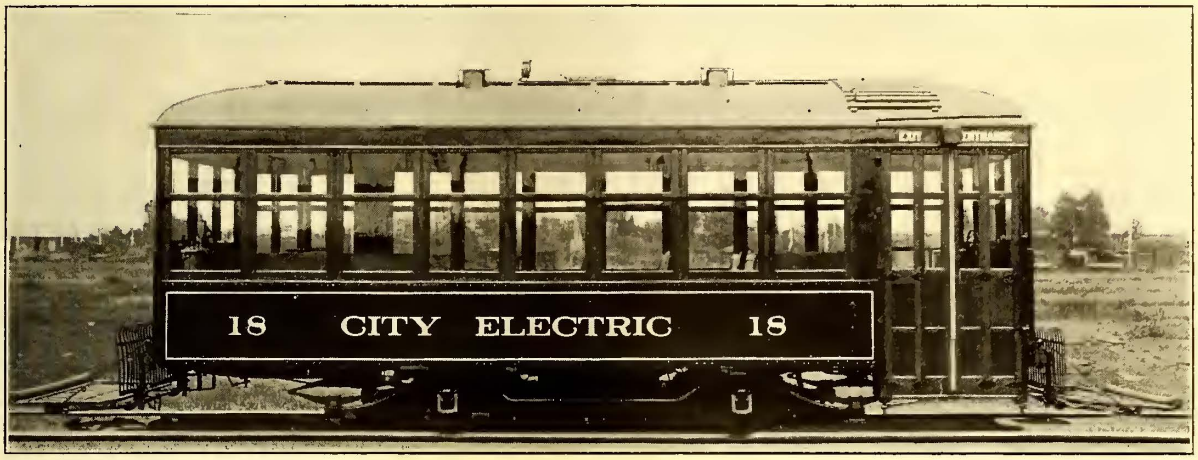
ing Co., Bound Brook, N. J.

Additional Evidence

The merits of the "Light-One-Man" unit are thoroughly recognized: it is superfluous to add any word to what Mr. Roslington says.



City Electric Company

CAPITAL $250,000.00

GEORGE ROSLINGTON, PRESIDENT
LLOYD STURGES, SECRETARY

ALBUQUERQUE, N.M.,
December 3rd, 1917.

Mr. Geo. L. Kippenberger,
Special Sales Agent St. Louis Car Co.,
Saint Louis, Missouri.

Dear Sir:

Replying to your inquiry regarding the trucks supplied on your last delivery of light weight cars, I beg to advise that these have been in continuous operation since their arrivial; and we have had absolutely no trouble or breakages of any kind in connection with them.

The riding qualities are excellent, and I do not think could be improved upon, although our experience very clearly shows that it is absolutely necessary to maintain the track in first class condition, in order to operate light weight cars with any satisfaction either to the Company or its patrons.

I might add that at the time of the delivery of these last cars we had a recruiting camp at one of our terminals, which taxed our capacity to the utmost. Every night for six weeks these cars with a seating capacity of twenty-six, and a weight of not to exceed thirteen thousand pounds, carried from sixty to ninety able bodied men passengers up and down a 3% grade - 1½ miles long. Of course, this traffic only existed from seven to eight and from ten to eleven P.M.

During the last month the camp was in Albuquerque we carried over 150,000 passengers, exclusive of transfers, on our eight miles of track with twelve of your light weight cars and two old green cars, which were in operation not to exceed six hours a week each. During that period we did not have one personal accident, and a very small amount of car repairs was necessary.

Yours very truly,

TRJ.

President.

WE HAVE BUILT THREE LOTS OF THIS TYPE FOR

City Electric Co.,
Albuquerque, N. M.

REPEAT ORDERS HAVE BEEN EXECUTED FOR

Aberdeen Ry. Co.,
Aberdeen, S. D.

Kankakee Elec. Ry. Co.,
Kankakee, Ill.

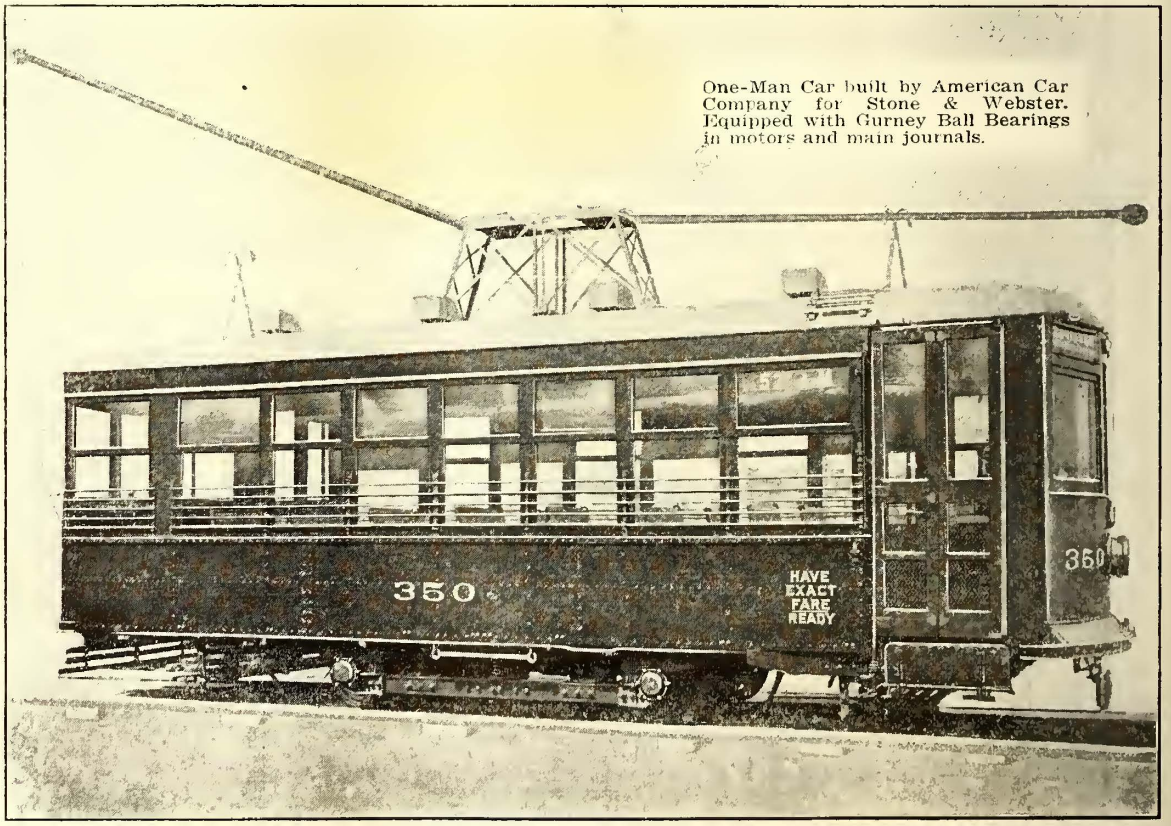
Lewiston-Clarkston T. Co.,
Clarkston, Wash.

St. Louis Car Company

Gurney Ball Bearings

370 watt-hours = 1 pound of coal

A recent calculation by W. D. Bearce shows that for general purposes it may be assumed that 2½ lbs. of coal are required to produce 1 kilowatt-hour at the bus-bar. Add 10 per cent to cover line losses and you find that every time you can save 370 watts at the motor you save a pound of coal in the boiler room.



One-Man Car built by American Car Company for Stone & Webster. Equipped with Gurney Ball Bearings in motors and main journals.

Gurney Ball Bearings are now standard equipment on all Stone & Webster Birney Safety Cars

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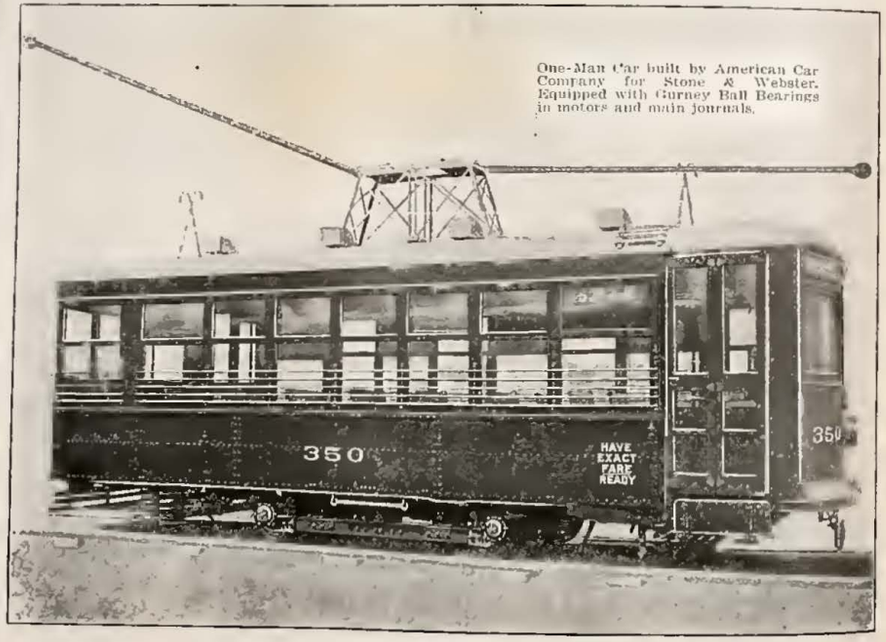


One-Man Car built by American Car Company for Stone & Webster. Equipped with Gurney Ball Bearings in motors and main journals.

Gurney Ball Bearings are now standard equipment on all Stone & Webster Birney Safety Cars

Save Coal

Set of 12 Gurney Bearings for One-Man Car. Two bearings are used for each journal box and two for each motor.

Ball Bearings save at least 10 per cent

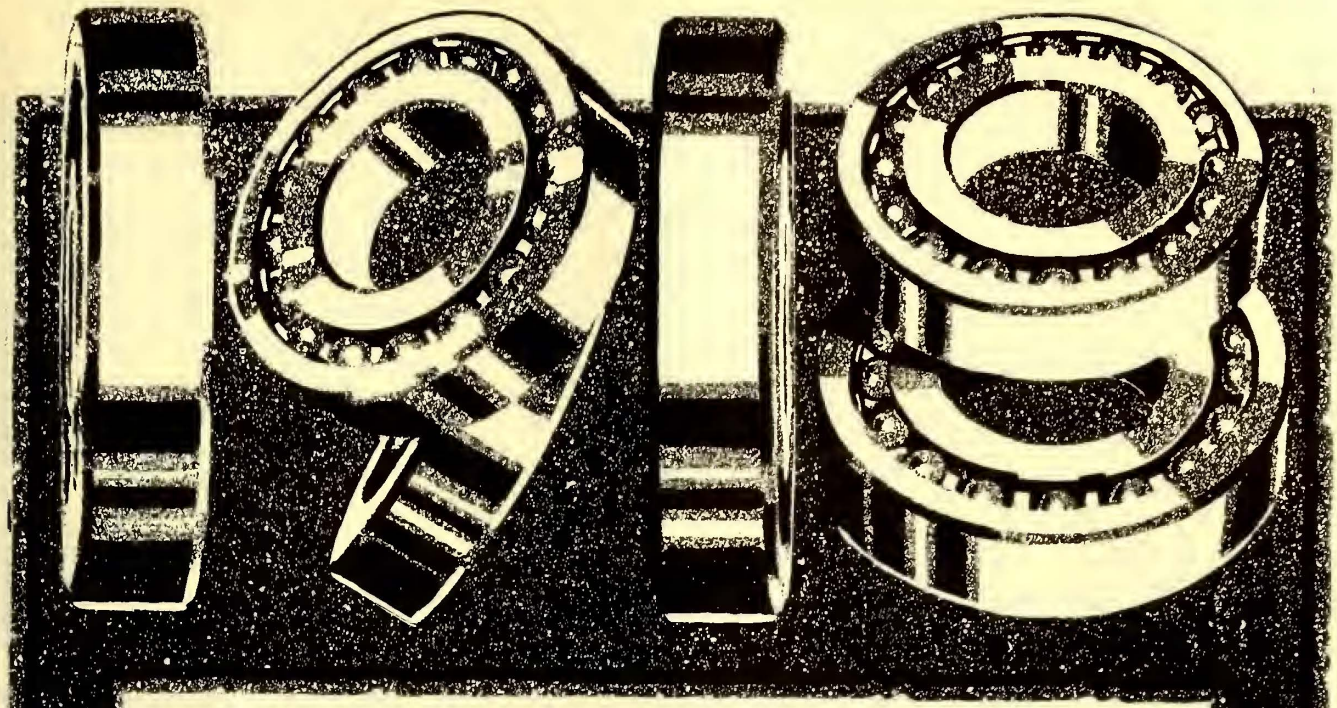
It is generally conceded that ball bearings on motors and journals will reduce the power consumption about 14 per cent, and it is certainly safe to assume that the saving will be not less than ten per cent (exclusive of current used for heating and lighting).

On your heavy cars which consume 370 watt-hours per car mile, Gurney Ball Bearings will save a pound of coal for every ten car-miles.

Other advantages of Ball Bearing Journals and Motors are elimination of hot boxes and fallen armatures, perfect alignment of gears, reduced inspection and lubrication expense.

Our Engineers will be glad to recommend suitable bearings for your equipment.

Gurney Ball Bearing Co.
Conrad Patent Licensee
Jamestown, N. Y.



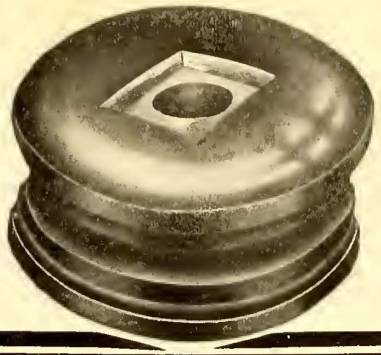
THROUGHOUT the coming year front covers and full-page announcements in this journal will tell the story of increased efficiency in Electric Railway Motors made possible by the use of SKF Ball Bearings. To those who follow the facts to be presented—facts drawn from actual operating service in prominent companies—the year 1918 will most certainly prove a profitable New Year.

SKF Ball Bearing Co.

Hartford, Conn.

SKF

BALL BEARINGS



It's Heavy— Glazed Porcelain

And that's one of the reasons why the White Trolley Hanger doesn't have cracked insulation troubles. This porcelain is tough and will stand the knocks if the trolley hits it.

WHITE'S
Porcelain
Trolley Hanger

is so simple to adjust and align on the span wire that it is a big time-saver in installation work.

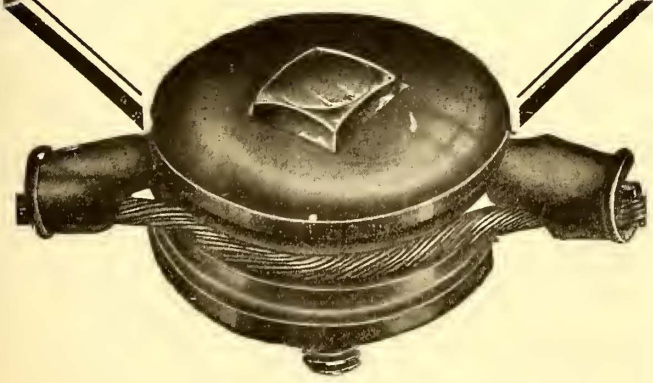
The yoke is sherardized malleable iron, and that doesn't rust; the bolt is a standard, furnished sherardized or in bronze. Those are the three simple parts of this hanger, and they mean economy for you.

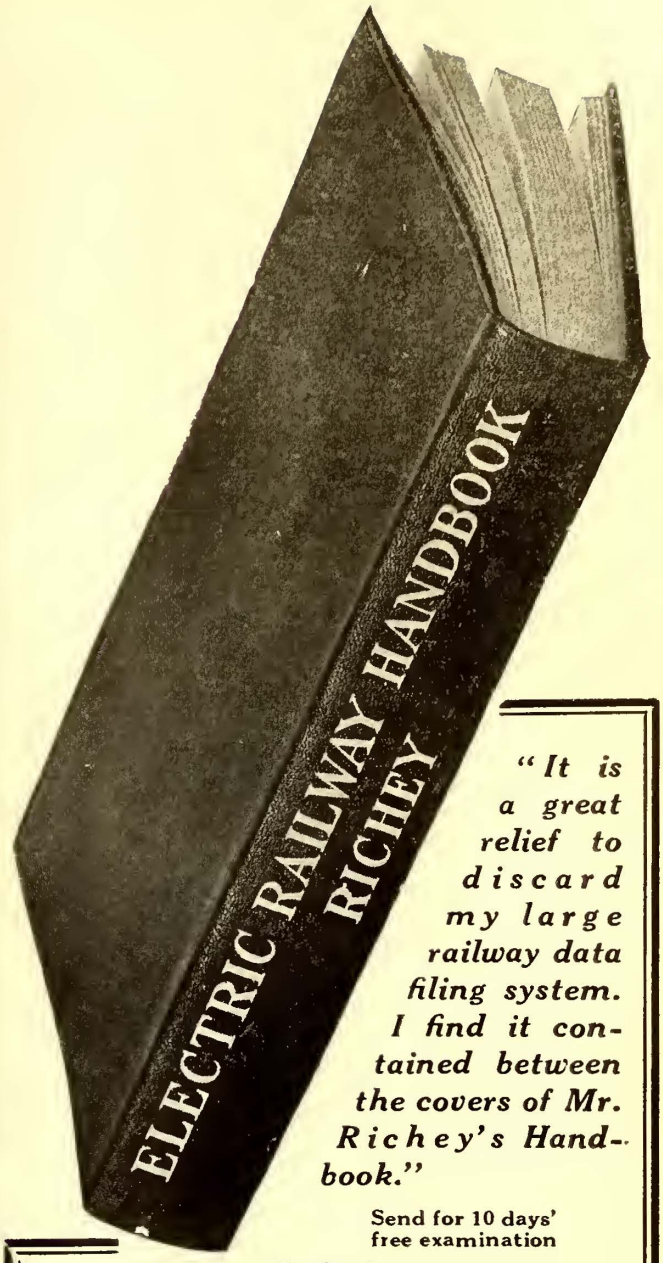
Let us send you a sample with quotations on complete hangers or parts which we have in stock for

Immediate Delivery

T. C. White Electrical Supply Co.

1122 Pine Street, St. Louis, Mo.





"It is a great relief to discard my large railway data filing system. I find it contained between the covers of Mr. Richey's Handbook."

Send for 10 days' free examination

Richey's

Electric Railway Handbook

By Albert S. Richey, Electric Railway Engineer,

Professor of Electric Railway Engineering, Worcester Polytechnic Institute, 832 pages, flexible leather, full-gilt edges, 4 x 7 inches, pocket size, with over 600 illustrations.

$4.00 (*Eng. price* 17*s*) *net postpaid.*

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
239 West 39th St., New York, N. Y.

You may send me on 10 days' approval:

Electric Railway Handbook, $4.00 net.

I agree to pay for the book or return it postpaid within 10 days of receipt.

....I am a regular subscriber to the Electric Railway Journal.

....I am a member of A. I. E. E. or A. E. R. A.

(Signed) .....

(Address) .....

.....

Reference ..... E. 1-5-18

(Not required of subscribers to the Electric Railway Journal or members of A. I. E. E. or A. E. R. A. Books sent on approval to retail customers in the U. S. and Canada only.)

SEARCHLIGHT SECTION

MISCELLANEOUS WANTS

Wanted at Once

For immediate shipment any quantity of battery lead plates, sediment, scrap copper and wire, brass and all other grades of scrap material. Write to us today for our prices. National Metal & Rubber Co., 31 India Wharf, Boston, Mass.

POSITIONS WANTED

ELECTRICAL and mechanical engineer, graduate, 20 years' experience with railway manufacturing and operating companies, 10 years as engineer of car equipment large electric railway system, desires position as chief or sales engineer in New York City. PW1802, Elec. Rwy. Journal.

ENGINEER, graduate 1909, experienced in the construction, operation and management of electric railway, lighting, power and ice plants and transmission systems, desires position as manager or superintendent. PW-1803, Elec. Rwy. Journal.

SUPERINTENDENT of current distribution, with 25 years' experience in this line, desires change. In present position has for several years supervised expenditures exceeding $100,000 annually for aerial and underground construction and maintenance. Thoroughly familiar with most phases of power distribution work, including accounting, on electric railroad. PW1801, Elec. Rwy. Journal.

TRAFFIC manager, 17 years' electric and steam line experience, desires change. Now employed. Best of references. At present handling one of the largest electric properties in the United States. Thoroughly familiar with every detail of traffic work. PW1761, Elec. Ry. Journal, San Francisco.

General Auditor

Efficient executive, employed by large Middle West public service corporation, solicits change.

Seventeen years' experience (12 years electric railways); age 35, married; references.

Only position with high class public utility considered. P. W., 1795, ELECTRIC RAILWAY JOURNAL, Chicago.

POSITIONS VACANT

CHIEF engineer wanted to take charge of power station consisting of 18—500-hp. Edgemoor boilers served with Green grates, 4—1500-kw. cross compound engines, 1—2500-kw. low-pressure turbine, 1—7500-kw. high-pressure turbine. Salary, $175 per month, with early advancement. P1793, Elec. Rwy. Journal, Chicago.

DRAFTSMEN wanted experienced in detailing street railway special track work. State experience and salary expected in first letter. Address chief engineer, Buda Co., Harvey, Ill.

DRAFTSMAN wanted in office of engineer maintenance of way. One with railroad experience preferred. Apply at once. The Northern Ohio Traction & Light Co., 224 Hamilton Building, Akron, Ohio.

POSITIONS VACANT

DRAFTSMAN wanted. Man capable of designing, computing and laying out special trackwork for electric and steam railroads. Must be quick, accurate and experienced in this line. Give full particulars with reply and state salary expected. New York Switch & Crossing Co., 15th & Madison Streets, Hoboken, New Jersey.

GENERAL storekeeper—Large railway and lighting company has an opening for a "live wire" man, who can efficiently and economically handle stores proposition, familiarity with market and railroad conditions necessary, and applicant must possess executive ability and force. Exempt men only. Reply should give age, experience, salary required and references. Mahoning & Shenango Railway & Light Co., Youngstown, Ohio.

GENERAL foreman wanted to supervise work in the inspection barn. Will have charge of 19 men and 35 cars, mostly K control and GE-57 and Westinghouse 68 equipment. P1794, Elec. Rwy. Journal, Chicago.

GENERAL superintendent wanted or Southern road. An experienced man of good executive ability; send full information first letter, copies only of recommendations. Must be able to supervise shop and power station operation, track maintenance, and to take charge of transportation department. P1781, Elec. Rwy. Journal.

MAN having experience in way and structure and shop accounting wanted to fill like position with large traction line. Application should state experience, present occupation, age and salary desired. P1800, Elec. Rwy. Journal.

MASTER mechanic wanted by up-to-date street railway system in southwest town of 20,000 population. State age, salary and experience first letter. P-1798, Elec. Rwy. Journal, Chicago.

MASTER mechanic wanted for street railway operating 30 cars. Must be an organizer and systematizer with initiative, familiar with inspection system. Prefer man having experience with W. H.-A. B. control. References required. P-1799, Elec. Rwy Journal, San Francisco.

SUPERINTENDENT wanted for an electric light and power plant serving several towns with a population of about fifty thousand, who fully understands dealing with the public. Permanent position and good salary to right party. P1792, Elec. Rwy. Journal.

Your Advancement

is largely in your own hands—it is doubtful if anyone else is worrying over it

Better positions are constantly being secured through small advertisements in the "Positions Wanted" Columns

60 cents for 20 words

EMPLOYMENT AGENCIES

Correspondence Service

The undersigned provides a confidential service designed to locate openings through correspondence for men earning not less than $2,500 and up to $25,000; all lines. Not an employment service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, H1 Niagara Square, Buffalo, N. Y.

Two Fairbanks-Morse No. 28

GASOLINE SPEEDERS

FOR SALE

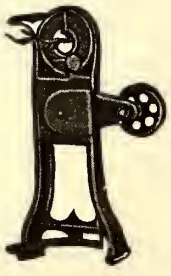
The Aurora, Elgin & Chicago R. R. Co., Aurora, Ill.

FOR SALE

Electric Locomotive

Weight, 88,000 lbs. 4 G.E.-55, 100 H.P. motors, Type M control, straight and automatic air brake, M.C.B. trucks.

ALBANY SOUTHERN RAILROAD
Rensselaer, N. Y.



Armature Coil Taping Machine

Saves Time, Labor and Money

A boy can tape 40 coils for Westinghouse 12A Armature in an hour. Further particulars gladly furnished.

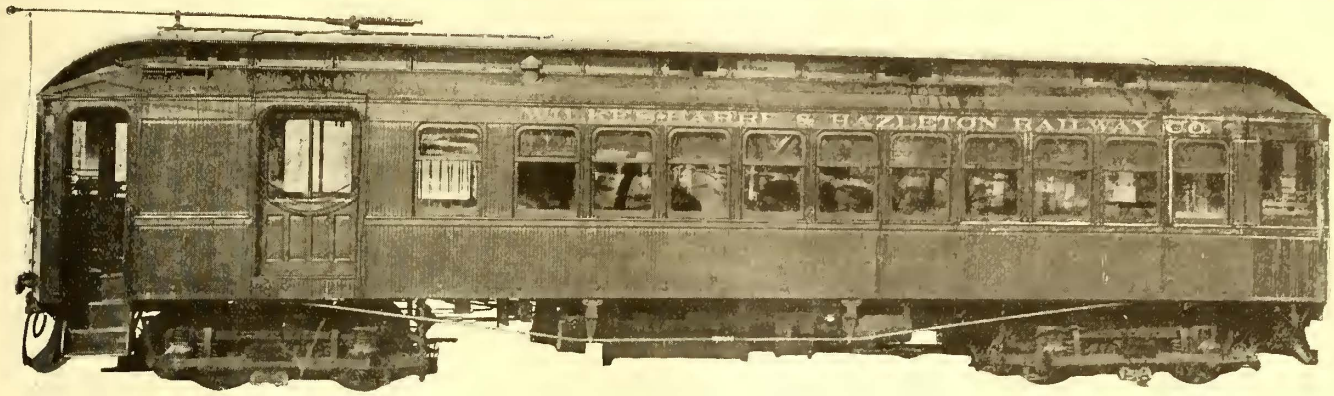
Geo. M. Griswold Machine Co.
New Haven, Conn.

OPEN and CLOSED
MOTOR and TRAIL

Write for Price and Full Particulars to

ELECTRIC EQUIPMENT Co.
601 Commonwealth Bldg. Phila. Pa.

Five Interurban Cars



For Sale by

THE C. E. A. CARR COMPANY

56 Imperial Bank Building, TORONTO, Canada

Brill High Speed Interurbans with Baggage and Smoker

52′ 5″ over all x 9′ 4″ over main sills, 10′ over grab handles, 13′ 10″ over trolley board.

Seats: H&K high back walkover, rattan; can be reupholstered, and with paint and varnish cars will be as good as new and look new.

Can be readily converted into straight passenger, seating 60 to 64 passengers, by installing seats in the present baggage compartment.

All woodwork, underframing, sheathing roof, ceiling and interior (which is mahogany) in perfect condition. No repairs needed.

TRUCKS: Brill 27E, 6′ 6″ wheel base, 6″ axles, 36″ MCB dropped forged steel wheels; most of them new; balance good as new. Special steel axles new. All first class operating condition.

AIR BRAKES: Westinghouse, both automatic and straight air for trailer or train control: can be used as locomotives. GE CP22 25′ compressor herring bone tooth type.

WEIGHT: Bodies only 22½ tons.

COUPLERS: MCB Janney passenger or freight; unlocking device in vestibule.

Interchangeable with and can be operated on steam roads.

Equipped with two trolleys and third rail shoes.

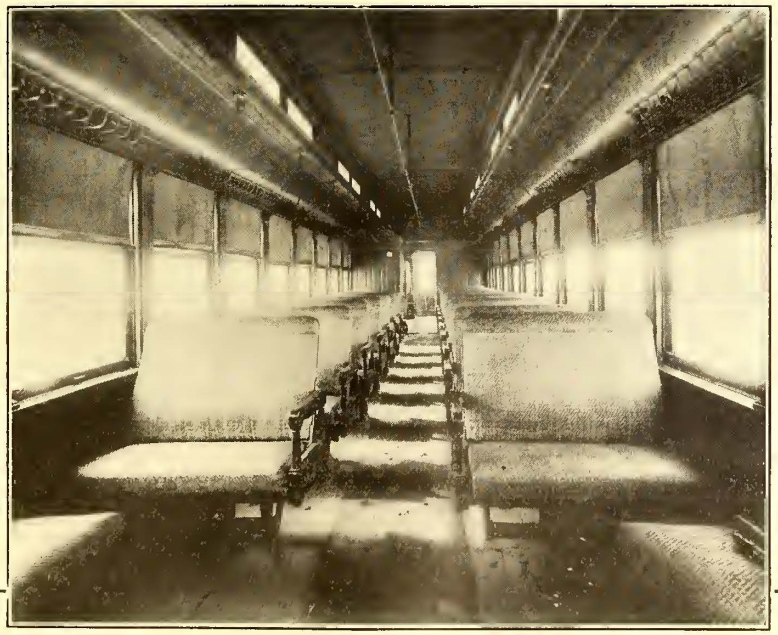
Full vestibules each end, steam coach monitor roof Pullman type, flush platforms with trap doors both ends and in the rear on both sides. Underframing composite heavily reinforced with steel.

The type "M" control is practically new in all details, having been installed about four years ago. Balance of equipment is a little over ten years old, but has been kept in the very best of condition.

Ready for immediate shipment and service.

This is a Real Bargain. Write us at once.

NOTE—We also have available 10 cars now in service with a seating capacity of 42; G. E. 74 Motors, mounted on Brill 27 E Trucks. These can be released within two weeks. WRITE US FOR FURTHER PARTICULARS.



Wanted: G-E Sixty-Six B Armatures Second-hand, but in good condition.

SEARCHLIGHT SECTION

Three 300 KW., 60 Cycle, 600/1200 Volt

General Electric
Rotary Converters
with
Transformers and Switchboards

FOR PROMPT SHIPMENT

3—300 KW. General Electric Rotary Converters, type TC, 3 phase, 60 cycle, 6 pole, 600/1200 volts, 1200 RPM., with speed limit device and starting rheostats.

3—300 KW. type HST oil cooled transformers, 3 phase, 12,000/24,000 volts primary, 370/185 volts secondary.

3—300 KW., 1200 volt D.C. rotary panels.

3—Transformer Panels.

2—1200 volt, 500 amp., feeder panels.

3—600 volt, 500 amp., feeder panels.

3—A.C. starting panels.

Complete with necessary instruments, bus copper, etc.

We have on hand all classes of Power Machinery

MACGOVERN & COMPANY, Inc.
114 Liberty Street, New York City

IMMEDIATE SHIPMENT

TURBINES

2—1000 K.W. Westinghouse Horizontal Turbo Generating, sets wound for 2 or 3 phase, 60 cycle, 2300 volts, 1800 R.P.M. Condensing Duty.

1—500 KW. General Electric Curtis steam turbine, 3 ph., 60 cy., 1800 rpm., 2300 volts, 150 lb. steam pressure, vertical type.

1—500 KW. Westinghouse Horizontal Turbo Generating Unit wound for 3 phase, 60 cy., 2300 volts, speed 3600 rpm., condensing duty.

DIRECT CONNECTED ALTERNATING UNIT

1—800 KW. Allis-Chalmers, 2300 v., 3 ph., 60 cy., 90 rpm. generator, direct connected to 22 and 44 x 48" Reynolds Corliss engine.

60 CYCLE ROTARY CONVERTERS

1—300 KW. West. rotary converter, 3 ph., 60 cy., 370 v., A.C., 575 v., D.C., 600 rpm., with 3—185 KVA. Gen. Elec., 60 cy. transformers, 2200-370 volts.

1—200 KW. Westg. 3 ph., 60 cy., 720 rpm., Rotary Converter, 575 volts D.C., 360/370 volts A.C.

1—150 KW. West. 3 ph., 60 cy. rotary converter, 550 v., 720 rpm., with two Scott connected transformers.

ARCHER & BALDWIN, Inc.
114-118 Liberty Street, New York City Telephone 4337-4338 Rector

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Simplex Car and Track Jack

Templeton, Kenly & Co., Ltd.
Chicago, Ill.

THE SEARCHLIGHT SECTION

will find { The man / The position / The plant } *you want*

PUT YOUR AD IN THE SEARCHLIGHT

FOR SALE

16 Peter Smith No. C-1

Hot Water Heaters

with or without piping. Heaters and pipe in first-class condition. Property now using these heaters to be operated entirely by water power is reason for sale.

ATLANTIC SHORE RAILWAY
Kennebunk, Maine

FOR SALE

Through plate girder

BRIDGE

designed for 60-ton interurban cars, made up of two plate girders, length 53 ft., depth 4 ft., with suitable floor system.

Indiana Railways & Light Company
Kokomo, Indiana

Rails

600 tons 60-lb. A.S.C.E. with angles.
250 tons 67½-lb. 5 in. high with angles.
100 tons 70-lb. A.S.C.E. with angles.
350 tons 75-lb., New, with angles.
150 tons 80-lb. A.S.C.E. with con. angles. **Good as new.**
150 tons 90-lb. 9 in. Grooved Girder Relay.
600 tons 100-lb. Standard with angles.
400 tons 105-lb. 7 in. Grooved Girder. **New.**

Interurban Cars

1—55 ft. passenger and baggage, 4 GE 57 motors, 55 h.p., seats 58 passengers. **Practically new.**

1—46 ft. 8 in. passenger trailer. Seats 50 passengers. **Practically new.**

Street Cars

4—30 ft. single-truck, P.A.Y.E.; one-man operation. Seat 28 and 32 passengers. GE 80 motors.

7—30 ft. 8 in. single truck. P.A.Y.E. Seat 32 passengers GE 80 motors, 550 to 600 volts

All First-class

Ballast Cars

25 Side Dump Cars, 23 yds. cap. Length 22 ft. Standard MCB equipment. Short couples. Will take 45 ft. radius curve. **Strictly first-class.**

ZELNICKER IN ST. LOUIS
GET BULLETIN 230—68 BARGAIN PAGES

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85 lb. A. S. C. E. Relayers

16,000 tons—with Angle Bars to match. Available immediate shipment and centrally located.
We positively own these Rails and offer same in carload lots and over.
25,000 tons—Relayers—sizes 25 lb. to 100 lb., in stock our Pittsburgh yards and vicinity.
Immediate shipment guaranteed and prices very attractive.
Carload and less than carload inquiries and orders solicited.
Rails cut to length for structural purposes.
Frogs, Switches, Bolts, Nuts, Spikes and all Accessories.

L. B. FOSTER COMPANY
Park Bldg. Pittsburgh, Pa.

CLEVELAND ARMATURE WORKS
Cleveland, Ohio

Everything in the Line of Repairs to Electrical Machinery

Complete Armatures, New Armatures, Rewound Armature Cores, Armature Shafts, Armature Coils, Fields and Commutators.

Established 22 Years.

Get Your Wants into the Searchlight

WHAT AND WHERE TO BUY

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

Acetylene Service and Apparatus.
Oxweld Acetylene Co.

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

Air Cleaners.
Horne Mfg. Co.

Air Rectifiers.
Holden & White, Inc.
National Safety Devices & Mfg. Co.

Alloys, Steel & Iron (See also Bearings and Bearing Metals.)
Titanium Alloy Mfg. Co.

Ammeters.
Weston Electrical Instrument Co.

Anchors, Guy.
Electric Service Supplies Co.
Holden & White, Inc.
Johns-Manville Co., H. W.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Anti-Climbers.
Railway Improv. Co.

Arc Lamp Cord.
Samson Cordage Works.

Automobiles and Buses.
Brill Co., The J. G.
General Vehicle Co.

Axle Straighteners.
Columbia M. W. & M. I. Co.

Axles.
Bemis Car Truck Co.
Brill Co., The J. G.
Carnegie Steel Co.
General Steel Co.
National Railway Appliance Co.
St. Louis Car Co.
Standard Steel Works Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Babbitting Devices.
Columbia M. W. & M. I. Co.

Badges and Buttons.
American Railway Supply Co.
Electric Service Supplies Co.
International Register Co., The.
Western Electric Co.
Woodman Mfg. & Supply Co., R.

Bankers and Brokers.
Coal & Iron National Bank.
National City Co.

Batteries, Dry.
Johns-Manville Co., H. W.
Western Electric Co.

Batteries, Storage.
Electric Storage Battery Co.
Western Electric Co.

Bearings and Bearing Metals.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Kerschner Co., Inc., W. R.
Long Co., E. G.
More-Jones Brass & M. Co.
St. Louis Car Co.
Taylor Elec. Truck Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side.
Baldwin Locomotive Works.
Holden & White, Inc.
Stucki Co., A.

Bearings, Oil-less, Graphite, Bronze and Wood.
Bound Brook Oil-less Bearing Co.

Bearings, Roller and Ball.
Gurney Ball Bearing Co.
Railway Roller Bearing Co.
SKF Ball Bearing Co.

Bells and Gongs.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.
Western Electric Co.

Benders, Rail.
Niles-Bement-Pond Co.
Watson-Stillman Co.
Zelnicker Supply Co., W. A.

Boiler Cleaning Compounds.
Dearborn Chemical Co.
Johns-Manville Co., H. W.

Boiler Coverings.
Johns-Manville Co., H. W.

Boiler Graphite.
Dixon Crucible Co., Joseph.

Boiler Tubes.
National Tube Co.

Boilers.
Babcock & Wilcox Co.

Bond Testers.
American Steel & Wire Co.

Bonding Apparatus.
Electric Railway Improv. Co.
Lincoln Bonding Co.
Ohio Brass Co.
Oxweld Acetylene Co.

Bonding Tools.
American Steel & Wire Co.
Electric Railway Improve. Co.
Electric Service Supplies Co.
Ohio Brass Co.

Bonds, Rail.
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Lincoln Bonding Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Book Publishers.
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel.
Niles-Bement-Pond Co.

Braces, Rail.
Kilby Frog & Switch Co.

Brackets and Cross Arms. (See also Poles, Ties, Posts, Piling and Lumber.)
Bates Expanded Steel Truss Co.
Creaghead Engrg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.
Western Electric Co.

Brake Adjusters.
Holden & White, Inc.
Smith-Ward Brake Co.

Brake Shoes.
American Brake S. & Fdy. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Long Co., E. G.
St. Louis Car Co.
Taylor Elec. Truck Co.
Wheel Truing Brakeshoe Co.

Brakes, Brake Systems and Brake Parts.
Bemis Car Truck Co.
Brill Co., The J. G.
Br. Westinghouse Elec. & Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.
Holden & White, Inc.
Horne Mfg. Co.
Long Co., E. G.
National Brake Co.
National Safety Devices & Mfg. Co.
St. Louis Car Co.
Safety Car Devices Co.
Taylor Elec. Truck Co.
Westinghouse Trac. Brake Co.

Brooms, Track, Steel or Rattan.
Paxson Co., J. W.
Western Electric Co.
Zelnicker Supply Co., W. A.

Brushes, Carbon.
American Carbon & Battery Co.
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co.
United States Graphite Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite.
Dixon Crucible Co., Jos.

Brush Holders.
Anderson Mfg. Co., A. & J. M.
Eureka Co.

Bushings, Case Hardened Manganese.
Bemis Car Truck Co.

Bushings, Fibre.
Diamond State Fibre Co.

Bushings, Graphite & Wooden.
Bound Brook Oil-less Bearing Co.

Business Instruction.
Alexander Hamilton Institute.

Cables, (See Wires and Cables.)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those Headings.)

Car Trimmings. (For Curtains, Doors, Seats, etc., see those Headings.)

Cars, Dump.
Differential Car Co.

Cars, Oil-Electric.
Electric Car & Loco. Corp.

Cars, Passengers, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Kuhlman Car Co., G. C.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand.
Carr Co., C. E. A.
Electric Equipment Co.
Kerschner Co., Inc., W. R.
Wendell & MacDuffie Co.

Cars, Self-Propelled.
Br. Westinghouse Elec. & Mfg. Co.
Electric Storage Battery Co.
General Electric Co.

Castings, Brass, Composition or Copper.
Anderson M. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
Frankel Connector Co.
Horne Mfg. Co.
More-Jones Brass & M. Co.

Castings, Gray Iron & Steel.
American B. S. & Fdry. Co.
American Steel Foundries.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Horne Mfg. Co.
Long Co., E. G.
St. Louis Car Co.
Standard Steel Works Co.
Union Spring & Mfg. Co.

Castings, Malleable and Brass.
American Brake S. & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Horne Mfg. Co.
Long Co., E. G.
St. Louis Car Co.

Catchers and Retrievers, Trolley.
Earll, C. I.
Electric Service Supplies Co.
Holden & White, Inc.
Horne Mfg. Co.
Kerschner Co., Inc., W. R.
Long Co., E. G.
Ohio Brass Co.
Trolley Supply Co.
Wood Co., C. N.

Ceiling, Car.
Keyes Products Co.

Certified Public Accountant.
Swan, James T.

Checks, Employees.
American Railway Supply Co.

Chemists.
Little, Inc., Arthur D.

Circuit Breakers.
Automatic Reclosing Circuit Breaker Co.
Cutter Electrical & Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Clamps and Connectors, for Wires and Cables.
Anderson Mfg. Co., A. & J. M.
Dossert & Co.
Electric Service Supplies Co.
Frankel Connector Co.
General Electric Co.
Hubbard & Co.
Klein & Sons, M.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Cleaners & Scrapers, Track (See also Snow-Plows, Sweepers and Brooms.)
Brill Co., The J. G.
Ohio Brass Co.
Root Spring Scraper Co.
Western Electric Co.

Clusters and Sockets.
General Electric Co.

Coal and Ash Handling. (See Conveying and Hoisting Machinery.)

Coasting Recorders.
Railway Improv. Co.

Coil Banding and Winding Machines.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Western Electric Co.

Coils, Armature and Field.
Cleveland Armature Works.
Coil Mfg. & Repair Co.
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Westingbouse Elec. & M. Co.

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

Coin-Counting Machines.
Electric Service Supplies Co.
International Register Co.
Johnson Fare Box Co.

Commutator Slotters.
Electric Service Supplies Co.
General Electric Co.
Westingbouse Elec. & M. Co.
Wood Co., C. N.

Commutator Slotting Files.
Handy Supply Co.

Commutator Stones.
Handy Supply Co.

Commutator Truing Devices.
General Electric Co.

Commutators or Parts.
Cameron Elec'l Mfg. Co.
Cleveland Armature Works.
Coil Mfg. & Repair Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Long Co., E. G.
Mica Insulator Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Compounds, Commutator.
Ideal Commutator Dresser Co.

Compressors, Air.
General Electric Co.
Westinghouse Trac. Brake Co.

Condensers.
General Electric Co.
Westinghouse Elec. & M. Co.

WHAT AND WHERE TO BUY

Conduits, Flexible.
Tubular Woven Fabric Co.

Condnits, Underground.
Johns-Manville Co., H. W.
Standard Underground Cable Co.

Connectors, Solderless.
Dossert & Co.
Frankel Connector Co.

Controller Regulators.
Electric Service Supplies Co.

Controllers or Parts.
Br. Westinghouse Elec. & Mfg. Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Horne Mfg. Co.
Johns-Manville Co., H. W.
Kerschner Co., Inc., W. R.
Westinghouse Elec. & M. Co.

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

Converters, Rotary.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Conveying and Hoisting Machinery.
Colnmbia M. W. & M. I. Co.
Green Eng'g Co.

Cooling System.
Spray Engineering Co.

Cordage.
Samson Cordage Works.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The.
Long Co., E. G.
Roebling's Sons Co., John A.
Samson Cordage Works.
Trolley Supply Co.

Cord Connectors and Couplers.
Electric Service Supplies Co.
Samson Cordage Works.
Wood Co., C. N.

Couplers, Car.
Brill Co., The J. G.
Long Co., E. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Couplings, Conduit.
Horne Mfg. Co.

Cranes. (See also Hoists.)
Niles-Bement-Pond Co.
Thew Automatic Shovel Co.

Creosoting. (See Wood Preservatives.)

Cross Arms. (See Brackets.)

Crossing Foundations.
Balkwill Manganese Crossing Co.
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing.)

Crossings, Track. (See Track, Special Work.)

Culverts.
American Rolling Mill Co.
Bark River B. & Culvert Co.
California Cor. Culvert Co.
Canada Ingot Iron Co., Ltd.
Canton Culvert & Silo Co.
Coast Culvert & Flume Co.
Corrugated Culvert Co.
Delaware Metal Culvert Co.
Dixie Culvert & Metal Co.
Hardesty Mfg. Co., R.
Illinois Corrugated Metal Co.
Independence Culvert Co.
Iowa Pure Iron Culvert Co.
Kentucky Culvert Mfg. Co.
Lone Star Culvert Co.
Lyle Corrugated Culvert Co.
Michigan Bridge & Pipe Co.
Montana Culvert Co.
Nebraska Culvert & Mfg. Co.
Nevada Metal Mfg. Co.
New England Metal Cul. Co.
North East Metal Co.
Northwestern Sheet & I. Wks.
O'Neall Co., W. Q.
Ohio Corrugated Culvert Co.
Pennsylvania Metal Cul. Co.
Road Supply & Metal Co.
Sioux Falls Metal Cul. Co.
Spokane Cul. & Tank Co.
Tennessee Metal Culvert Co.
Utah Corr. Cul. & Flume Co.
Virginia Metal & Culvert Co.
Western Metal Mfg. Co.
Wyatt Mfg. Co.

Curtains and Curtain Fixtures.
Brill Co., The J. G.
Du Pont Fabrikoid Co.
Electric Service Supplies Co.
Hartshorn Company, Stewart.
St. Louis Car Co.

Cutting Apparatus, Oxy-Acetylene.
Oxweld Acetylene Co.

Derailing Devices.
Cleveland Frog & Crossing Co.

Destination Signs.
Columbia M. W. & M. I. Co.
Creaghead Engrg. Co.
Electric Service Supplies Co.

Detective Service.
Wisch Service, P. Edward.

Die Blocks.
General Steel Co.

Door Operating Devices.
Consolidated Car Heating Co.
National Pneumatic Co.
Safety Car Devices Co.

Doors, Asbestos.
Johns-Manville Co., H. W.

Doors and Door Fixtures.
Brill Co., The J. G.
Hale & Kilburn Co.

Doors, Folding Vestibule.
National Pnenmatic Co.

Draft Rigging. (See Couplers, Car.)

Drills, Track.
American Steel & Wire Co.
Electric Service Supplies Co.
Long Co., E. G.
Niles-Bement-Pond Co.
Ohio Brass Co.

Dryers, Sand.
Electric Service Supplies Co.
Zelnicker Supply Co., W. A.

Engineers, Consulting, Contracting and Operating.
Archbold-Brady Co.
Arnold Co., The.
Beeler, John A.
Byllesby & Co., H. M.
Ford, Bacon & Davis.
Hunt & Co., Robert W.
Jackson, D. C. & Wm. B.
Little, Inc., Arthnr D.
Richey, Albert S.
Sanderson & Porter.
Sargent & Lundy.
Scofield Engineering Co.
Sloan, Huddle, Feustel & Freeman.
Stone & Webster Eng'g Corp.
White Companies, The J. G.
Woodmansee & Davidson Engineering Co.

Engines, Gas and Oil.
Westinghouse Elec. & M. Co.

Engines, Steam.
Westinghouse Elec. & M. Co.

Fare Boxes.
Brill Co., The J. G.
Cleveland Fare Box Co.
International Register Co., The.
Johnson Fare Box Co.
Ohmer Fare Register Co.

Fences, Woven Wire and Fence Posts.
American Steel & Wire Co.
Page Steel & Wire Co.

Fenders and Wheel Guards.
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Root Spring Scraper Co.
Star Brass Works.
Trolley Supply Co.
Western Electric Co.
Wood Co., Charles N.

Fibre and Fibre Tubing.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Westinghouse Elec. & M. Co.

Fibre Insulation.
National Ry. Appliance Co.

Field Coils. (See Coils.)

Filters, Water.
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatns.
Johns-Manville Co., H. W.

Fire-Proofing Materials.
Johns-Manville Co., H. W.

Flooring, Composition.
American Mason Safety T. Co.
Johns-Manville Co., H. W.
Western Electric Co.

Forgings.
Columbia M. W. & M. I. Co.
Eureka Co.
Standard Steel Works Co.

Freqnency Meters.
Weston Electrical Instruments Co.

Fuses and Fuse Boxes.
Chicago Fuse Mfg. Co.
Colnmbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Western Electric Co.
Westinghouse Elec. & M. Co.

Fuses, Refillable.
Columbia M. W. & M. I. Co.
Economy Fuse & Mfg. Co.
General Electric Co.
Horne Mfg. Co.

Gages, Oil and Water.
Ohio Brass Co.

Gaskets.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Power Specialty Co.

Gas-Electric Cars.
General Electric Co.

Gas Producers.
Westinghouse Elec. & M. Co.

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

Gear Blanks.
Carnegie Steel Co.
Diamond State Fibre Co.
Standard Steel Wks. Co.

Gear Cases.
Colnmbia M. W. & M. I. Co.
Electric Service Supplies Co.
Kerschner Co., Inc., W. R.
National Ry. Appliance Co.
Thayer & Co., Inc.
Westinghonse Elec. & M. Co.

Gears and Pinions.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Diamond State Fibre Co.
Electric Service Supplies Co.
General Electric Co.
Kerschner Co., Inc., W. R.
Long Co., E. G.
National Ry. Appliance Co.
Nuttall Co., R. D.

Generating Sets, Gas-Electric.
General Electric Co.

Generators.
Dick, Kerr & Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Gongs. (See Bells and Gongs.)

Graphite.
Dixon Crucible Co., Joseph.
Morgan Crucible Co.

Grates, Chain.
Green Eng'g Co.

Greases. (See Lubricants.)

Grinders and Grinding Supplies.
General Electric Co.
Goldschmidt Thermit Co.
Railway Track-work Co.

Grinding Blocks & Wheels.
Norton Co.

Gnards, Trolley.
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley.
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
Hensley Trolley & Mfg. Co.
More-Jones Brass & M. Co.
Nuttall Co., R. D.
Star Brass Works.
Western Electric Co.

Headlights.
Electric Service Supplies Co.
General Electric Co.
Long Co., E. G.
Ohio Brass Co.
St. Louis Car Co.
Trolley Snpply Co.

Headlinings.
Kerschner Co., Inc., W. R.
Keyes Products Co.

Heaters, Car, Electric.
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Smith Heater Co., Peter.

Heaters, Car, Hot Air and Water.
Cooper Heater Co.
Smith Heater Co., Peter.

Heaters, Car, Stove.
Electric Service Supplies Co.
Smith Heater Co., Peter.

Hoists and Lifts.
Columbia M. W. & M. I. Co.
Duff Manufacturing Co.
Ford Chain Block & Mfg. Co.
Niles-Bement-Pond Co.
Yale & Towne Mfg. Co.

Hose Bridges.
Ohio Brass Co.

Hose, Pneumatic and Fire.
Johns-Manville Co., H. W.

Hydranlic Machinery.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Hydrogronnds.
Horne Mfg. Co.

Inspection.
Elec'l Testing Laboratories.
Hunt & Co., Robert W.

Instrument Transformers.
Weston Electrical Instrument Co.

Instrnments, Measnring, Testing and Recording.
Economy Electric Devices Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghonse Elec. & M. Co.
Weston Elec'l Instrument Co.

Insulating Cloths, Paper and Tape.
Anchor Webbing Co.
Diamond State Fibre Co.
Freydberg Bros., Inc.
General Electric Co.
Hope Webbing Co.
Horne Mfg. Co.
Johns-Manville Co., H. W.
Mechanical Rubber Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
Okonite Co.
Packard Electric Co.
Standard Paint Co.
Standard Underground Cable Co.
Standard Woven Fabric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Insulation. (See also Paints.)
Anderson M. Co., A. & J. M.
Diamond State Fibre Co.
Electric Service Supplies Co.
General Electric Co.
Horne Mfg. Co.
Johns-Manville Co., H. W.
Mechanical Rubber Co.
Mitchell-Rand Mfg. Co.
Okonite Co.
Standard Varnish Works.
Western Electric Co.
Westinghouse Elec. & M. Co.

WHAT AND WHERE TO BUY

Insulators. (See also Line Material.)
Anderson M. Co., A. & J. M.
Creaghead Engrg. Co.
Drew Elec. & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Horne Mfg. Co.
Johns-Manville Co., H. W.
Locke Insulator Mfg. Co.
Macallen Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.
White Elec. Supply Co., T. C.

Insulator Pins.
Hubbard & Co.

Insurance, Fire.
Marsh & McLennan.

Inventions, Developed and Perfected.
Peters & Co., G. D.

Jacks. (See also Cranes, Hoists and Lifts.)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
Duff Manufacturing Co.
National Ry. Appliance Co
Templeton, Kenly Co., Ltd.
Watson-Stillman Co.

Joints, Rail.
Atlantic Welding Co.
Carnegie Steel Co.
Rail Joint Co.
Zelnicker Supply Co., W. A.

Journal Boxes.
Bemis Car Truck Co.
Brill Co., The J. G.
Gurney Ball Bearing Co.
Long Co., E. G.
Railway Roller Bearing Co.

Junction Boxes.
Johns-Manville Co., H. W.
Standard Underground Cable Co.

Laboratories.
Elec'l Testing Laboratories.
Little, Inc., Arthur D.

Lamp Guards and Fixtures.
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Lamps, Arc and Incandescent.
Anderson M. Co., A. & J. M.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Lamps, Signal and Marker.
Ohio Brass Co.

Lathes, Car Wheel.
Niles-Bement-Pond Co.

Lighting Regulators, Car.
Holden & White, Inc.

Lightning Arresters.
Horne Mfg. Co.
Railway & Ind. Eng. Co.

Lightning Protection.
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold-Brady Co.
Columbia M. W. & M. I. Co.
Creaghead Engrg. Co.
Diamond State Fibre Co.
Dick, Kerr & Co.
Dossert & Co.
Drew Elec. & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Holden & White, Inc.
Hubbard & Co.
Johns-Manville Co., H. W.
Locke Insulator Mfg. Co.
Macallen Co.
More-Jones Brass & M. Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.
White Elec. Supply Co., T. C.

Locks.
Yale & Towne Mfg. Co.

Locomotives, Electric.
Baldwin Locomotive Works.
Brill Co., The J. G.
General Electric Co.
Westinghouse Elec. & M. Co.

Lubricating Engineers.
Galena-Signal Oil Co.

Lubricants, Oil and Grease
Borne, Scrymser Co.
Dearborn Chemical Co.
Dixon Crucible Co., Jos.
Galena-Signal Oil Co.

Lumber. (See Poles, Ties, Posts, etc.)

Machine Work.
Columbia M. W. & M. I. Co.
Holden & White, Inc.
Horne Mfg. Co.

Machine Tools.
Columbia M. W. & M. I. Co.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Manganese Parts.
Bemis Car Truck Co.

Mats.
Johns-Manville Co., H. W.

Meters, Car, Watthour.
Economy Electric Devices Co.

Meters. (See Instruments.)

Mica.
Long Co., E. G.
Macallen Co.
Mechanical Rubber Co.

Mirrors for Motormen.
Drew Electric Mfg. Co.

Motormen's Seats.
Electric Service Supplies Co.
Wood Co., C. N.

Motor Generator, Bonding and Welding.
Lincoln Bonding Co.

Motor Leads.
Dossert & Co.

Motor Trucks, Gas and Electric.
General Vehicle Co.

Motors and Generators Sets
General Electric Co.

Motors, Electric.
Br. Westinghouse Elec. & Mfg. Co.
Dick, Kerr & Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Nuts and Bolts.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.
Long Co., E. G.
National Ry. Appliance Co.
Roller Lock Nut Co.

Oils. (See Lubricants.)

Overhead Equipment. (See Line Material.)

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

Packing.
Diamond State Fibre Co.
Electric Service Supplies Co.
Johns-Manville Co., H. W.
Mechanical Rubber Co.
Power Specialty Co.

Packing Rings.
Johns-Manville Co., H. W.

Paints and Varnishes. (Insulating.)
General Electric Co.
Holden & White, Inc.
Johns-Manville Co., H. W.
Long Co., E. G.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
Packard Electric Co.
Standard Paint Co.
Standard Varnish Works.

Paints and Varnishes. (Preservative.)
Dixon Crucible Co., Jos.
Johns-Manville Co., H. W.
Long Co., E. G.
National Ry. Appliance Co.
Standard Paint Co.

Paints and Varnishes for Woodwork.
National Railway Appliance Co.

Paving Material.
American B. S. & Fdy. Co.
Barrett Co., The.

Paving Pitch.
Barrett Co., The.

Pickups. (Trolley Wire.)
Electric Service Supplies Co.
Ohio Brass Co.

Pinion Pullers.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Wood Co., C. N.

Pinions. (See Gears.)

Pins, Case Hardened, Wood and Iron.
Bemis Car Truck Co.
Electric Service Supplies Co.
Long Co., E. G.
Ohio Brass Co.

Pipe.
National Tube Co.

Pipe Fittings.
Power Specialty Co.
Standard Steel Works Co.
Watson-Stillman Co.

Pliers, Insulated.
Rubber Ins. Metals Corp.

Pole Sleeves.
Drew Electric & Mfg. Co.

Poles, Metal Street.
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Hubbard & Co.
National Railway Appliance Co.

Poles, Ties, Posts, Piling and Lumber.
Carney & Co., B. J.
Lindsley Bros. Co.
Page & Hill Co.
Valentine-Clark Co.
Western Electric Co.

Poles and Ties, Treated.
Lindsley Bros. Co.
Page & Hill Co.
Valentine-Clark Co.
Western Electric Co.

Poles, Trolley.
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Long Co., E. G.
National Tube Co.
Nuttall Co., R. D.

Pole Reinforcing.
Hubbard & Co.

Poles, Tubular Steel.
National Tube Co.

Potheads.
Okonite Co.

Power Factor Meters.
Weston Electrical Instrument Co.

Power Saving Devices.
Arthur Power-Saving Recorder Co.

Pressure Regulators.
General Electric Co.
Ohio Brass Co.

Pumps.
Watson-Stillman Co.

Punches, Ticket.
American Railway Supply Co.
Bonney-Vehslage Tool Co.
Horne Mfg. Co.
International Register Co., The.
Wood Co., C. N.
Woodman Mfg. & Supply Co., R.

Punching Machinery.
Watson-Stillman Co.

Purifiers, Feed Water.
Scaife & Sons Co., Wm. B.

Rail Grinders. (See Grinders.)

Rails, Relaying.
Zelnicker Supply Co., W. A.

Rail Welding. (See Welding Processes and Apparatus.)

Rattan.
Brill Co., The J. G.
Electric Service Supplies Co.
Hale & Kilburn Co.
St. Louis Car Co.

Recorders, Power Saving.
Arthur Power-Saving Recorder Co.

Registers and Fittings.
Bonham Recorder Co.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The.
Long Co., E. G.
Ohmer Fare Register Co.
Rooke Automatic Register Co.

Reinforcing Concrete.
American Steel & Wire Co.

Repair Shop Appliances. (See also Coil Banding and Winding Machines.)
Colnmbia M. W. & M. I. Co.
Electric Service Supplies Co.

Repair Work. (See also Coils, Armature and Field.)
Cleveland Armature Works.
Coil Mfg. & Repair Co.
Columbia M. W. & M. I. Co.
General Electric Co.
Independent Lamp & W. Co.
Westinghouse Elec. & M. Co.

Replacers, Car.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Resistance, Grid.
Columbia M. W. & M. I. Co.

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

Retrievers, Trolley. (See Catchers and Retrievers, Trolley.)

Rheostats.
General Electric Co.
Mica Insulator Co.
Westinghouse Elec. & M. Co.

Roofing, Building.
Barrett Co., The.
Johns-Manville Co., H. W.
Standard Paint Co.

Roofing, Car.
Johns-Manville Co., H. W.
Keyes Products Co.
Pantasote Co., The.

Rubber Specialties of all Kinds.
Mechanical Rubber Co.

Sand Blasts.
National Ry. Appliance Co.

Sanders, Track.
Brill Co., The J. G.
Cleveland Fare Box Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Holden & White, Inc.
Horne Mfg. Co.
Ohio Brass Co.
St. Louis Car Co.

WHAT AND WHERE TO BUY

Sash Cord.
Samson Cordage Works.

Sash Fixtures, Car.
Brill Co., The J. G

Sash, Metal, Car Windows.
Hale & Kilburn Co.

Sash Operators.
Drouvé Co., The G.

Scales, Weights, Balances and Dynamometers.
Horne Mfg. Co.

Seating Material. (See also Rattan.)
Brill Co., The J. G.
Du Pont Fabrikoid Co.

Seats, Car.
Brill Co., The J. G.
Hale & Kilburn Co.
Peters & Co., G. D.
St. Louis Car Co.

Second-Hand Equipment. (See also pages 152-155.)
Archer & Baldwin.
Kerschner Co., Inc., W. R.
MacGovern & Co.

Shade Rollers.
Hartshorn Co., Stewart.

Shades, Vestibule.
Brill Co., The J. G.
Electric Service Supplies Co.

Shovels.
Hubbard & Co.

Shovels, Power, Steam, Gas and Electric.
Thew Automatic Shovel Co.

Signal Cord.
Samson Cordage Works.

Signals, Car Starting.
Consolidated Car Heating Co.
National Pneumatic Co.

Signals, Highway Crossing.
Electric Service Supplies Co.
Nachod Signal Co., Inc.
U. S. Electric Signal Co.

Signal Systems, Block.
Electric Service Supplies Co.
Federal Signal Co.
Nachod Signal Co., Inc.
Union Switch & Signal Co.
U. S. Electric Signal Co.
Western Electric Co.
Wood Co., C. N.

Skylights, Steel, Puttyless.
Drouvé Co., The G.

Slack Adjusters. (See Brake Adjusters.)

Sleet Wheels and Cutters.
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Bonney-Vehslage Tool Co.
Columbia M. W. & M. I. Co.
Drew Electric & Mfg. Co.
Holden & White, Inc.
More-Jones Brass & M., Co.
Nuttall Co., R. D.

Snow-Plows, Removers, Sweepers, etc.
Brill Co., The J. G.
Colnmbia M. W. & M. I. Co.
Consolidated Car Fender Co.

Soldering and Brazing Apparatus. (See Welding Proc. & App.)

Speed Indicators.
Johns-Manville Co., H. W.
Wood Co., C. N.
Woodman Mfg. & Supply Co., R.

Spikes.
American Steel & Wire Co.

Splicing Compounds.
Johns-Manville Co., H. W.
Mechanical Rubber Co.
Standard Woven Fabric Co.
Westinghouse Elec. & M. Co.

Splicing Sleeves. (See Clamps and Connectors.)

Springs, Car & Truck.
American Steel Foundries.
American Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Long Co., E. G.
Standard Steel Works Co.
Taylor Elec. Truck Co.
Union Spring & Mfg. Co.

Sprinklers, Track and Road.
Brill Co., the J. G.
St. Lonis Car Co.

Steps, Car.
American Mason S. T. Co.
Universal Safety Tread Co.

Stokers, Mechanical.
Babcock & Wilcox Co.
Green Engrg. Co.
Murphy Iron Works.
Westinghonse Elec. & M. Co.

Storage Batteries. (See Batteries, Storage.)

Straps, Car, Sanitary.
Holden & White, Inc.
Railway Improvement Co.

Structural Iron. (See also Bridges.)

Sub-Stations, Portable.
Railway & Ind. Eng. Co.

Superheaters.
Babcock & Wilcox.
Power Specialty Co.

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

Switchboard Mats.
Western Electric Co.

Switches, Automatic.
Western Electric Co.

Switchstands.
Kilby Frog & Switch Co.
Ramapo Iron Works.

Switches, Track. (See Track, Special Work.)

Switches and Switchboards.
Anderson M. Co., A. & J. M.
Cutter Electrical & Mfg. Co.
Electric Service Supplies Co.
General Electric Co.
U. S. Electric Signal Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Syncroscopes.
Weston Electrical Instrument Co.

Tampers, Tie.
Ingersoll-Rand Co.

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

Telephones and Parts.
Electric Service Supplies Co.
Western Electric Co.

Terminals.
Frankel Connector Co.

Terminal Cables.
Standard Underground Cable Co.

Testing Clips.
Frankel Connector Co.

Testing, Commercial and Electrical.
Electrical Testing Laboratories.
Hunt & Co., Robert W.

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

Thermostats.
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Railway Utility Co.
Smith Heater Co., Peter.

Ticket Boxes.
Macdonald Ticket & Ticket Box Co.

Ticket Choppers and Destroyers.
Electric Service Supplies Co.
Patten Co., Paul B.

Tickets and Transfers.
American Railway Snpply Co.

Ties, Mechanical.
Dayton Mechanical Tie Co.

Ties and Tie Rods, Steel.
Barbour-Stockwell Co.
Carnegie Steel Co.
International Steel Tie Co.

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

Tools, Track and Miscellaneous.
American Steel & Wire Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Johns-Manville Co., H. W.
Klein & Sons, M.
Railway Track-work Co.

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

Towers and Transmission Structures.
Archbold-Brady Co.
Bates Expanded Steel Truss Co.
Westinghouse Elec. & M. Co.

Tower Wagons and Auto-Trucks.
General Vehicle Co.
McCardell & Co., J. R.

Track, Special Work.
American Frog & Switch Co.
Barbour-Stockwell Co.
Cleveland Frog & Crossing Co.
Columbia M. W. & M. I. Co.
Kilby Frog & Switch Co.
New York Switch & Crossing Co.
Ramapo Iron Works.

Transfers. (See Tickets.)

Transfer Issuing Machines.
Ohmer Fare Register Co.

Transfer Tables.
Archbold-Brady Co.

Transformers.
General Electric Co.
Packard Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Treads, Safety Stair Car Step.
American Mason Safety Tread Co
Universal Safety Tread Co.

Trolley Bases.
Anderson M. Co., A. & J. M.
Electric Service Snpplies Co.
General Electric Co.
Holden & White, Inc.
Horne Mfg. Co.
More-Jones Brass & M. Co.
Nuttall Co., R. D.
Ohio Brass Co.
Trolley Supply Co.

Trolley Bases, Retrieving.
Holden & White, Inc.

Trolley Cord.
Samson Cordage Works.

Trolley Shoes.
Holden & White, Inc.
Miller Trolley Shoe Co.

Trolleys and Trolley Systems.
Ford Chain Block & Mfg. Co.

Trucks, Car.
American Steel Foundries.
Baldwin Locomotive Works.
Bemis Car Truck Co.
Brill Co., The J. G.
Long Co., E. G.
St. Louis Car Co.
Taylor Elec. Trnck Co.

Tubing, Steel.
National Tube Co.

Tubular Webbing.
Tubular Woven Fabric Co.

Turbines, Steam.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Turnstiles.
Perey Mfg. Co., Inc.

Valves.
Ohio Brass Co.

Varnishes. (See Paints, etc.)

Ventilator, Building.
Drouvé Co., The G.

Ventilators, Car.
Brill Co., The J. G.
Globe Ventilator Co.
Holden & White, Inc.
Railway Utility Co.
St. Louis Car Co.

Volt Meters. (See Instruments.)
Atlantic Welding Co.

Washers.
Bonnd Brook Oil-less Bearing Co.
Diamond State Fibre Co.

Water Softening and Purifying Systems.
Scaife & Sons Co., Wm. B.

Wattmeters.
Weston Electrical Instrument Co.

Welders, Portable Electric.
Electric Railway Improv. Co.

Welding Processes and Apparatus.
Electric Railway Improvement Co.
General Electric Co.
Goldschmidt Thermit Co.
National Ry. Appliance Co.
Oxweld Acetylene Co.
Westinghouse Elec. & M. Co.

Wheel Grinders.
Wheel Truing Brake Shoe Co.

Wheel Guards. (See Fenders and Wheel Guards.)

Wheels, Car, Cast Iron.
American Steel & Wire Co.
Association of Mfrs. of Chilled Car Wheels.
Bemis Car Truck Co.
Griffin Wheel Co.
Long Co., E. G.

Wheels, Car. (Steel and Steel Tired.)
American Steel Foundries.
Bemis Car Truck Co.
Carnegie Steel Co.
Standard Steel Works Co.

Wheels, Trolley.
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Bound Brook Oil-less Bearing Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hensley Trolley & Mfg. Co.
Holden & White, Inc.
Johns-Manville Co., H. W.
Long Co., E. G.
More-Jones Brass & M. Co.
Nuttall Co., R. D.
Star Brass Works.

Whistles, Air.
General Electric Co.
Ohio Brass Co.

Window Operators.
Drouvé Co., The G.

Wire Rope.
American Steel & Wire Co.
Roebling's Sons Co., John A.

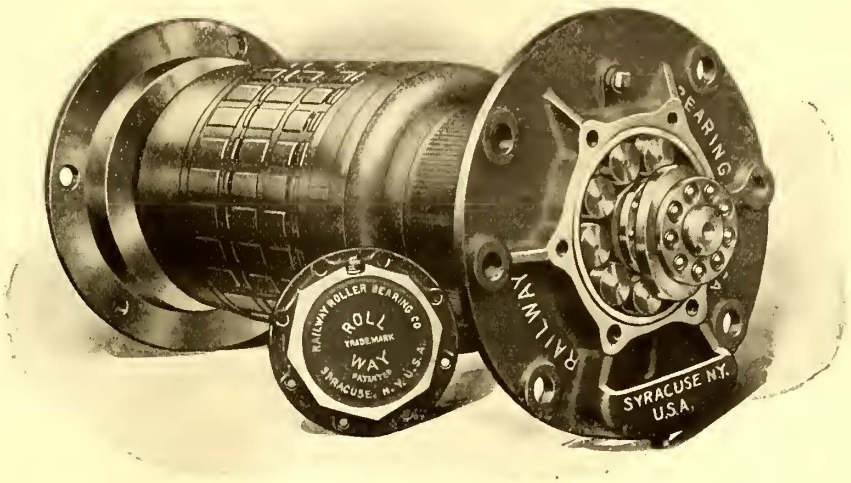
Wires and Cables.
Aluminum Co. of America.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
D & W Fuse Co.
General Electric Co.
Kerite Insulated Wire & Cable Co.
Okonite Co.
Packard Electric Co.
Page Steel & Wire Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Wood Preservatives.
Barrett Co., The.
Lindsley Bros. Co.
Valentine Clark Co.

ALPHABETICAL INDEX TO ADVERTISEMENTS

Rollway Bearings

Will Raise Your Schedule Speeds



Of course, you are interested in saving power because that means saving coal—and coal is pretty scarce and expensive in these days.

But that isn't the biggest return you can get for an investment in Rollway Bearings. Note the following figures:

A railway compared two 26-ton, four-motor cars, one with plain bearings and one with Rollway Bearings, over a 12.7 mile line with the same motorman and under the same physical conditions.

The Rollway Bearing car not only used 10.15 per cent less energy, but it made the run in

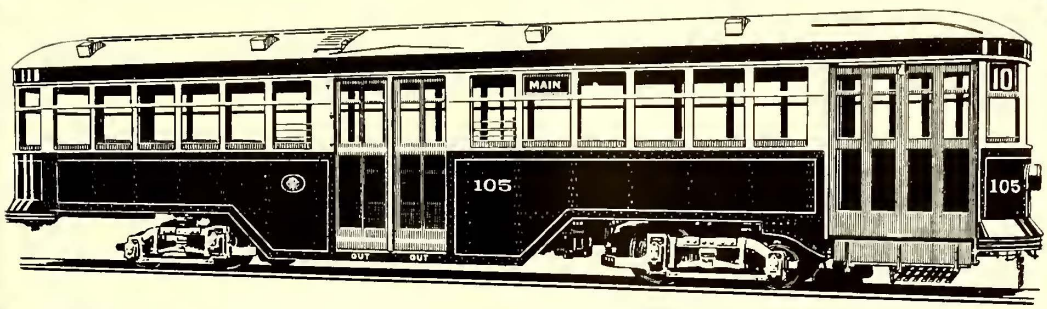
55 instead of 61 minutes

This saving of 9 per cent in running time is almost the equivalent of 9 cars for 10 for the same car mileage!

The Railway Roller Bearing Co.

Syracuse, New York

THE DOUBLE-TRUCK CAR OF 1918



THE city railway manager who is hard after every possible means of making his equipment pay bigger returns to offset bigger costs is getting rid of whatever stands in the way of progress and is leading the way along modern lines, adjusting equipment and methods to the new order of things. He sees that the only way to win is to fight for the right equipment and then fight with it. He sees victory ahead if he concentrates his big attack on the proposition by putting more money into it, by spending more money to make more money, by equipping with modern cars, the cars being the essential part of his equipment to keep modern, his stock-in-trade which he must keep up-to-date to make the whole investment pay a fair return.

Out of the wide variety of city car features developed in the last decade there has been a natural selection according to peculiar, practical fitness, and combinations galore have resulted. These combinations have had to prove their worth just as the individual features had to prove theirs, and so it is the world-old story of the survival of the fittest. It is no matter of opinion as to which type of double-truck city car has won and is holding the first place to-day—more cities have put Peter Witt Cars on their lines in the last couple of years than have ever made a choice of one special double-truck design since prepayment cars first had their being. It is marvelously simple in its plan and operation and yet it is the distinctly modern prepayment—post-payment—nearside—one-man—two-man car, the car for quickest loading and unloading, the surest car for speeding up schedules, the car for highest convenience to passengers, the easiest car for fare collection, the best car for women conductors. Peter Witt calls it "The Car Rider's Car," railway men call it the "Peter Witt Car," but no matter what it is called it does the work in its own special way and there is no doubting that this way fully satisfies the management, crews and public from the first.

The G. C. Kuhlman Car Company worked out the plans through years of development in association with Mr. Witt and standardized the car completely. The broad experience of many big installations put it squarely up to you.

G C. KUHLMAN CAR COMPANY, CLEVELAND
WASON MANFG. COMPANY, SPRINGFIELD

BRILL