

ELECTRIC RAILWAY JOURNAL

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MILLER Trolley Shoes

(patented)

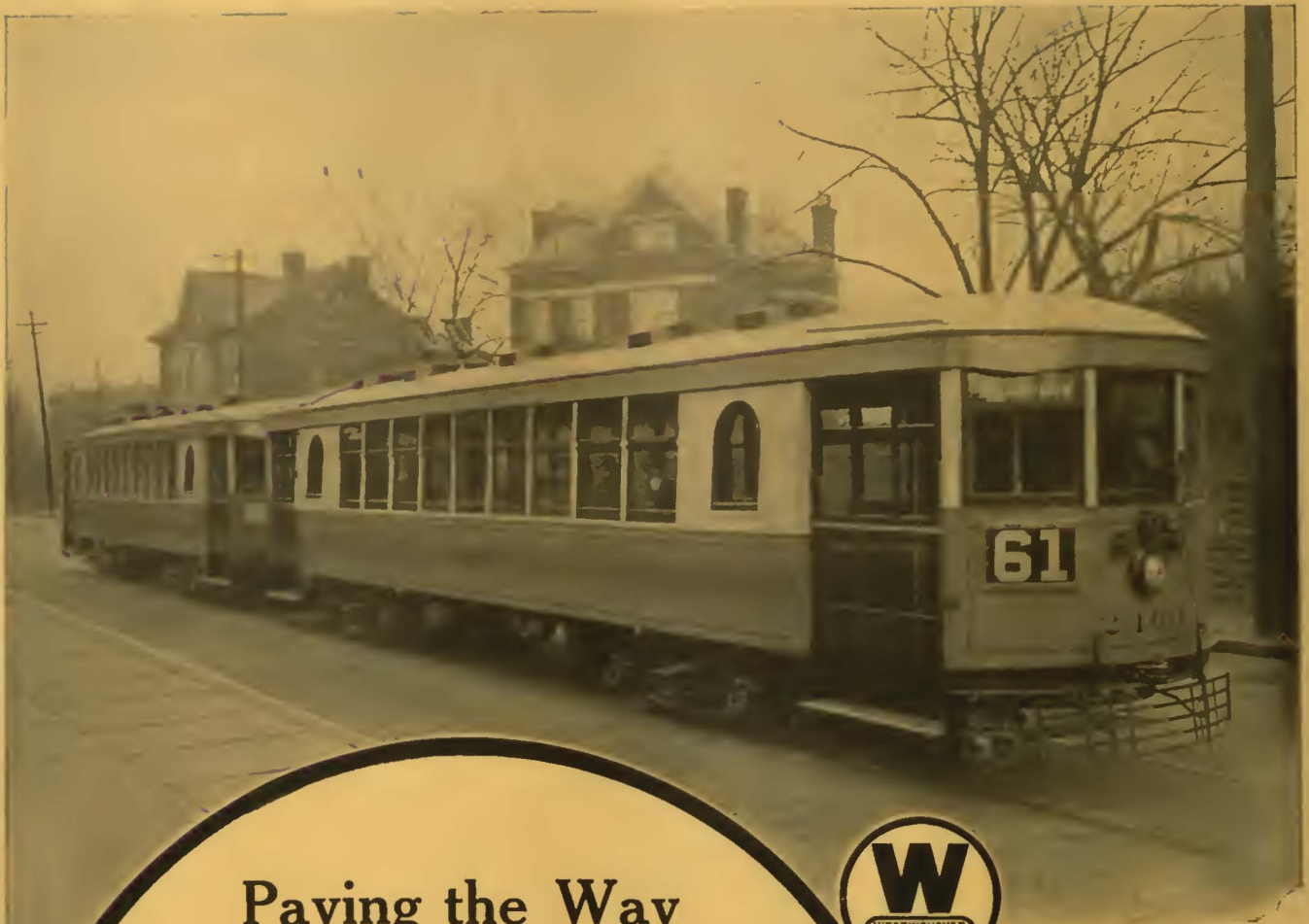
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With the sliding type of contact you save all that cost of lubrication and bushings which trolley wheels entail. That in itself is a considerable economy. But it is only one of the many advantages and savings gained with Miller Trolley Shoes on the sixty odd roads where they are used.

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Economy Electric Devices Co.
1590 Old Colony Bldg.,
Chicago, Ill.



Paving the Way for Future Needs

Track capacity is, primarily, limited by the number of car units and possible headways.

With train control track capacity may be very materially increased without interfering with schedules.

The illustration shows one of the Two-car Trains now being operated by the Cincinnati Traction Company equipped with Westinghouse No. 510 Motors and HL Control.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.



Train Operation in City Service



No. 510, Thirty-five H.P. Motor



Westinghouse

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CONTENTS

Editorials	749
New Cars for London Underground Railways.....	751
The cars are particularly luxurious in their furnishings. Particular attention has been given to reducing noise and vibration. Wheels are shrouded and window openings reduced in size.	
Cost Accounting in the Engineering Department.....	755
BY R. B. GENEST. An account of the present practice of the Montreal Tramways by which the capital and other cost data are maintained continuously and promptly. Exact specifications of clerical duties is a factor.	
Liberty Bell Route Inaugurates Chair Car Service	759
Zone Fares and Transferable Short-Ride Weekly Cards for Berlin	760
Signaling on the Frankford Elevated—II.....	761
BY J. N. DODD. The interlocking features are taken up in this article, as well as the speed control signals which form a special feature of the installation. Junction with the Market Street line involved unusual problems.	
Galvanizing vs. Painting of Exposed Steel Structures... ..	765
17 per Cent Increase in Railway Competition.....	765
Why One-Man Operation Is Popular in Binghamton.....	766
The Readers' Forum	768
Association News and Discussions	770
Maintenance of Equipment.....	774
News of the Industry	777
Financial and Corporate	780
Traffic and Transportation.....	782
Personal Mention	784
Manufactures and the Markets	787

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Consult the Index

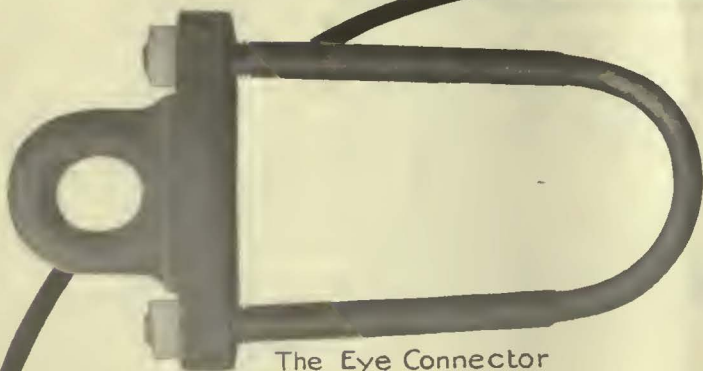
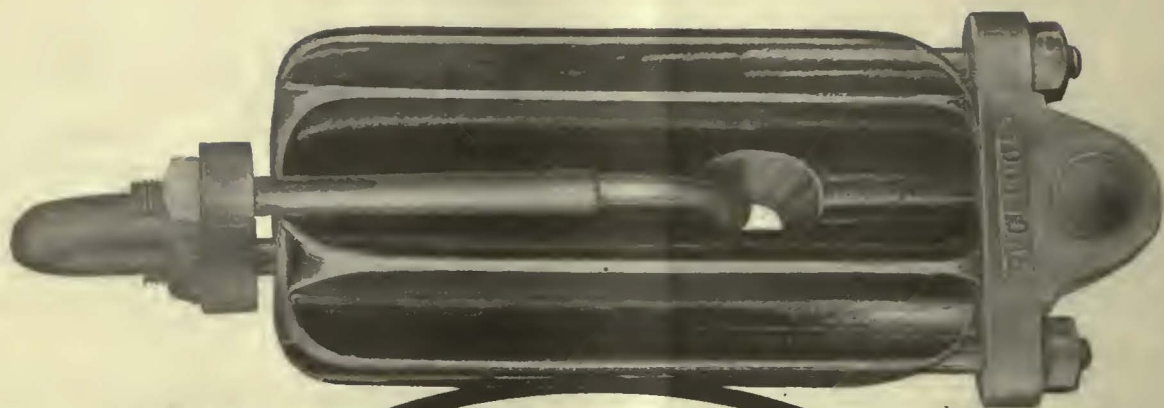
"In a recent issue there was an article on straightening surface bent street railway rails. Won't you please send copy of this and any other articles you have in reference to this subject. Please send as soon as possible as we are in great hurry for same."
—Public Service Company.

THE above telegram is typical of a great host of inquiries that come to the JOURNAL editors from readers. It prompts two comments.

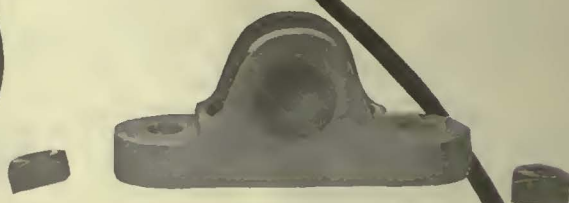
First, it suggests the importance of preserving your copies of the JOURNAL so that the information may be available to refer back to as occasion arises for its use. On almost any problem that comes up, the back issues will reveal helpful data and information.

Second, the matter published is carefully indexed twice a year so that there may be bound in each six months' volume a ready means of finding the subject matter desired. These indexes are published in the last issues of June and December. In addition, a brief index of articles by titles is published on the first inside page of each issue—adjacent to this column.

The editors are always glad and willing to give constructive help, and also, if necessary, hunt through several years' back indexes in order to find a certain article or the various references on a certain subject. But we believe it would be much more helpful if the readers were not compelled to wait the time that must necessarily elapse while their requests travel to New York by mail or wire and the replies return. Why not have at hand and consult the same indexes that we use in order to find the information you request? We would feel lost without our indexes, and the numerous requests received each week from our readers prove how indispensable these indexes are when information is needed and needed at once.



The Eye Connector



Details of Clevis Connector

A New Insulator Connector

We highly recommend this connector for use with our Type PS Porcelain Strain Insulators.

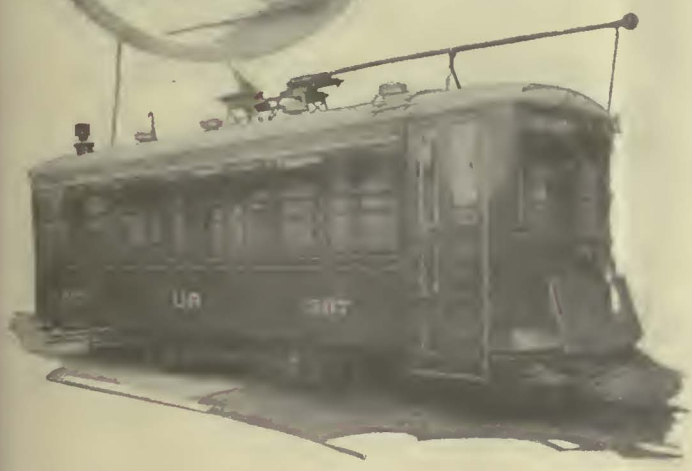
The eye and clevis castings are made of malleable iron. The U bolt, made of hot-rolled steel, is turned down so that the diameter at the bend is smaller than at the ends, making it a very simple matter to bend the U bolt after inserting it in the insulator.

The connector is so designed that the maximum creepage is obtained, giving an increased factor of safety.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.



Westinghouse



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O-B Car Equipment has stood the test of time, service, sun, wind, rain and snow in St. Louis.

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Products: Trolley Material, Rail Bonds, Electric Railway Car Equipment, High Tension Porcelain Insulators, Third Rail Insulators

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We will be glad to outline this service to business executives who are interested in reducing insurance costs.

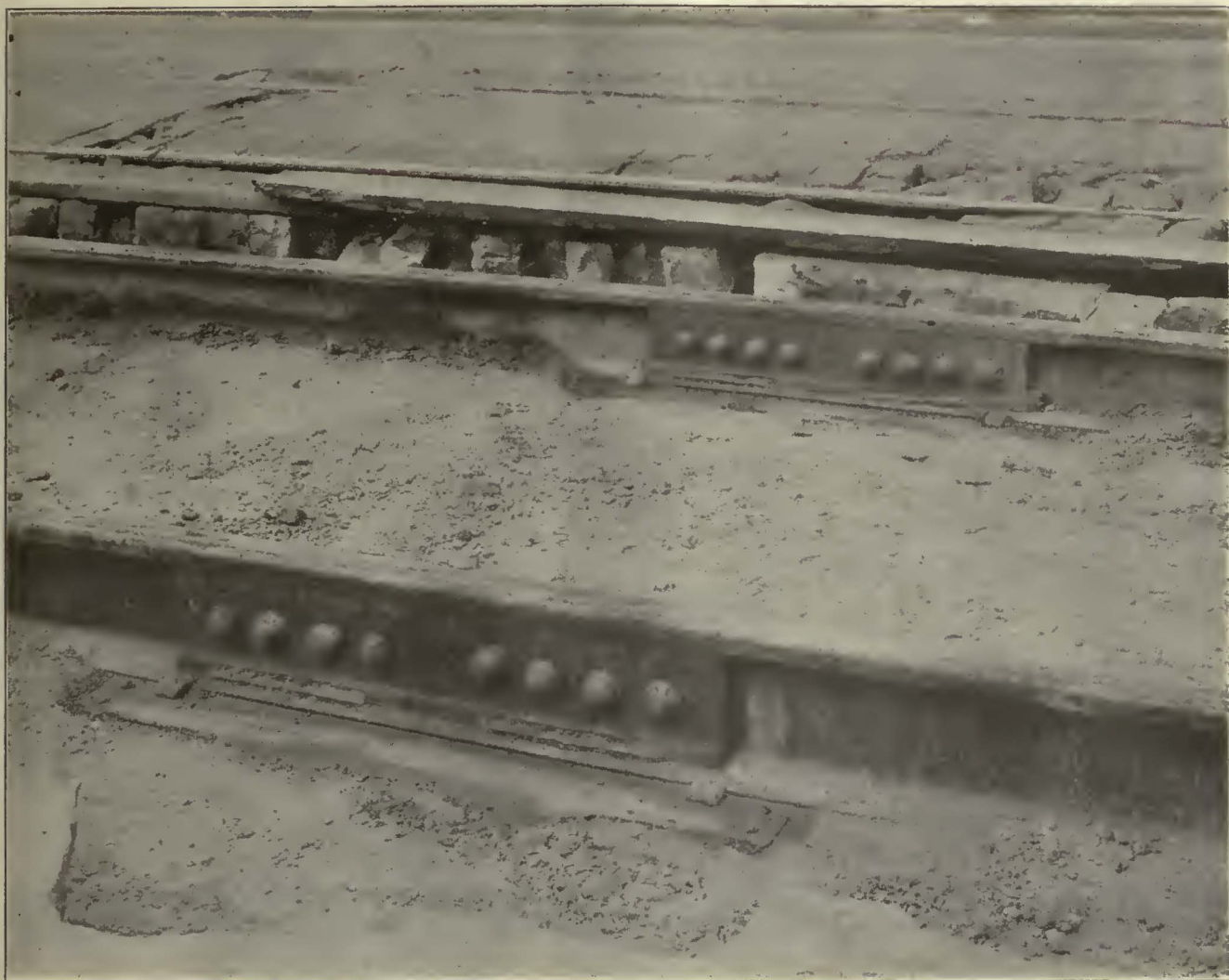
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There are 468 square inches of bearing in each plate of a steel twin tie.

THE TIE-PLATE IS PART OF THE TIE

To help increase the life of wood ties by preventing rail cutting, many Engineers favor tie-plates.

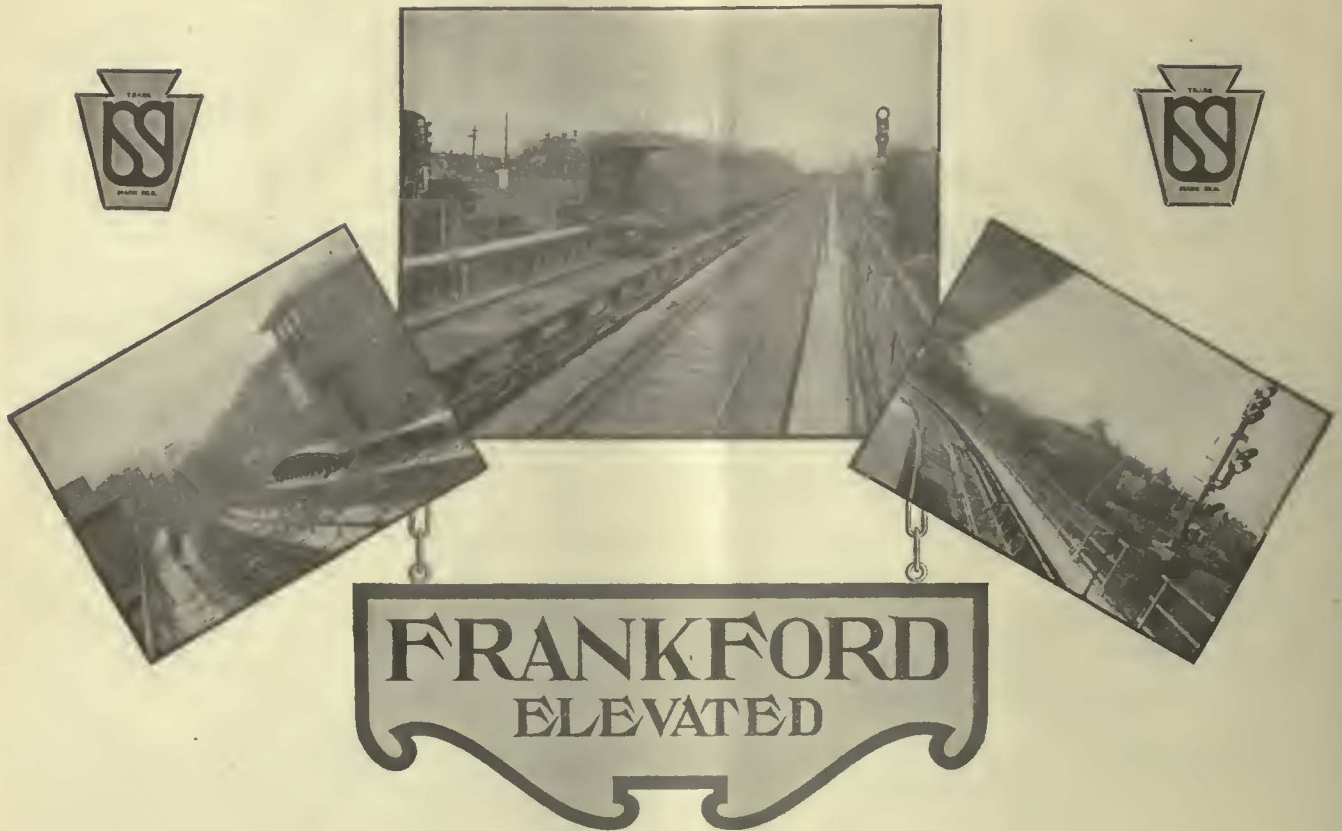
The principle involved has been extended and developed in STEEL TWIN TIES in which the tie-plate is part of the tie.

The plates provide a larger bearing

than is possible with wood ties on two-foot centers. They distribute the wheel loads on top of the concrete of the track foundation instead of at some point six to eight inches below the base of the rail. Hence there is more concrete in bearing with less total concrete required. The ultimate result is better track at a lower first cost.

THE INTERNATIONAL STEEL TIE COMPANY
Cleveland, O.

Steel Twin Tie Track



The Frankford Elevated Railway is
100% Signalled

The Material used for Signaling is
100% Union

5 Electro-Pneumatic Interlockings having 107 operated units are controlled from 52 working levers.

53 Automatic Style "N" Color Light Signals are used between interlockings.

74 Electro-Pneumatic Train Stops are in service.

The installation is described and illustrated in this issue.

Union Switch & Signal Co.
SWISSVALE, PA.



STOP!

Say it with

FARADAY Car Signals



Type B Push Button



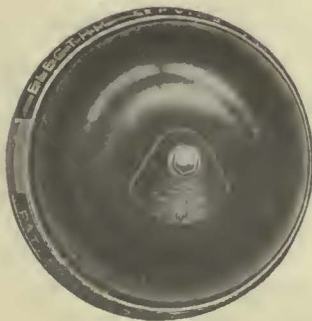
Type A Push Button

Patrons do not like to depend on the conductor's memory. Neither do they like the gymnastics sometimes necessary to attract his attention to their approaching stop. And many passengers dislike to leave their seats ahead of time in order to notify the motorman. They much prefer to press the Faraday button which tells the operator when and where to stop.

Faraday High Voltage Car Signal Systems permit the use of buzzers, vibrating or single stroke bells or a combination of both on the trolley circuit. Faraday Signal Systems are supplied in several types, all of which employ the same mechanism which reduces arcing to a point where it is not sufficient to damage the contacts in any way. Approved by the National Board of Fire Underwriters.

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For auto busses specify Faraday Battery Signal Systems.



No. 21022 Single Stroke Bell



No. 19587 Vibrating Bell

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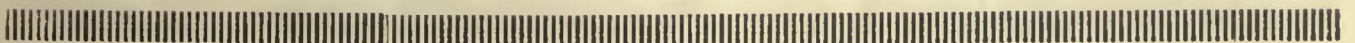
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No. 22181 Resistance Panel



No. 19403 Buzzer



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"NATIONAL" TUBULAR STEEL POLES

Predominate

EXPERIENCE has taught many valuable lessons in the selection of poles for trolley lines, electric lighting, telephone, telegraph, and signal systems. Perhaps the lessons of greatest value are those which resulted in the policy of choosing poles for long life, reliability, and, especially, for safety. The recognized safety (dependability) of "NATIONAL" TUBULAR STEEL POLES is a consideration of first and ultimate importance as evidenced by the extensive use of "NATIONAL" POLES throughout America.

*Ask for a copy of "NATIONAL" Bulletin
No. 14—"NATIONAL" Tubular Steel Poles*



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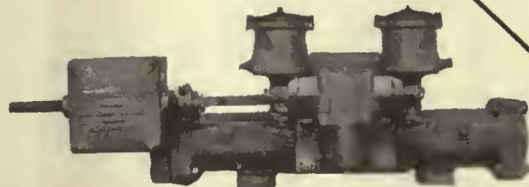
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used by leading
surface and rapid transit
electric railways
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If you want motor and control equipment for your shops our nearest House can help you.

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If you want close personal voice control of your personnel our nearest House can help you.

This House is one of 48. It carries stocks of material produced by manufacturers of national reputation. It can save you time and money.

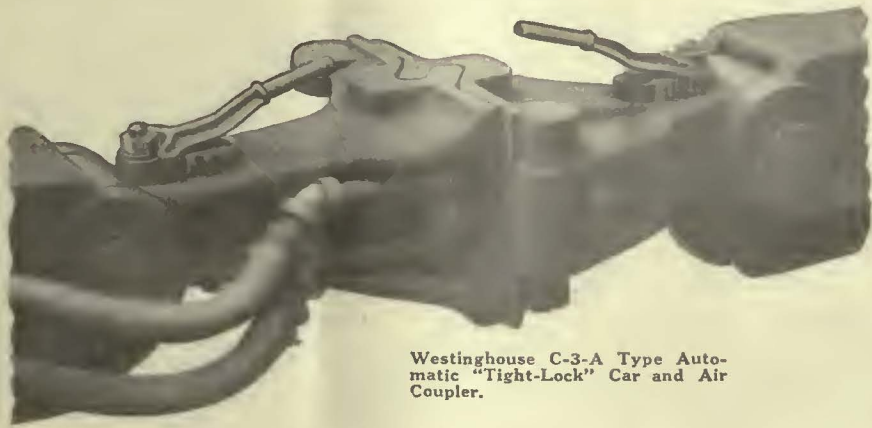
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NATIONAL
ELECTRICAL
SERVICE



Western Electric Company

OFFICES IN ALL PRINCIPAL CITIES

Facilitates
Multiple-Unit
Operation



Westinghouse C-3-A Type Automatic "Tight-Lock" Car and Air Coupler.

Three Coupling Worries Gone—**SAVE** Time, Risk and Expense

YEARS of experience has proved the advantage of automatic couplers for multiple-unit railway service.

Years of experience likewise has proved the unvarying efficiency and dependability of Westinghouse "Tight-Lock" Types, operating automatically to provide quick, solid car and air, or car, air and electric connections.

Westinghouse Automatic Couplers are furnished in various sizes and designs for all classes of service, from the lightest to the heaviest. The essential "Tight-Lock" feature is a characteristic of all types.

The C-3-A type, giving car and air connections, can be used advantageously for any form of light or medium weight motor and trailer service.

Install Westinghouse Automatic "Tight-Lock" Couplers—eliminate three coupling worries: Lost time, accident risk and labor expense.

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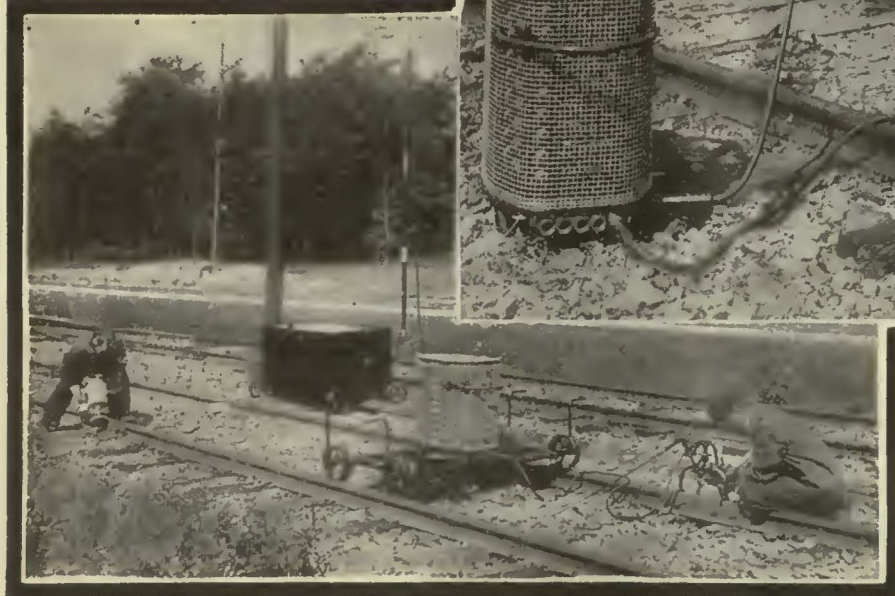
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WESTINGHOUSE TRACTION BRAKES

*The Series Type is
exclusively ERICO*



The ERICO Series Type Arc Welding and Bonding Outfit

is built to endure, under the hardest use and even abuse. The sturdy resistance element, over $\frac{1}{4}$ inch in diameter, is made of the finest non-corrosive resistance alloy known. Its large diameter and well ventilated coil permit high, continuous welding currents without danger of injury. Only Pure mica and steel

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Each detail in the Series Type Rheostat has been designed to give long service without depreciation. Even the five current taps which furnish ample currents for Braze Bonding or Arc Welding thru a voltage range of from 300 to 650 volts, are copper welded to the resistance coil to eliminate dangerous mechanical connections.

For further details of service and performance write

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Cleveland, O.

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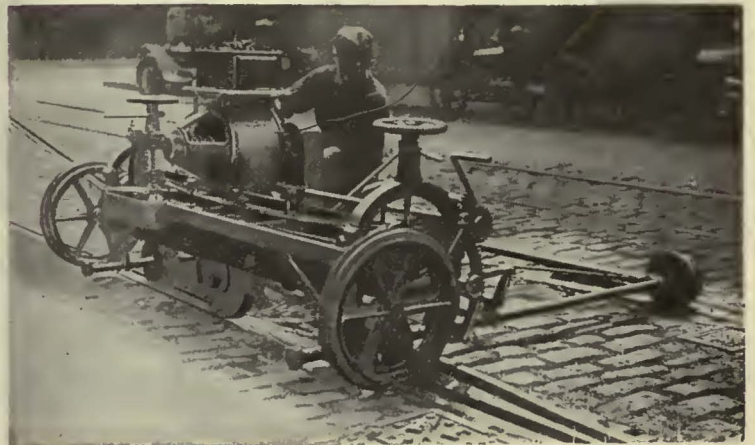
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TYPE**

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For removing all trace of corrugations from straight and curved track it has no equal. Most economical because the grinding blocks adapt themselves to the shape of the original rail head, and avoid unnecessary grinding and waste of metal.

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Bias
Tape*



*Sewed
Bias
Tape*

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Try a small trial order and you will be sure to re-order.

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Seven factors of Quality

High Dielectric Strength
High Resistance
Flexibility

Non Hygroscopic
Heat Resisting
Chemically Neutral

Maximum Elasticity



Dick come out here. I just rode down in this car. I want you to tell me why all our cars can't run as quiet as this does.

They can, Boss. Equip them all like that one, and they will all be as quiet. How are they equipped? With Helical gears. They will not only run quiet, but the Nuttall Company say it has been proven repeatedly that the smooth running cuts down vibration, reducing maintenance costs, and adding to the life of the gear and pinion.

Well, if we can have the cars all as quiet as this one, we certainly will order Helicals for our new equipment.

That means also that I can order them for replacements. Most certainly, we want the best.



R.D. NUTTALL COMPANY
PITTSBURGH PENNSYLVANIA

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In Canada: Lyman Tube & Supply Co., Ltd., Montreal and Toronto.

EVERY GEAR REGISTERED

Nuttall

One Car or Three Thousand

IF the United Railways of St. Louis can save \$189,900 in power bills, the first year of operation with Economy Meters, *your property* can make a saving proportionately as great, since the savings available are only limited by the ultimate possibilities of both men and equipment.

There is no mystery about power saving with Economy Meters. They show the motorman whether he has

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From a transportation standpoint, from a record-keeping standpoint, from a "safety first" standpoint and from a mechanical standpoint the *Economy Meter* is the most efficient, simple, adaptable and profitable equipment of its kind.

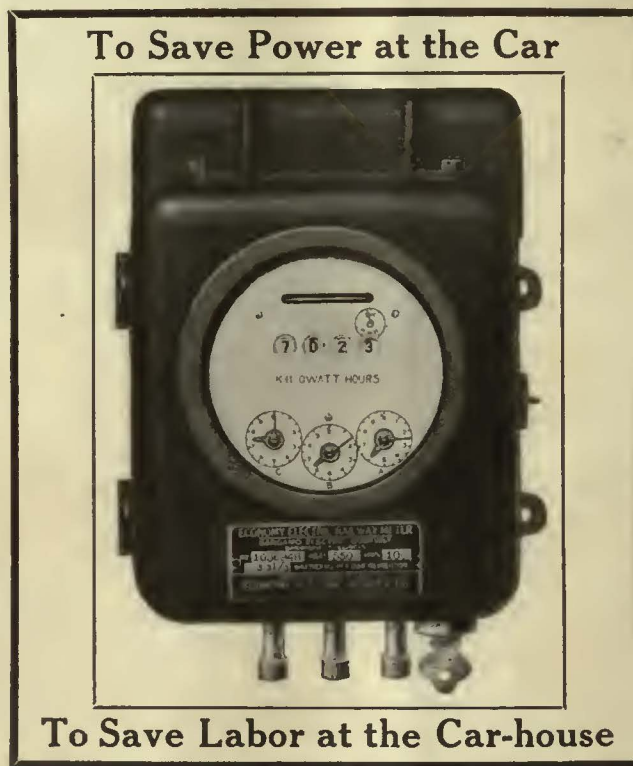
ECONOMY METERS

THE Economy Meter is now standard on over 100 properties, large and small. It is easily installed and costs practically nothing to maintain. One company reports a maintenance expense of only 97 cents per meter per year.

This simple, rugged, energy-measuring device is inducing savings from $\frac{1}{2}$ to $\frac{1}{2}$ cent per car mile, a total saving well worth while whether you are operating one car or three thousand on *your property*.

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 Buffalo & Lake Erie Trac. Co. (Repeat Order)
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 Wheeling Traction Co. (Repeat)
 Union St. Ry. New Bedford, Mass. (Repeat)
 Dayton & Western Trac. Co. (Repeat)
 The Milwaukee Elect. Ry. & Lt. Co. (Repeat)



Interstate Public Service Co. (Repeat)
 Denver Tramway Co. (Repeat)
 Middlesex & Boston St. Ry. Co.
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 Western Ohio Railway Co., (Repeat)
 Sunbury & Selinsgrove Railway Co.
 United Railways Co. of St. Louis (Repeat)
 Phila. Rapid Transit Co. (Repeat)
 Pittsburgh County Railway Co.
 United Traction Co. (Albany, N. Y.)
 Cincinnati, Georgetown & Portsmouth R. R. (Repeat)
 Omaha & Council Bluffs St. Ry. Co. (Repeat)
 Chicago Surface Lines.

*Let us quote you prices and answer detailed questions.
 Ask about our deferred payment plan.*

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L. E. Gould, *President*
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Peter Smith Heaters
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{ District Agents for }

Bemis Boyerized Truck Specialties
 Miller Trolley Shoes

1592 Old Colony Building, Chicago

Meter the energy—that's what you want to save



Positive Safety Appliances

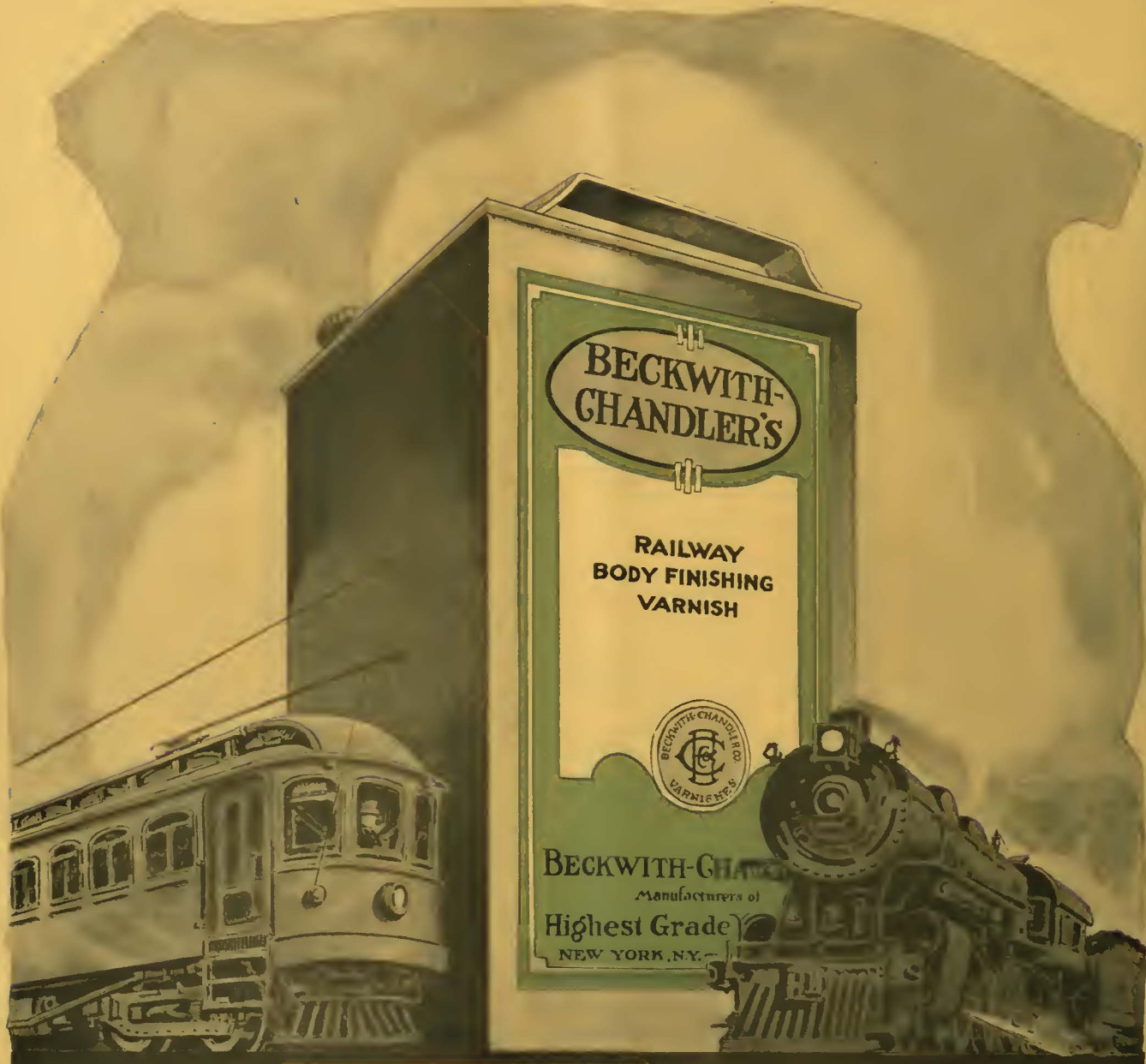
Recommend themselves on
account of

- Lower first cost
- Lower installation cost
- Less weight
- Less Piping

Seven new cars for the Maumee Valley Traction Company and seven converted cars for the Cincinnati, Lawrenceburg and Aurora Railway will have Positive Safety Appliances.

Drawings and Details upon request

Nic Le Grand Inc.
ROCK ISLAND
ILL.



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CHANDLER**

Body-Finishing Varnish
Mahogany Enamel
Red Signal Enamel
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Standard on

America's leading steam and electric
railroads for highest grade exterior
and interior car work.

*Send us your
trial order*

BECKWITH-CHANDLER COMPANY

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A straight line

is the shortest distance between two points. The installation of Galena Oils leads immediately to better operating conditions, through increased lubricating efficiency.

A checking-up of hot journals, hot armature bearings and hot axle bearings per 100,000 car-miles will determine the degree of improvement to your own satisfaction—a reliable comparison that will tell the story truthfully.

The reduction in expenses through the improved performance in these items alone will convince you of the actual economy of Galena lubrication, without even considering the better service it brings.

A complete line

of Galena lubricants covers every requirement of Electric Railway car or power house equipment. Each product is built specially to suit the type of equipment used.

Galena Oils are not ordinary refinery lubricants. They are made from selected stocks by our own special processes. Over a half century of experience in practical railway lubrication has contributed to their development.

Hundreds of electric properties are now using Galena Lubrication Service. Their uniformly efficient performance in mileage and low upkeep costs is conclusive evidence of its economic value.

Lubricating Efficiency



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and offices in principal cities

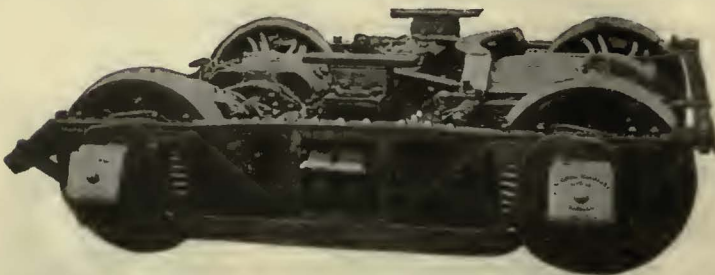


CITY and interurban cars and trucks, safety cars, combination and work cars, snow-plows, sweepers and electric locomotives.

Twenty years of specialization in the construction of all classes of rolling stock for the successful operation of electric railways.



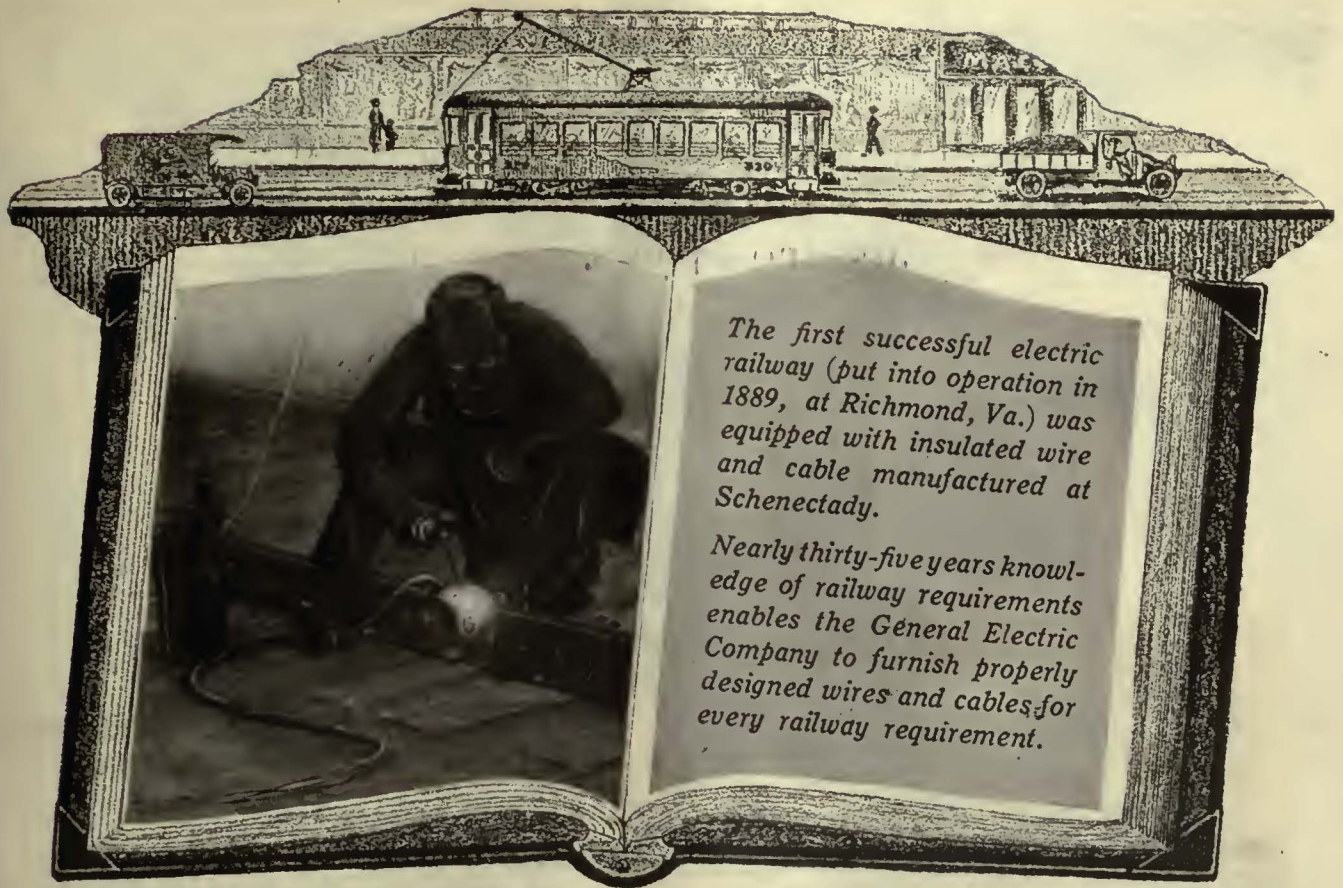
McGuire-Cummings No. 62 Motor Truck for low car body for city service. Inside hung brake-equalizer design.



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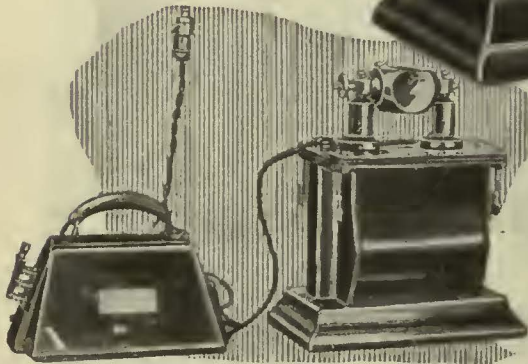
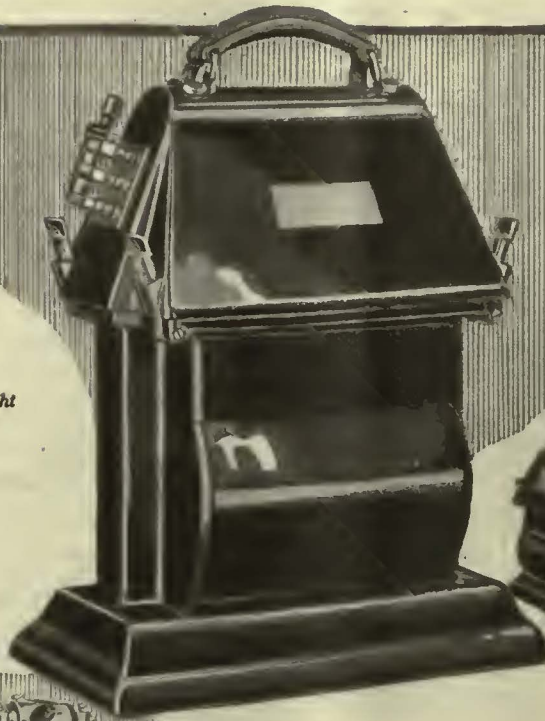
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GENERAL ELECTRIC

New York, Saturday, May 5, 1923

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Published by McGraw-Hill Company, Inc.

HENRY W. BLAKE and HARRY L. BROWN, *Editors*



Selling Transportation Is More than a Mere Advertising Slogan

SO MUCH has been said about "selling transportation" that there is some danger lest the practical railway man shall come to regard the idea as a mere advertising catch-phrase. But the experience of the Binghamton Railway, described elsewhere in this issue, proves again that there is a great deal more to the idea than that. By a carefully planned policy of giving the public real service this company has achieved an enviable popularity.

Two main points of their policy stand out. In the first place, bright and attractive looking cars, well heated, well lighted and well ventilated, have encouraged riding. In the second place, the point of view of "How will it affect the passenger?" has served to eliminate many of those little things that keep the public antagonistic.

It seems that some electric railways do not concern themselves with the psychology of the passengers. Cars are delayed at the carhouse while crews are changed or trainmen draw their pay. Cars are pulled in for inspection or minor defects and the passengers forced to change. Stops for collection of second fares occasion annoying delays. Too many "special" cars run by waiting people. While none of these things is particularly important in itself, there is usually no compelling necessity for them, and all together they form a series of irritating "little things" that dispel the friendly feeling engendered by service with dispatch. If the railway hopes for the beneficial results that follow a well-directed campaign of "selling transportation" it must not forget to iron out such little annoyances as these.

Cars Built for Comfort and Convenience

THE London Underground Railway is trying out six sample cars in its tube service which were built by six different manufacturers. While many electric railway operators in the United States will think that the attention given in the design of these cars to luxurious furnishings and provisions for reducing noise was needlessly great, there are nevertheless many features worthy of consideration by American designers, particularly for cars to be used in interurban and rapid transit service where the ride is long and where comfort and attractiveness are important factors in inviting riders.

A brief summary of the details of construction, together with the interior illustrations, given in this issue, show the results that have been accomplished by the various builders. Probably no finer cars of this class have ever been built. The measures taken by the designers to reduce the noise resulting from the operating of steel cars in an inclosed tube are particularly interesting. Wheels have been shrouded with various materials.

Windows have been reduced in size and window frames done away with to eliminate rattling and minimize the noise or vibration transmitted through the glass. The car bodies are sound insulated, and this feature has also been extended to the framing of the seats. That much has been accomplished is evident from the comparison of the sound photographs reproduced with the article. It is stated that a marked difference in noise is noticeable by walking from one of the new cars into another on which no special precautions have been taken to reduce noise.

In the material used the large amount of rolled sections is particularly noticeable. The seating is longitudinal throughout, but special barriers are provided at the entrances so as to shield passengers from drafts. Various lighting arrangements have also been tried and the lighting fixtures embody attractive designs.

Some of the British designers consider that the industry has been standing still for years in respect to rolling stock and that improvement in design and construction is now essential.

Electrification Gets a New Impetus in Virginian Railway Project

THE announcement of the Virginian Railway this week that it has let contracts for the electrification of 213 miles of track in the Blue Ridge mountains may be considered an epoch in heavy transportation. This railroad, in its brief existence of fourteen years, has developed a traffic in heavy freight equaled by few roads. In order to move this immense volume trainloads of 5,500 tons have been hauled at speeds of about 7 m.p.h. by three of the heaviest Mallet locomotives. Even this has been insufficient to care for the growth of the business, and electrification has been resorted to as the only solution, for by it the trainloads can be increased to 9,000 tons, and the speed to 14 m.p.h. Indeed, it is anticipated that the trains can be as great as 12,000 tons when the system is fully equipped.

Full details have not yet been worked out, but the system will be operated with a single-phase trolley at 11,000 volts. This is to be stepped down by transformers along the route from an 88,000-volt transmission line. Power will be supplied by a 90,000-hp. generating plant to be erected on the New River. The decision to employ single-phase trolley on such an important project as this is significant, if considered from the viewpoint of a possible trend toward standardization of the trolley system. With agreement of engineering opinion on no more than this one thing, electrification work would go forward on a much more sound basis, as motive power could then be operated on any line regardless of the kind of equipment used on any particular locomotive.

The paper presented at the spring convention of the American Institute of Electrical Engineers by A. H.

Babcock of the Southern Pacific Railroad gives another phase of the electrification problem. Tests made on oil-burning engines on this road indicate a higher fuel economy than is accredited to steam locomotives by some electrification proponents. Mr. Babcock's deductions from these tests were criticised in the discussion. But there can be no issue with his major proposition that electrification may be desirable for many other reasons than economy. No better proof of this could be cited than the decision of the Virginian to spend \$15,000,000 for its Blue Ridge project, which is primarily for the purpose of increasing the capacity of the road.

Why Are Anti-Friction Bearings Not Used on More Electric Cars?

AS A PIECE of machinery containing many bearings, the electric car has been carefully studied for a long time by bearing experts with a view to providing it with the best possible bearings. The ordinary sleeve bearings used on the motors and air compressors, and the journal bearings are satisfactory from considerations of simplicity and cost, but they have their limitations in regard to friction and durability. Hence, from the early days of the electric railway attempts have been made to produce anti-friction bearings which would not only cut down energy consumption but would increase bearing life. Bearings of a high degree of mechanical perfection have been produced for this purpose, but so far hardly a start has been made in convincing electric railways that they are successful in this field. However, the success of anti-friction bearings in the automobile and manufacturing fields indicates that they ought to have great possibilities on electric railway cars.

As far as friction reduction is concerned, there is no question as to the ability of the anti-friction bearing to cut costs. The article in the issue of this paper for April 21, giving results of tests made on electric car roller bearings in England, demonstrates this clearly. Such additional proof, however, is hardly necessary because the same thing has been shown time and time again by tests made in this country. Why, then, if ball and roller bearings are so nearly frictionless, have they not made more headway in the electric railway industry?

The first handicap which the anti-friction bearing has had to overcome is that of high first cost. By its very nature such a bearing must be made of excellent material by highly skilled mechanics. A cheaply made bearing is sure to fail. Offsetting this high cost is, of course, the capitalized value of energy and maintenance savings. If there is a convincing difference in favor of the more expensive bearing, this type will ultimately be used. It takes time, however, to "sell" the electric railway industry on any proposition that involves large capital investment. The industry has been short of money and has felt it necessary to spend this money on changes in practice which gave promise of greater return on the investment than did anti-friction bearings.

Involved intimately with the matter of cost is that of durability. A ball or roller bearing must have a life of several years to compete with the ordinary "friction" bearing. As endurance tests must be continued so long, it is very difficult to prove the success of any particular design. If accelerated tests could be devised which would be acceptable to electric rail-

way managers, this handicap might be overcome. The fact is that anti-friction axle bearings as made in the past have not had sufficient capacity to enable them to withstand the shocks of railway service. Manufacturers, of course, realize this and are taking steps to increase the strength.

Another handicap of the anti-friction bearing is its complexity as compared with the ordinary bearing. Master mechanics strongly favor simple devices. They particularly object to the necessity of pressing a bearing off an axle as contrasted with the simplicity of removal of a plain journal bearing. Further, the accurate adjustments which have in general been necessary with the anti-friction bearing have been objectionable in view of the small degree of skill often available in shops. As a result, while the admirable qualities of frictionless, wearless bearings appeal to the master mechanics, their practical difficulties prejudice them against the theoretically better bearing.

The bearing ought to be pushed for interurban service first. There it can demonstrate best its capacity for saving energy, whereas in city service bearing friction plays a less important part relatively because more energy is used in starting and stopping. If it were well established in the interurban field, the bearing could then more easily invade the city.

Unique Features of the Frankford "L" Signaling

THE account of the signaling system of the Frankford Elevated Railway in Philadelphia, given by J. N. Dodd in articles in this and the last issue of the ELECTRIC RAILWAY JOURNAL, covers one of the most important installations of recent years. Among many features the plan used for controlling the speed of trains at certain points by allowing a definite minimum time between signals is of special interest. Again, the provision of push-buttons on standards to permit the depressing of track trips from the motorman's cab window is worthy of notice. The trainmen were desirous of having a door at the front of the car as a means of exit, particularly for the purpose of lowering the trips. This was considered impracticable by the car designers, but the push-button standard was accepted as a substitute for the desired door. Excellent, also, is the mechanical arrangement of the air distribution system and the electric circuits, which were worked out with special care amply justified by the results. The availability of air for operating track tools is a by-product of the signal installation which should simplify maintenance work.

The design of the Frankford Elevated signaling was slightly complicated by the fact that the trips on the Philadelphia Rapid Transit cars and those of the Frankford "L" are differently located and the system had, therefore, to provide for both types of cars. It was in details like this, as well as in the larger matters such as expediting traffic at the junction of the new line with the Market Street subway-elevated line, that the installation is noteworthy.

Signaling is one of the phases of electric railway work that suffered acutely from the depressed condition of the industry during war time. The situation is now improving somewhat, as is indicated by work like that on the Frankford line, although operators are not yet fully reawakened to consideration of the possibilities of a good signal system in increasing safety, speeding up schedules and permitting full use to be made of track.

New Cars for London Underground Railways

The Cars Are Particularly Luxurious in Their Furnishings—Considerable Attention Has Been Given to Reducing Noise and Vibration—Wheels Are Shrouded and Window Openings Reduced in Size

ON FEB. 3 there was a demonstration run on the Great Northern Piccadilly & Brompton Railway of a train including six new experimental trial cars. The London underground electric railways are being extended, and it is the desire of the management to introduce improved rolling stock, especially for the longer journeys which will soon be possible. Some time ago Lord Ashfield, chairman of the companies, instituted a competition among five car manufacturers for the construction of the best type of electric car to suit the conditions. Orders were placed with six firms for the production of one car each, namely, the Birmingham

is that passengers can converse without unduly raising their voices. Graphs were obtained comparing the intensity and fluctuation of noise in an ordinary tube railway car and in one of the new ones, and specimens of these are produced herewith.

The new cars are of steel, and in external appearance and size are similar to the old. Each seats forty-eight passengers. Internally, however, they vary in finish according to the ideas of the builders. The seats, upholstered in moquette, are luxuriously comfortable. The decorations include gray, blue and gold, blue and gray, green and brown, mahogany and maple, and brown and



Car 720—Designed by the Underground Engineering Staff



Car 820—The Color Scheme Is Light Blue

Railway Carriage & Wagon Company, Cammell, Laird & Company, the Gloucester Railway Carriage & Wagon Company, the Leeds Forge Company, the Metropolitan Carriage, Wagon & Finance Company, and the Gloucester Company.

General essential features were specified, but otherwise the builders were given a free hand. An important point specified was that the door dimensions of all the cars should be similar. The arrangement is different from that of the original rolling stock. Some of the existing cars have both end doors and center doors, and some only end doors. The new cars have no end doors nor center doors, but are provided with two double sliding doors on each side, each pair being about one-third of the distance from the end of the train. On starting from a station, all the doors have to be shut before an automatic signal can be given to the operator to start.

Several arrangements have been adopted to reduce noise, which is very pronounced in "tube" tunnels. The wheels have been shrouded by a covering, and the size of the windows has been reduced. It was found that the larger the windows the more the noise. A reduction in sound has also been effected by ventilating the cars from the roof instead of from the windows. The result

white. The metal fittings are in oxidized silver finish, aluminum, and oxidized copper. In one case the floor, instead of having narrow wood slats, is covered with a non-flammable rubber composition fabric.

The scheme of vertical rods from floor to ceiling for the use of standing passengers—tried on a number of previous cars—has been abandoned, and a reversion is made to straps to which standing passengers can hold. Most of these loop straps are, however, much improved, so as to be more comfortable to the hand. Concealed lighting is adopted in one car, but as usual in such a case more lamps are required. The new cars are being subjected to severe tests, and these will decide what is to be the new standard car, of which probably about 200 will be required. Some of the essentials of construction of the various cars are as follows:

CAR NO. 823—BIRMINGHAM RAILWAY CARRIAGE & WAGON COMPANY, LTD.

The body is built of U-section pressed-steel pillars and angle section rails, securely framed together and paneled with cold-rolled close-annealed plates riveted to the framing. The roof is of clerestory type and consists of mild steel plates riveted to light angle carlines, and the whole is secured to cant rails. Frameless win-

dows contain balancing devices and drop 6 in. Ventilation is by a series of air scoops fitted in the roof; air passes into a channel formed by the clerestory rail and inside panel and is controlled by ornamental grids inside the car. The body of the car is sound insulated by sheet cork secured to the inside panels, while the roof has a double layer of insulating cork. One layer is secured to the roof plates and the other layer to the top of the ceiling panel. The floor consists of successive layers of slag wool, asbestos and cork, with wood slats above. Over the trucks a further layer of asbestos insulation is secured. To overcome the "drum" effect caused by the longitudinal seats which also form wheel boxes, thick "Wadnit" sound insulation is used, secured to the seat plates. The wheels are fitted with wood blocks between spokes to reduce the metallic ring when in motion.

Seats are of Woods' patent wire-woven type, of special light construction, suitably upholstered and covered with moquette. The car interior is decorated with polished mahogany moldings, panels being painted French gray and further relieved on the end and door pocket



Car 821—Bowl Fittings Are Used for Lighting and Aluminum Trim Is Employed Quite Extensively

steadier running. There are three systems of springs between axle truck boxes and car body; anti-vibration packings are inserted between bolsters and truck center bearings. To obtain noiseless running all play in moving parts has been reduced, and "Ferodo" wearing surfaces have been introduced in the brake rigging and elsewhere. The floor consists of steel dovetail sheeting, with an upper layer of floorboards, the space between being filled with a granulated cork composition. The sides and roof are insulated with three-ply "Salamander" hair felt between inside and outside linings. This insulation is rendered fire-resisting. Canvas is applied to the inside paneling and seat plates to prevent "drumming." Each truck is shrouded in a leather covering reaching down to within a few inches of the rail.

Structural work is of the lightest possible description consistent with strength. Unit principles in design have been adopted to avoid multiplicity of details and fittings. The center roof plates are flanged on the outer edges to avoid the necessity for roof purlins. Aluminum is used wherever practicable for the con-



Car 822—Upholstery Is in Blue and Paneling Is Mahogany and Maple

panels by ornamental festoons. Ceiling panels are of Agasote, with "Adams" treatment in decoration, and painted white. Doors are of a double sliding type, electrically and pneumatically controlled. All main pipe fittings for the door system are located in two of the longitudinal seat boxes.

The underframe is of light rolled sections for solebars and longitudinals, bolsters and headstocks being pressings. Truck frames are of mild steel plates and angles, and bolsters and spring planks of pressings. Bolster springs are of double elliptic type, and side-bearing springs of a laminated type with auxiliary springs of rubber. The truck brake rigging is arranged for all wheels to be braked on both sides, and the type of rigging permits of automatic slack adjusters being used, and for the brakeshoes to be worn out without the necessity of hand adjustment. Exteriors are painted in vermilion, black and cream, in accordance with the specification as in the case of the other vehicles. All fittings have oxidized silver finish.

CAR NO. 824—CAMMALL LAIRD & COMPANY, LTD.

Only marketable materials are used, but the advisability of using high tensile steel in future is considered further to lighten the structure. Truck wheel bases have been increased from 5 ft. to 6 ft., giving

construction and for interior fittings. Panel plates are flanged on their edges to obtain stiffness without the need for providing additional stiffeners. Outside moldings and joints have been avoided wherever possible. The framing and paneling of side doors is entirely of aluminum.

Seats and seat backs are fitted with coil spring cushions. The ventilation includes balanced-side sliding windows, sliding glass panels in end doors, and louver type ventilators in the clerestory, operated by cam action. Outside ventilators of special type, combining intake and exhaust action in either direction of travel, are used. This type of outside ventilator has not previously been employed, but has been the subject of exhaustive tests and trials. Doors have soft rubber flexible edges to give the required resiliency and to obtain a weather joint, while at the same time preventing risk of injury should a passenger's hand or a portion of his clothing be trapped between the two doors when closing. To maintain the door tracks free from obstruction, a track cleaner is fitted to each side door.

Diffused lighting is a feature of this car. The main lights are placed in troughs, housed inside the deck rails and glazed on the underside with semi-transparent glass mounted in hinged frames. These troughs are utilized as longitudinal roof members. The underframe

embodies two strong central girders, which take up the principal draw and buffing shocks and form the load-carrying members, so that the side doorway openings do not cut into the main underframe members, as would be the case if the solebars carried the load. Floor and side loads are transmitted to center girders by braced crossbars. Over the truck the seat front plates serve as the central girders. The interior decoration is in blue with gold finish.

CAR NO. 820—GLOUCESTER RAILWAY CARRIAGE & WAGON COMPANY, LTD.

Trucks are of Gibbins' spring frame type, giving easy riding, as the load is taken direct on the springs from the main frame; the weight of the body is taken on roller side bearings, and not on the center bearing, thus eliminating side roll, while the fact that there is no clearance between axle boxes and bolster to be taken up, as on the ordinary truck, gives smooth starting and stopping. The weight is also considerably reduced.

The car body is insulated by "Wadnit" rammed between exterior and interior panels, the former being

ment on curves. The springing is arranged to reduce unsprung weight, to obtain resilience without undue vertical movement, and to absorb rail shocks near the point of origin. Shrouding plates are of steel, covered on the inner and outer surfaces with canvas, and with hinged side plates for examination. The end shrouding is sloped to deflect sound onto the roadbed.

The underframe is of pressed steel construction, and in so far as load carrying is concerned, is incorporated as a unit with the body. The headstocks, together with the end top plates, form a rigid structure for transmission of buffing shocks, and at the same time care for racking stresses. Both mid-longitudinals and crossbars run through, the latter being under the former and connected by means of rack plates.

In the buffing and drawgear "Ferodo" bushes have been used for the sector bar pins, and also for the platform plate plungers. The design of the body was prepared with a view to ease and quickness of production, there being no unwieldy portions to obtain or handle. Sides, ends and roofs are built in jigs as units to secure complete interchangeability, all parts being



Car 823—Seats Are of Special Light Construction Covered with Moquette



Car 824—Diffused Lighting Is Used and Decoration Is in Blue and Gold

lined with canvas. Windows are of frameless type, fitted with spring balances and arranged to fall 6 in. Spring roller curtains can be fitted to all windows if required, one being supplied. The curtain roller is out of sight, being attached to the top light mold and easily removed. Twelve ventilators are fitted in the monitor, of pivoted vane type, exhausting the air automatically in both directions. Hit-and-miss covers are provided to regulate the exhaust.

Seats are of "Peters" type, covered in moquette. One cross seat has been fitted with "Woods" woven wire for comparison. The double side doors are of mahogany, sheathed with aluminum and operated by air engines. All doors are fitted with rubber edges, forming a flexible and watertight joint. The interior finish is of Agasote panels. No cornice moldings are used, and the molds employed are of light and plain type so as not to harbor dust. Hand grips of special type in polished mahogany are suspended from the roof. The color scheme is light blue. Metallic fittings are silver oxidized.

CAR NO 821—LEEDS FORGE COMPANY, LTD.

Truck frames are of pressed steel, giving ample strength without excessive weight. The bolster suspension is designed to prevent excessive lateral move-

drilled to templets. The construction is all steel, aluminum or alloy only being used for doors, fittings and interior moldings.

Timber is used only for floor slats, window capping, end door posts, windscreen parts, handrails and on ends of seats. The sides are constructed with pressed-steel pillars, sheathed on the outside with steel plates, there being no expensive window or other pressings. Horizontal moldings, cant rails, crib rails, inside waist rails, and door pocket members are of rolled-steel sections. The interior sides and ends are of steel sheets secured to the framing. Aluminum molding is secured by means of wood screws into fiber blocks. The ceiling is of Agasote, secured to the roof framing in the same manner.

The side sliding doors are of one-piece aluminum castings sheathed on both sides with aluminum plates. They have standard rollers at the bottom with the exception that an eccentric pin is pivoted to lift or lower the doors when the very limited clearances allowable make it necessary. A "Crittall" runner is fitted, and is provided with springs which allow the door to ride over any obstruction, and also to prevent rattle. A "Crittall" runner has also been fitted at the rear of the sliding door for connecting to the air motor arm. The sliding doors are fitted on the closing sides with sponge

rubber safety edges, molded to fit one slightly into the other, and are of such soft nature as to provide, with the compression of the air motor springs, a complete watertight joint. They also effectively prevent injury to a limb, and allow clothing, etc., to be very easily withdrawn when the doors are closed and the coach is in motion.

Windows are provided with zinc water pockets, and the lifting gear is made as one unit. Seats are of Vi-Spring pattern, made by the Marshall Patent Mattress Company. Longitudinal seats are constructed individually, to permit easy access to the door operating gear, and for economy in repairs.

Ventilation is by extraction. There are twenty-eight extractor ventilators in all, twenty of which ventilate the interior of the car. The remaining eight ventilate the air space between the outer and inner walls of the body. Electric lamps, inclosed in Holophane bowl fittings, are installed at the lower clerestory and the center ceiling. Emergency lights are fitted into two of the bowl fittings, making it unnecessary to break up the ceiling by further fittings. Two extra bulbs are provided for an illuminated sign.

Noise insulation includes canvas attached to the inside of the outer sheeting of sides, ends and roof and

side bearings are fitted to reduce friction. The underframe includes bulb angle section solebars, and pressed-steel headstocks, bolsters, crossbars and longitudinals, and has reinforced end construction. "Ferodo" strips and washers are used extensively for trucks and underframe and elsewhere to prevent noise.

The body consists of light steel pressings for pillars, and angle sections for bracings, longitudinals, side members and roof. Side and end plates are of aluminum and copper alloy. Windows each consist of two complete steel pressings. Spaces between the inner and outer sheeting of walls and ceilings are sectionalized by small wood packings, to reduce "drumming," the spaces being filled with eel grass quilting, a material useful both for sound and heat insulation.

Sliding doors include aluminum plates, light steel channels and wood linings, spaces being filled with eel grass quilting. A ball-bearing attachment between the door-operating air-motor and the door minimizes sliding friction. A new type of door roller is employed, enabling the door to be removed readily without disturbing the runner track, while V-rollers provide for self-centering. There are also twin ball races giving correct alignment. Special arrangements are made to obtain weather-tightness between the doors, while the



Sound Photograph Taken in Ordinary Tube Car



Sound Photograph Taken in One of the New Cars

between all metal-to-metal joints, and use of hair felt. The floor is of key section steel, the trough being filled with cork. A layer of cork covers the whole of the key flooring, and on this are laid the wood slats. The interior is designed to avoid dust-collecting ledges. Bright surfaces requiring cleaning have also been avoided. The interior decoration is in green and brown. Fittings are of aluminum. Straps are attached to sockets suspended from the roof.

CAR NO. 822—METROPOLITAN CARRIAGE, WAGON & FINANCE COMPANY, LTD.

Among the special features of this car are that nickel steel has been used for the undergear; that the flooring is of corrugated steel with a thickness of non-inflammable wood and a fluted covering of fire-resisting rubber; that white-metal sheets are used for paneling; that natural non-inflammable material is used for seat rests, etc., and that sliding doors are of self-centering construction.

To reduce noise the wheels are filled in with teak segments, sound-insulating materials are freely used, and even the painting scheme includes the use of Docker "loaded" paint, having qualities by which it assists to deaden sound vibration. The trucks are completely shrouded with pulped wood sheeting, with flapdoors for inspection. The ends are streamlined.

Trucks have 2-ft. 8-in. wheels and laminated side bearings fitted with Spencer's auxiliary rubber springs, double elliptical bolster springs are provided, and "Metro" patent ball-bearing center plates and roller

meeting edges are fitted with rubber joints which enable a passenger (or his clothing) who may be trapped to withdraw.

Windows have drop lights apparently frameless, provision being made for easy cleaning, adjustment and withdrawal, to avoid rattle, and for draining rainwater. Ventilators in the clerestory are of "M. & M." pattern, with staggered air openings. Air scoops are also fitted. Half the seats have small closely-nested springs, with spiral springs for the backs; the others have seats and backs of woven wire with supplementary spiral springs. All seats are in self-contained frames, these and the backs being removable. Seat risers and top plates are heavily shrouded to reduce noise. Strap-hangers are of light gray rubber with strong canvas inserted.

Electric lamps are sunk in flush with the spherical bulb, the lights themselves being opalescent or frosted glass. Dust-collecting ledges, etc., are avoided. Ceilings are of Agasote fire-resisting millboard, with light upper decoration. Fittings are of bronze. Upholstery is in blue, and the interior of the car has mahogany and maple paneling.

CAR NO. 720—UNDERGROUND COMPANIES' DESIGN (Constructed by the Gloucester Carriage & Wagon Company)

The interior decoration is in brown with white paneling; fittings are in oxidized copper. The lighting is entirely by side brackets, except for two emergency lamps in the center. The seats are of "Nesta" all-metal design, covered with moquette, and the arm rests with

leather. Straps include Bakelite handles on swivel joints attached to the clerestory rail. The ceiling is white, decorated in the "Adams" style.

To reduce noise the roof and body are insulated by sheet cork and "Wadnit" asbestos, the flooring, which is otherwise to the usual "Underground" standards, being similarly insulated, but having different thicknesses of material. The trucks are of an improved design not hitherto used. They are provided with shrouding of "Wadnit" asbestos secured to underframes of wheel

boxes, "Sundela" board panels being used on sides and ends of bogies. The exterior body panels are of steel, the interior panelling being of asbestos millboard. Doors have wood frames covered on either side with aluminum plates. Special attention is given to weather tightness, while a drainage system is provided to deal with rainwater. The side sliding doors have rubber edges to prevent injury to a passenger who might be trapped or his clothing caught, as in the case of the other cars.

Cost Accounting in the Engineering Department

An Account of the Present Practice of the Montreal Tramways by Which the Capital and Other Cost Data Are Maintained Continuously and Promptly—Exact Specification of Clerical Duties Is a Factor

By R. B. Genest

Chief Clerk Engineering Department, Montreal Tramways

ABOUT four years ago the engineering department of the Montreal Tramways found it desirable to revise the system of cost accounting previously in use. This came about on account of the rapid expansion of the department due to increase in track mileage, construction of new and improvement of old buildings, standardization of track construction, etc.

To this end the filing and record systems were revamped and other general improvements made, as will be detailed in a later article.

The objective was to secure the cumulative cost records without the tiresome and time-wasting summarizing of figures and reports usually following the completion of a job of track or other work. To accomplish this, several forms are filled in by the checkers or inspectors who are constantly on hand at the job. These forms for securing the original data are as follows:

Daily Time Reports. Fig. 1—This form is used to cover time made on all work executed by the engineering department forces, with the exception of snow removal. It was originally intended for trackwork only, but was found to be applicable also to the work of the departments of bridges and buildings, tools and machinery, and bonding, welding and grinding. The alphabetical subdivisions of the labor distribution are shown on a sheet in a summary.

This form is made in triplicate. One sheet is forwarded to the accounting department for auditing purposes, one is retained by the engineering department, and the third remains in the timekeeper's possession.

Forms for Requisitioning and Transferring Material. Figs. 2 and 3.—The delivery, return or transfer of material is covered by the forms shown in these illustrations. Fig. 2 is the form used for requisitioning or ordering material. It is made in triplicate, distributed as above. No material can be transferred or returned unless the shipments are accompanied by three copies of the form shown in Fig. 3. This serves the manifold purpose of a transfer slip, a credit note, a receipt, and a shipping bill. A fourth copy is signed by the material car conductor and is held by the checker.

Daily Report of Track Construction. Fig. 4.—This

MONTREAL TRAMWAYS COMPANY																	
ENGINEERING DEPARTMENT												Date Nov 15 1923					
DAILY TIME REPORT - TRACK												Report No.					
W.O. 4169												Location Wellington St					
No.	Name	OUT	Subst.	Mfr.	Subst.	Mfr.	Subst.	Mfr.	Subst.	Mfr.	Subst.	Mfr.	Total	Rate	Amount		
65	Griffin J.	7:30	L	10									5 1/2	10 71	7 10		
66	O'Neill P.	-	-	10									10	44	4 40		
67	Darais F.	-	-	10									10	127	1 23		
68	Higgins G.	-	-	10									10	-	1 25		
69	Christie W.	-	-	C	10								10	50	5 00		
70	Damarco S.	-	-	-	G	10							10	37 1/2	3 75		
71	Damovic J.	-	-	-	-	10							10	-	3 75		
72	Emandis F.	-	-	-	-	10							10	-	3 75		
73	Labarets	-	-	-	-	-	A	10					10	30	5 00		
74	"	-	-	-	-	-	-	10					10	-	5 00		
75	"	-	-	-	-	-	-	10					10	-	3 00		
A 9 00		1 Foreman	10	10	7 1/2	7 10											
C 3 00		1 Timekeeper	10	-	4 1/2	4 40											
G 11 25		2 Boys	20	-	12 1/2	2 50											
L 14 80		1 Conductor	10	-	5 0	5 00											
# 39 25		3 Trustees	30	-	37 1/2	11 25											
		3 Laborers	30	-	30	9 00											
			10	-		# 39 25											
Total			40	10	30	30							110		39 25		
Chief Clk.		A.C. Lytle		Conductor P.O'Neill		Foreman J.Griffin											

Fig. 1—Daily Time Report Form

MONTREAL TRAMWAYS CO. C No 22751		
STOREKEEPER—Supply material on order via <u>Aug. 15 23</u>		
Quantity	PARTICULARS	REQUIRED FOR
500	Standard Ties	Work Order 4234
2 bags	Spikes 5 1/2" x 9/16"	St James St
100	Tie Rods 3" x 1/2"	
Delivered Aug 16 11 at 9:00 Guy to Fulford on West Board Track		
A. Maria		J. Griffin
Inspector		Foreman

Fig. 2—Requisition Form

form is used on all trackwork with the exception of section gang maintenance. It indicates work progress by means of the rough diagram and legend, furnishing at the same time a summary of material received daily and memoranda on working forces and cost of labor.

Section Foreman's Daily Report. Fig. 5.—The sample which is reproduced shows clearly the purpose and use of this form which is used to cover the operation of section gangs on maintenance work.

Daily Working Force Report. Fig. 6.—In order that

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
Nov 26 1922

WE HAVE THIS DAY TRANSFERRED TO W.O. 4198 - THE
FOLLOWING MATERIAL FROM W.O. 4182 Wellington Street

NO.	QTY.	DESCRIPTION	UNIT	REMARKS
1	1000	RAIL	FT.	
2	1000	RAIL	FT.	
3	1000	RAIL	FT.	
4	1000	RAIL	FT.	
5	1000	RAIL	FT.	
6	1000	RAIL	FT.	
7	1000	RAIL	FT.	
8	1000	RAIL	FT.	
9	1000	RAIL	FT.	
10	1000	RAIL	FT.	

A. H. HARRIS

Fig. 3—Form for Use in Transferring Material

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
DAILY REPORT TRACK RECONSTRUCTION
Nov 26 1922

Street St. Catherine to St. Alouise
From St. Lawrence to St. Alouise
Work Order 4288

REPORT NO. 4182

RAILS DISTRIBUTED: 1000
RAILS OF PILING: 1000
S. GROUNDS: 1000
E. TRACK FOUNDATIONS: 1000
F. TRACK FOUNDATIONS: 1000
G. TRACK LANE: 1000
H. TRACK LANE: 1000
I. TRACK LANE: 1000
J. TRACK LANE: 1000
K. TRACK LANE: 1000
L. TRACK LANE: 1000
M. TRACK LANE: 1000
N. TRACK LANE: 1000
O. TRACK LANE: 1000
P. TRACK LANE: 1000
Q. TRACK LANE: 1000
R. TRACK LANE: 1000
S. TRACK LANE: 1000
T. TRACK LANE: 1000
U. TRACK LANE: 1000
V. TRACK LANE: 1000
W. TRACK LANE: 1000
X. TRACK LANE: 1000
Y. TRACK LANE: 1000
Z. TRACK LANE: 1000

Points: Grading - Tampers - Paving and Concreting

Fig. 4—Daily Track Construction Report Form

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
SECTION FOREMAN'S DAILY REPORT
Nov 2 1922

Location: Bligny + Craig Street

Work Order: 4288

REPORT NO. 4182

RAILS DISTRIBUTED: 1000
RAILS OF PILING: 1000
S. GROUNDS: 1000
E. TRACK FOUNDATIONS: 1000
F. TRACK FOUNDATIONS: 1000
G. TRACK LANE: 1000
H. TRACK LANE: 1000
I. TRACK LANE: 1000
J. TRACK LANE: 1000
K. TRACK LANE: 1000
L. TRACK LANE: 1000
M. TRACK LANE: 1000
N. TRACK LANE: 1000
O. TRACK LANE: 1000
P. TRACK LANE: 1000
Q. TRACK LANE: 1000
R. TRACK LANE: 1000
S. TRACK LANE: 1000
T. TRACK LANE: 1000
U. TRACK LANE: 1000
V. TRACK LANE: 1000
W. TRACK LANE: 1000
X. TRACK LANE: 1000
Y. TRACK LANE: 1000
Z. TRACK LANE: 1000

Points: Grading - Tampers - Paving and Concreting

Fig. 5—Section Foreman's Daily Report Form

the head office may be informed of the total number of men employed daily on trackwork, the form shown in Fig. 6 was designed. Information for use in filling in this form is telephoned or forwarded by messenger to the head timekeeper's office before 9 a.m. from the different locations and is summarized as shown. The printed names on the left side of this form under the heading of "West Division" and "East Division" indicate the section gang.

Movement and Time of Work Cars. Figs. 7 and 8.—The movements of construction and material cars and the time allotted to them are checked and audited by the use of the forms shown in Figs. 7 and 8. Two forms were necessary because the crews of construction and material cars are paid by the operating department and the running time is charged to the engineering department. It was therefore found expedient to evolve some simple method of auditing these charges.

THE EVOLUTION OF A WORK ORDER

To illustrate the way in which information for cost accounting is gathered, the following summary of the principal parts in the execution of a track job will

serve to show the procedure from the initiation to the termination of a piece of work.

Assuming that it has been decided to renew or extend the track at a specified location, the first steps are the compilation of an estimate of the cost, the drawing up of material lists and specifications, the preparation of working drawings and application for a work order showing the cost and the charges to capital or renewal. This is forwarded to the proper authority for visé, and as soon as official sanction for the work has been given, permitting the use of an appropriation for the purpose indicated, a numbered work order is issued by the accounting department, and under this order number all actual cost charges are accumulated.

In the meantime, official notice is forwarded to the heads of the municipal department and a permit is obtained to carry out the work on the city streets. Notifications are also issued to the heads of other company departments concerned.

Next, a foreman and a checker are appointed for the job, the construction car is instructed to pick up tools, stock material, shanties for the checkers, etc., from the stores, the gang is organized and the job under way.

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
DAILY REPORT—WORKING FORCE
Nov. Aug. 27/22

Weather Fine

NAME	TIME	REMARKS	TOTAL
WEST DIVISION			
1	1		1
2	1		1
3	1		1
4	1		1
5	1		1
6	1		1
7	1		1
8	1		1
9	1		1
10	1		1
EAST DIVISION			
11	1		1
12	1		1
13	1		1
14	1		1
15	1		1
16	1		1
17	1		1
18	1		1
19	1		1
20	1		1
21	1		1
22	1		1
23	1		1
24	1		1
25	1		1
26	1		1
27	1		1
28	1		1
29	1		1
30	1		1
31	1		1
32	1		1
33	1		1
34	1		1
35	1		1
36	1		1
37	1		1
38	1		1
39	1		1
40	1		1
41	1		1
42	1		1
43	1		1
44	1		1
45	1		1
46	1		1
47	1		1
48	1		1
49	1		1
50	1		1
51	1		1
52	1		1
53	1		1
54	1		1
55	1		1
56	1		1
57	1		1
58	1		1
59	1		1
60	1		1
61	1		1
62	1		1
63	1		1
64	1		1
65	1		1
66	1		1
67	1		1
68	1		1
69	1		1
70	1		1
71	1		1
72	1		1
73	1		1
74	1		1
75	1		1
76	1		1
77	1		1
78	1		1
79	1		1
80	1		1
81	1		1
82	1		1
83	1		1
84	1		1
85	1		1
86	1		1
87	1		1
88	1		1
89	1		1
90	1		1
91	1		1
92	1		1
93	1		1
94	1		1
95	1		1
96	1		1
97	1		1
98	1		1
99	1		1
100	1		1

Fig. 6—Daily Working Force Report Form

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
CONSTRUCTION CAR TIME REPORT
Nov 26 1922

W.O. No. 4169 Location Wellington St

DATE	CAR NO.	ARRIVED	LEFT	REMARKS
Aug 3rd	3053	7:00	8:00	Deliver Track Material
	3041		5:45	Loaded with Material
	3044			Material Transport
	3044	8:15	8:15	Delivering 1/2 Stone
	3044	8:20	8:20	Delivering 1/2 Stone
	3044	8:25	8:25	Delivering 1/2 Stone
	3044	8:30	8:30	Delivering 1/2 Stone
	3051	8:35	8:35	Delivering 1/2 Stone
	3070		2:45	Delivering 1/2 Stone
	3062			

Signed: L. Scanlon Checked: W.W. Nolman

Fig. 7—Form for Recording Movement of Work Cars

MONTREAL TRAMWAYS COMPANY
ENGINEERING DEPARTMENT
DAILY REPORT—TIME OF CAR NO. 3057
Nov 26 1922

W.O. No. 4169 Location Wellington St

NO.	LOCATION	IN	OUT	REMARKS
1	St. Denis Yard	7:00	7:15	
2	Hotel de la Paix	7:15	7:30	
3	St. Denis Yard	7:30	7:45	
4	Hotel de la Paix	7:45	8:00	
5	St. Denis Yard	8:00	8:15	
6	Hotel de la Paix	8:15	8:30	
7	St. Denis Yard	8:30	8:45	
8	Hotel de la Paix	8:45	9:00	
9	St. Denis Yard	9:00	9:15	
10	Hotel de la Paix	9:15	9:30	
11	St. Denis Yard	9:30	9:45	
12	Hotel de la Paix	9:45	10:00	
13	St. Denis Yard	10:00	10:15	
14	Hotel de la Paix	10:15	10:30	
15	St. Denis Yard	10:30	10:45	
16	Hotel de la Paix	10:45	11:00	
17	St. Denis Yard	11:00	11:15	
18	Hotel de la Paix	11:15	11:30	
19	St. Denis Yard	11:30	11:45	
20	Hotel de la Paix	11:45	12:00	
21	St. Denis Yard	12:00	12:15	
22	Hotel de la Paix	12:15	12:30	
23	St. Denis Yard	12:30	12:45	
24	Hotel de la Paix	12:45	1:00	
25	St. Denis Yard	1:00	1:15	
26	Hotel de la Paix	1:15	1:30	
27	St. Denis Yard	1:30	1:45	
28	Hotel de la Paix	1:45	2:00	
29	St. Denis Yard	2:00	2:15	
30	Hotel de la Paix	2:15	2:30	
31	St. Denis Yard	2:30	2:45	
32	Hotel de la Paix	2:45	3:00	
33	St. Denis Yard	3:00	3:15	
34	Hotel de la Paix	3:15	3:30	
35	St. Denis Yard	3:30	3:45	
36	Hotel de la Paix	3:45	4:00	
37	St. Denis Yard	4:00	4:15	
38	Hotel de la Paix	4:15	4:30	
39	St. Denis Yard	4:30	4:45	
40	Hotel de la Paix	4:45	5:00	
41	St. Denis Yard	5:00	5:15	
42	Hotel de la Paix	5:15	5:30	
43	St. Denis Yard	5:30	5:45	
44	Hotel de la Paix	5:45	6:00	
45	St. Denis Yard	6:00	6:15	
46	Hotel de la Paix	6:15	6:30	
47	St. Denis Yard	6:30	6:45	
48	Hotel de la Paix	6:45	7:00	
49	St. Denis Yard	7:00	7:15	
50	Hotel de la Paix	7:15	7:30	
51	St. Denis Yard	7:30	7:45	
52	Hotel de la Paix	7:45	8:00	
53	St. Denis Yard	8:00	8:15	
54	Hotel de la Paix	8:15	8:30	
55	St. Denis Yard	8:30	8:45	
56	Hotel de la Paix	8:45	9:00	
57	St. Denis Yard	9:00	9:15	
58	Hotel de la Paix	9:15	9:30	
59	St. Denis Yard	9:30	9:45	
60	Hotel de la Paix	9:45	10:00	
61	St. Denis Yard	10:00	10:15	
62	Hotel de la Paix	10:15	10:30	
63	St. Denis Yard	10:30	10:45	
64	Hotel de la Paix	10:45	11:00	
65	St. Denis Yard	11:00	11:15	
66	Hotel de la Paix	11:15	11:30	
67	St. Denis Yard	11:30	11:45	
68	Hotel de la Paix	11:45	12:00	
69	St. Denis Yard	12:00	12:15	
70	Hotel de la Paix	12:15	12:30	
71	St. Denis Yard	12:30	12:45	
72	Hotel de la Paix	12:45	1:00	
73	St. Denis Yard	1:00	1:15	
74	Hotel de la Paix	1:15	1:30	
75	St. Denis Yard	1:30	1:45	
76	Hotel de la Paix	1:45	2:00	
77	St. Denis Yard	2:00	2:15	
78	Hotel de la Paix	2:15	2:30	
79	St. Denis Yard	2:30	2:45	
80	Hotel de la Paix	2:45	3:00	
81	St. Denis Yard	3:00	3:15	
82	Hotel de la Paix	3:15	3:30	
83	St. Denis Yard	3:30	3:45	
84	Hotel de la Paix	3:45	4:00	
85	St. Denis Yard	4:00	4:15	
86	Hotel de la Paix	4:15	4:30	
87	St. Denis Yard	4:30	4:45	
88	Hotel de la Paix	4:45	5:00	
89	St. Denis Yard	5:00	5:15	
90	Hotel de la Paix	5:15	5:30	
91	St. Denis Yard	5:30	5:45	
92	Hotel de la Paix	5:45	6:00	
93	St. Denis Yard	6:00	6:15	
94	Hotel de la Paix	6:15	6:30	
95	St. Denis Yard	6:30	6:45	
96	Hotel de la Paix	6:45	7:00	
97	St. Denis Yard	7:00	7:15	
98	Hotel de la Paix	7:15	7:30	
99	St. Denis Yard	7:30	7:45	
100	Hotel de la Paix	7:45	8:00	

Signed: W. J. Gathings Checked: T. H. H. H. H.

Fig. 8—Work Car Time Record Form

When the job is completed, the checker fills in the form shown in Fig. 9, the final report on track construction, and forwards it to the head timekeeper's office, together with a rough sketch showing a general layout of the work as actually just done.

The checker also turns in his field ledger, containing the summarized detail of labor charges, and also details of material received, transferred or returned. This field ledger is closely examined and audited; the labor charges are checked against the original time sheet (Fig. 1); the material records are balanced against the original requisition (Fig. 2), and checked against the storage department delivery sheet and freight way bill.

This preliminary audit of cost records holds back the final report for two or three days, but the delay is advantageous as the cost checking of the records of the stores and engineering departments reduces to a minimum the possibility of error. The final report, ledger sheet and sketch are then clipped and fastened together, placed in a file folder, labeled and numbered and sent to the chief clerk for inspection. After this they are turned over to the estimating engineer for record and comparison with the original estimate.

DISSECTING AND CLASSIFYING THE COST RECORDS—THE TRACK RECORD CARD SYSTEM

With the data of a new job in hand, it remains only to incorporate these with the existing records in order to bring the cost records up to date. The information for track and special trackwork is kept on cards which are revised as explained below. (See Fig. 10.)

Taking up first straight track, the situation is complicated somewhat by the fact that there are still in existence on the Montreal Tramways system several different kinds of old straight-track construction. A record of each type is maintained on a separate card,

with the result that there may be three or four cards to record the work between any two points of intersection. When a complete renewal of a piece of track between any two points of intersection is made, a new type of track construction is installed, which we know as 115-CG. This symbol indicates that the rail used is 115 lb. and that the track has concrete foundation, with slab and granite block paving.

When the new work is installed, one card is substituted for the three or four previously used, which are destroyed, the history of the replaced types of construction being inscribed on the new cards.

One side of the card is devoted to the history of the track, and here are given the location, year of installation, number of miles of single track, work order number, types of new and old construction, starting and finishing dates of the work, and name of the foreman under whose direct supervision the work was done.

The total cost of the work is then compiled and split up under the following headings: Actual cost value,

MONTREAL TRAMWAYS COMPANY Form 29
ENGINEERING DEPARTMENT
FINAL REPORT TRACK CONSTRUCTION
This Report to be sent to Storage Office or cost or work is needed.

W. O. 418 Subject to opening office Nov 1/12 Date Nov 15/12
Street St. Lawrence St. from Royal Ave. to Sherbrooke
Work started July 24/12 Work finished Nov 1/12
Estimated Cost \$162,841.00 Actual Cost \$161,275.00
Information to show kind of materials
Intersections indicated None Working on Line Date _____

Track old None Rails removed 87° Scrap
Joints 6 W. 115° New End rails 115° New
The points 564 New, To Road 507 1/2 New, To Road 506 1/2 New
Washers N.T.C. 1/2 W. 115° To Road 507 1/2 To Road 506 1/2
Ties 564 New, Approx. 115° New In Stationing Road

TRACK CONSTRUCTION	Kind of Ballast	From Section	To Section	Joints	Laid	Taken up	Aband. by	Subst. by	Excavation by
Concrete slab	Granite	115°	115°	115°	115°	115°	N.T.C.	N.T.C.	N.T.C.
Subst. to paving	Gravel	115°	115°	115°	115°	115°	N.T.C.	N.T.C.	N.T.C.
Foundation	Sand	115°	115°	115°	115°	115°	N.T.C.	N.T.C.	N.T.C.

Order No. 53840
Reading Start 448 Finish 1458
Construction 115 CG Year 1913
Lines given by Engineers N.T.C. Drawn given by Engineers N.T.C.
Temporary Track Under on West Side as Built Based Track
Remarks Concrete Slab Laid 2". Paving Done Laid 4" Sand Cushion and Granite Block a New Used
Drawn H. Scott Inspector J. Seaman

Fig. 9—Final Report on Track Construction

Intersection St Catherine & Guy Sts. Foreign Print File 312
M.T. Co. Drawing No. 759 N.A.

Type Special Work A Profile No. 132KK Actual Cost Value _____
Manufacturer Con Steel Foundry Draw'g No. 899 N.B. Contract Value _____
Manfr's Draw'g No. 717 Construction 115 CG Paving Adjustment _____
Manfr's Price _____ Track W. O. 3283 Capital Cost _____
Inspected Nov 16/1914 Date Laid Apr-May 1913 Total Cost _____
Piece Renewal Nos 31, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 52, 66
renewed July 1921.

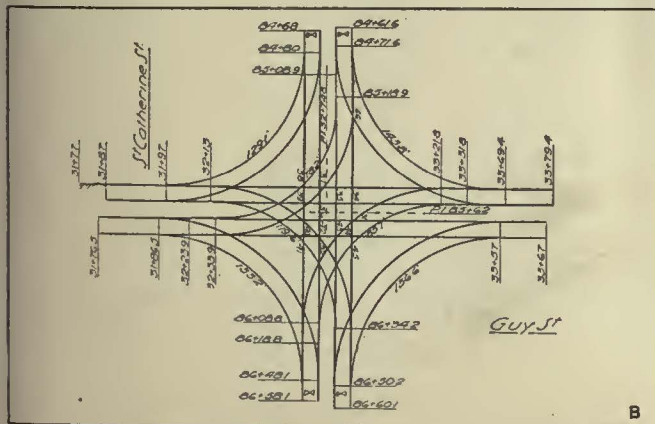
A

Track St Catherine St Year 1913
Miles .752
From Guy St To Dee St

Track W. O. 2688 Work Started May 1913 Actual Cost Value _____
Construction 115 CG Work Finished Aug 1913 Contract Value _____
Replacing 96° F Foreman F. Scott Paving Adjustment _____
Capital Cost _____
Total Cost _____

Number	Drawing	Title
	<u>Relined & Regroded from 85-77 to 98-60</u>	
	<u>July 1921 W.O. 4033</u>	
<u>104KK</u>	<u>Profile Victoria to first</u>	

C



contract value, paving adjustment, capital cost and total cost. At the bottom of the card space is reserved for the profile drawing numbers, etc.

The reverse of the card is devoted to a diagram of the piece of track. This is made in color and shows the section of rail used, the chainages, the beginning and end of the work and the points of intersection.

RECORDING SPECIAL TRACKWORK

All intersections, turnouts, crossovers and guarded curves are classified as special trackwork. Each piece of special trackwork is recorded on a separate card. On the back of the card is given a drawing showing the number and length of curves, chainages to switch points, end of combination rails, sections of rail used and total length of single track through the intersection. The different types and weights of rail section are illustrated by different colors of ink.

On the face of the card for special trackwork are

a complete valuation was made of the Montreal Tramways system. This gives a starting point for the cumulative cost records. Thus, as each work order is completed and the cost data are audited and turned in, an adjustment of the contract valuation is made, either increasing or decreasing the capital, as the case may require. This facilitates an easy and accurate valuation of track and roadbed throughout the system at any time.

If an intersection is completely renewed, a new card showing the new work is substituted for the old card.

From what has been said it is apparent that the maintenance of this card record system is not a difficult matter and it furnishes a very complete record of track.

TRACK MAINTENANCE COSTS

The costs of track maintenance are compiled in practically the same manner as the costs on work orders, with the exception that final reports are not made up. The information required on labor and material distribution is contained in semi-monthly reports. The renewal or replacement of special trackwork pieces, however, is covered by special reports, giving detailed information to the superintendent of tracks.

The system is divided into two divisions, east and west, under the direct supervision of division roadmasters, who are assisted by a clerk and a traveling timekeeper.

RECORDS OF SUB-DEPARTMENTS

The records described above refer to track and these are kept at the main office. It happens that the clerical staff and foremen connected with the sub-departments of bridges and buildings, tools and machinery, and bonding, welding and grinding are housed in a separate building located about 2 miles from the head office, which is in a central part of the city. The records of these sub-departments are maintained separately in this building, so as to keep these records in close relation with the actual work, for under the same roof are also contained the machine shops, carpenter shops, store-room, and bonding, welding and grinding plant and outfit.

The instructions to the clerical staff quoted on page 759 indicate the method of record keeping and the routine followed in these sub-departments.

ORGANIZATION

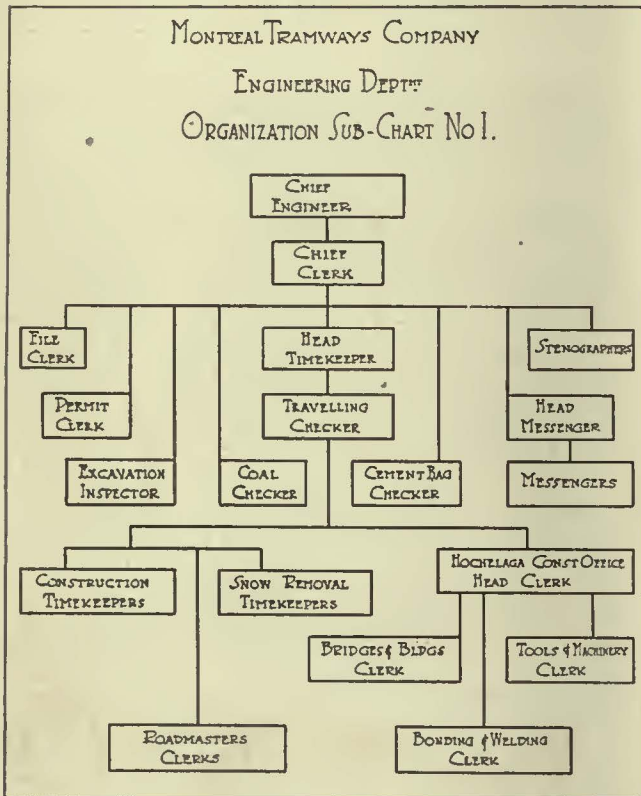


Fig. 11—Organization Chart for Record Section of Engineering Department

noted the point of intersection, the foreign print number or manufacturer's drawing number, the Montreal Tramways' drawing number, the type of special trackwork used, the name of the manufacturer, the price and the date of inspection. There are also noted the city of Montreal's profile drawing numbers, the tie diagram numbers, the work order number and the date of installation of the intersection.

A space is reserved at the bottom of the card for memoranda of piece renewals. If at any time it is necessary to renew a switch, mate or crossing, notation is made under the heading "Piece Renewal," giving the number of pieces renewed, the section of rail used and the installation date. There is also a column reserved to show the intersection installation cost and analysis thereof.

In this connection it is important to note that in 1917

Fig. 11 shows a chart of the organization force which carries out the work described in the preceding pages, including some items not mentioned specifically. The titles given will, however, indicate the duties of the men in charge of these items.

During the course of the construction season it is necessary to utilize the services of several temporary timekeepers in addition to the permanent staff, who are also employed on snow-removal work during the winter.

Timekeepers are broken in on the work gradually. A green timekeeper is given a copy of the "blue book," or instructions to checkers, together with a list of the names and titles of officials and other members of the staff and a telephone list showing office locations. He is first thoroughly drilled in a correct interpretation of the instructions. The final destination of all reports and the process of checking and auditing are demonstrated to him. He is then taken out on the work and introduced to all other timekeepers, foremen or members of the staff with whom he will come in contact and obtains a general idea of the location of shops,

The Duties of Each Clerk Are Systematized

DUTIES OF CLERK IN CHARGE BRIDGES AND BUILDINGS

1. Material requisitions for carpenters, plumbers, bricklayers, painters (B. & B. department).
2. Posting material requisitions in ledger for cost distribution and reference for final reports.
3. Pricing above mentioned material.
4. Compiling lumber records in ledger.
5. Keeping price book up to date.
6. Compiling final reports for B. & B. department.
7. Compiling fortnightly statement for B & B. department.
8. Compiling daily time reports for B. & B. department.
9. Posting daily time reports in ledger for cost distribution.
10. Checking distribution record for B. & B. department with stores department record.

11. Daily working force report (gang location).
12. Stationery room records.

DUTIES OF CLERK IN CHARGE TOOLS AND MACHINERY

1. Material requisitions for tools and machinery.
2. Posting material requisitions in ledger for cost distribution and final reports.
3. Pricing above-mentioned material.
4. Keeping price book up to date.
5. Keeping T. & M. ledger.
6. Compiling final reports for T. & M.
7. Compiling fortnightly statement.
8. Making out daily time reports.
9. Posting daily time reports in ledger.
10. Checking up requisitions for T. & M. against stores department records.
11. Posting tool ledger account.
12. Field work—water meter reading, Western Division.

DUTIES OF CLERK IN CHARGE BONDING, WELDING AND GRINDING

1. Material requisitions for bonders, welders and grinders.
2. Posting material requisitions in ledger for cost distribution and final reports.
3. Pricing above-mentioned material.
4. Keeping price book up to date.
5. Compiling final reports for bonders, welders and grinders.
6. Compiling fortnightly statement.
7. Making out daily time reports.
8. Posting daily time reports in ledger for cost distribution.
9. Reports of work done by bonders, welders and grinders.
10. Compiling electric weld joint record (ledger).
11. Compiling record of oxygen and acetylene consumption.
12. Field work—water meter reading, Eastern Division.

storerooms, etc. A few days as an understudy to an experienced timekeeper enables him to pick up a practical knowledge of labor distribution and field routine, after which he is detailed to cover a work order. Timekeepers are continually in touch with the head office by telephone, messenger and through the medium of the chief clerk, traveling checker and cement bag checker who cover the outside work at frequent intervals.

Montreal Tramways timekeepers and material checkers cover also, when required, the inspection of stations and platforms, cattleguards, fencing and culverts. During heavy weather they are frequently called in from the field to cross check the delivery of material against the records of the stores department. The distribution of coal during the winter months to switch and hillmen's shanties is covered by a checker. As a high percentage of trackwork is carried on at night, checkers are subject to call for night work.

The necessary overtime for night work is distributed evenly as far as possible with due consideration to the ability and experience of the checker.

Liberty Bell Route Inaugurates Chair Car Service

A PLEASING improvement in the Philadelphia service of the Lehigh Valley Transit Company, operating over the Liberty Bell route, consists of giving chair-car service on two of the round trips daily. The company operates a limited service every hour between Allentown and Philadelphia. The run is made in one hour and fifty-seven minutes, which is quicker than competing steam roads. The one-way fare is \$1.66, and an extra charge of 50 cents is made for a seat in the chair cars.



No. 1—Type 700 Car Before Remodeling. No. 2—Exterior of Remodeled Chair Car. No. 3—Interior of Chair Car Compartment

In order to provide the additional cars necessary for this service some of the company's type 700 center-entrance cars were remodeled. Accompanying illustrations show these cars before and after the work of reconstruction took place. The work of remodeling consisted of cutting out the well in the center part of the car, but leaving the ramp and center sills to form a truss. The side sills were straightened out and an angle iron was added for a support. The floor in the car was relaid to make it level. Side panels were filled in where the center doors originally were, and two additional windows were added in the center. Steps and trapdoors were installed at diagonally opposite ends of the car, and a glass partition was placed between the smoker and parlor compartments. In general, the electrical equipment underneath the car was not relocated but was blocked up during reconstruction and until proper supports were provided.

This reconstruction gives an all-steel car of 50 ft. over all with a width of 8 ft. 9 in., weighing 69,180 lb. The chairs used are of special design, being willow upholstered with spring seats. There are eighteen chairs in the passenger compartment and five in the smoking compartment. A mouse-colored rug is used over the entire floor in the parlor compartment, and the platform has been arranged to provide an observation compartment in the smoker.

The officials of the railway report that the service has proved quite popular, and that there has been a considerable increase in passenger traffic due to its inauguration.

Zone Fares and Transferable Short-Ride Weekly Cards for Berlin

THE Berlin (Germany) Street Railways has always been an exception to the European rule of graduated fares for large cities, although the Berlin rapid transit lines are on a basis of short-haul and long-haul fares as well as two classes of fares. No longer ago than October, 1922, in a signed article, De Leonhard

However, the skyrocket increases in Berlin city fares have had such disastrous influence on traffic that the city-owned street railways are prepared to try at least a short-haul fare and to add also a modification of the old-time weekly card. For example: In the spring of 1922 the surface cars carried 2,000,000 riders a day, but by October, 1922, the traffic had gone down to 1,050,000.

It is almost useless to state fares except as ratios to explain the innovations. On Jan. 30, 1923, the standard fare was advanced to 150 marks, or 1,500 times the pre-war rate! A ticket, including transfer to either surface or elevated lines, cost 220 marks. Unlimited-ride monthly cards of non-transferable type cost 9,000 marks if good on one line only, 12,000 marks when good on three lines and 24,000 marks on the system. Monthly cards for students cost 2,800 marks. Approximately half rates (80 marks) for single trips apply to children between the ages of six and fourteen years, students and apprentices between the ages of fourteen and seventeen years and crippled veterans.

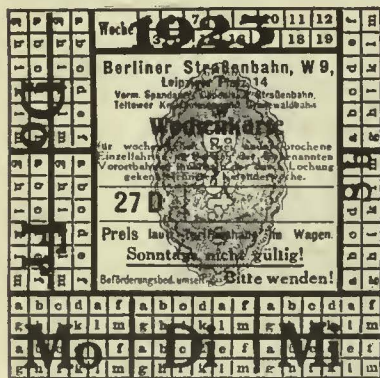
NEW ZONE FARES AND WEEKLY CARD FOR SHORT RIDERS

The foregoing kinds of fares are of the types formerly standard. To these was added on Jan. 8 a system of zone fares for trial on Routes 9, 16 and 116. The routes are divided into sections averaging 3 km. (1.9 miles) and the fare first charged was 50 marks. This was raised to 100 marks on Jan. 30, but this sum is of course less than the standard fare. Although there is an extraordinary proportion of overlapping routes in Berlin, the zone fares do not apply to other cars on the same streets.

The second innovation, made on Jan. 8, may be described as a short-haul weekly card, differing from the season tickets or passes in being transferable and in being valid for only a limited number of rides. The purpose of this card is to encourage short rides in the business sections. The test is being made with 1.5 km. (0.93 mile) sections on all routes radiating from Alexanderplatz and Potsdamerplatz respectively. These cards were placed on sale for 420 marks, or 35 marks for each of the twelve weekly rides possible—a reduction from the 70 marks standard fare and the 50 marks single short-haul fare, then in force. The cards are not valid on Sundays, but may be used on weekday holidays, thereby assuring twelve rides if wanted. There is no rebate for rides not taken. Cards are for sale on the Saturday before week of use. The punch made by the conductor on the first ride determines the section on which the card may be used the rest of the week. One of these cards is reproduced, together with the corresponding weekly card used on the Berlin Elevated.

On the surface weekly ticket the numbers 5 to 19 at the top of the ticket, overprinted with 1923, indicate the week covered by the ticket, as explained in a schedule on the back of the ticket. The letters "a" to "m" refer to the twelve routes on which the ticket may be used. The large letters at the bottom and sides of the ticket, "Mo," "Di," etc., refer to the days of the week. Monday, Tuesday and so on.

The elevated weekly ticket is much simpler as there is only one route. It, however, is non-transferable and the purchaser must sign his name in the lower ruled space in the center space on the card. The "7" in the upper space indicates the seventh week of 1923.



Weekly Passes Used on Surface and Elevated Lines in Berlin. They Are Good for Only Two Rides a Day for Six Weekdays

Adler, manager of the system, wrote that Berlin conditions did not seem to encourage the use of a graduated fare. He said that the average surface car haul was only 3.9 km. (2.4 miles), whereas fare collection difficulties would not permit a lesser short-haul ride than 2.5 to 3 km. (1.8 to 1.9 miles). An extensive zone fare would drive the public to the cheaper Stadtbahn (the Prussian Government's belt lines).

Signaling on the Frankford Elevated—II

The Interlocking Features Are Taken Up in This Article, as Well as the Speed Control Signals Which Form a Special Feature of the Installation—Junction with Market Street Line Involved Unusual Problems

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Automatic Train Stop, Color Light Signals, and Switch and Lock Movement, Electro-Pneumatic Interlocking, on Frankford Elevated

IN THE issue of this paper for April 28, 1923, page 711, the writer explained the layout of the signal system of the Frankford Elevated line, in Philadelphia. He left the subject with an account of the air supply system. There remained to be covered the switch interlocking arrangements and the special problems involved in the connection at Front and Market Streets with the Market Street subway-elevated line of the Philadelphia Rapid Transit Company:

The interlocking plants govern the switches, the "dwarfs," the home signals and, except where the signal is next to the station, they also govern the approach signals. Where a cross-over is adjacent to a station the interlocking governs the approach signal on the side away from the station. The valves controlling the air supply to the switches are of the cut-off type and when the movement is completed they cut off the supply of air to the pistons and thus eliminate the loss of air experienced when the pistons are kept charged at full pressure. Because of restricted space these valves are mounted on a special bracket fastened outside of the bench walk.

Signals for operation in the normal direction controlled by the interlocking plant are of the semi-auto-

matic type; that is, they may be thrown to indicate "stop," but when thrown to the reverse position they act as automatic signals and permit a train to proceed only when track conditions are favorable. Each is equipped with an illuminated dial 7 in. in diameter, bearing the letter T in white on a dark background. The operating rules forbid passing a tower-controlled signal displaying a red light without a special call from the towerman. Accordingly, mounted on the mast is a permissive or "call-on" signal, consisting of a yellow light 5 in. in diameter. "Permissives" and "dwarfs" are non-automatic. They are manually controlled and give a proceed sign only when their controller is operated. Their range is 500 ft. as against 1,000 ft. for the signals for normal operation.

The interlocking machines are 110-volt, a.c., electro-pneumatic. Each machine is inclosed in a steel case having separate, removable doors for each section, to give access to the interior. Signal and switch levers are painted red and black respectively, and project in opposite directions. Levers are equipped with latches to prevent accidental movement, and there is the usual mechanical interlocking between levers. This locking makes it impossible to move a lever until other levers

interlocked with it have been thrown to the correct position. Movement of a lever immediately locks the other levers in position before energy can be applied to the unit controlled, and release of other levers cannot be effected until the lever has been thrown to the end of its travel. This locking prevents the throwing of a switch until the signals governing passage over it indicate danger, and in the same way it prevents giving a proceed signal over a switch until the switch has been locked in the proper position and all opposing signals have been thrown to the "stop" position.

For each spare lever, and where space is left for the future installation of a lever, room is left in the locking bed for one cross-locking bar and one longitudinal bar for the full length of the machine.

ELECTRIC LOCK FOR SWITCHES AND SIGNALS

Sectional route locking is provided by equipping each switch lever with an electric lock which prevents the moving of the switch as long as any part of the train is on the section. It is also provided with an indication lock, circuit controlled, so that when the lever is thrown

approach sections and the motorman has been given a proceed signal. Under certain restrictions the approach locking can be cut out. The release is by a clockwork mechanism which permits throwing the switch only after the lapse of a predetermined period. This period is adjustable, but the time is made sufficiently long to insure that the train will be brought to a stop before the switch can be moved. Locking which performs the same function is provided in connection with all "dwarfs" and with certain semi-automatic signals for which approach locking is not provided. This, however, is always effective, and is not dependent on the presence of a train in the approach section. This locking has automatic time release.

There is a sealed clockwork release for each electric lock on switch levers. This makes it possible to throw a switch when a car is on the section, but only after the seal has been broken, and it is impossible to give any proceed signal other than a permissive over a switch unlocked in this way.

Under each switch lever is a visual indicator of the electric-light type, which indicates by a green light that



Color-Light Signals at Torresdale Street Electro-Pneumatic Interlocking



Another Installation of Color-Light Signal at Interlocking on the Frankford Elevated

the movement cannot be completed, and thus the mechanical locking affecting other levers be released, until the switch has been moved to and locked in the position corresponding to the position of the lever. Each signal lever is equipped with a similar lock, circuit controlled, so that when the lever is thrown toward normal the movement cannot be completed until the controlling relays for all signals, including permissive, directly controlled and indirectly controlled, have assumed their most restrictive position. The circuits for the signals, as distinguished from the circuits for their levers or relays, are also controlled through relays that positively repeat the position of the switch.

Permissive signals are controlled by a button mounted on the front of the machine and placed directly below the lever for the semi-automatic signal on which the "permissive" is mounted. This button is so interlocked with the lever that the circuit of the "permissive" cannot be completed through its controller until the lever has been reversed. The button also depresses the trip.

Electric locking is also provided to prevent taking away or changing a route after a train has entered the

the track circuit controlling the lever is unoccupied and that the lever may be moved. Under each signal lever controlling a semi-automatic signal is a similar indicator which shows by a green light that the track circuit controlling the semi-automatic signal is unoccupied. It is also provided with a red light. When the lever is thrown this light indicates by a flash that the relay controlling the signal has responded. Incidentally if a train is on the section and the signal therefor indicates "stop," although the lever has been reversed, this light will give a continuous indication.

PROVIDING FOR REVERSE-DIRECTION TRAFFIC

There are four traffic levers on each machine. Each lever in conjunction with a similar lever in an adjacent tower permits the establishment of a reverse direction of traffic on a track between the two towers, but only when the levers controlling the signals at the entrance to the controlled territory are normal and the signals indicate stop and at the same time the controlled territory is unoccupied. They are provided with locking which does not restrict non-conflicting train movements, but permits following trains in the established direction

at close intervals. Under each traffic lever is a visual indicator which shows by a green light when conditions are proper for change in direction of traffic, and the lever may be reversed.

Mounted on an angle iron frame directly above each machine is an illuminated model showing tracks, track sections, signals, and other features of the interlocked section. Each track circuit on the model is colored sufficiently distinctive to differentiate adjacent sections. It is also indicated by a round spotlight located approximately at the middle of the section it repeats and which burns only when the track section is unoccupied. The model has one light for each track section within interlocking limits, one for each of the approach blocks and one for the receding track territory controlling the home signal at the entrance to the switch.

Near each machine is a switch panel carrying the following instruments: one voltmeter for the 110-volt mains, one air gage, two ground detectors and one switch for tower lighting.

SPECIAL PROBLEM AT FRONT AND ARCH JUNCTION

Special treatment was found necessary for the junction at Front and Arch Streets, between the line from Frankford and that from the ferries. At a junction point the signal layout must be such as to insure a specially high track capacity. It is true that, except for interference between trains running in opposite directions, if trains are run to schedule there will be no more congestion at a junction point than at other points of the line operating the same schedule, but it is also true that on a rapid-transit line trains cannot be run exactly to schedule. One train will stop at a station for say ten seconds, while the following train may easily be held for as long as ninety seconds. By proper dispatching at a number of points these differences may to a certain extent be smoothed out.

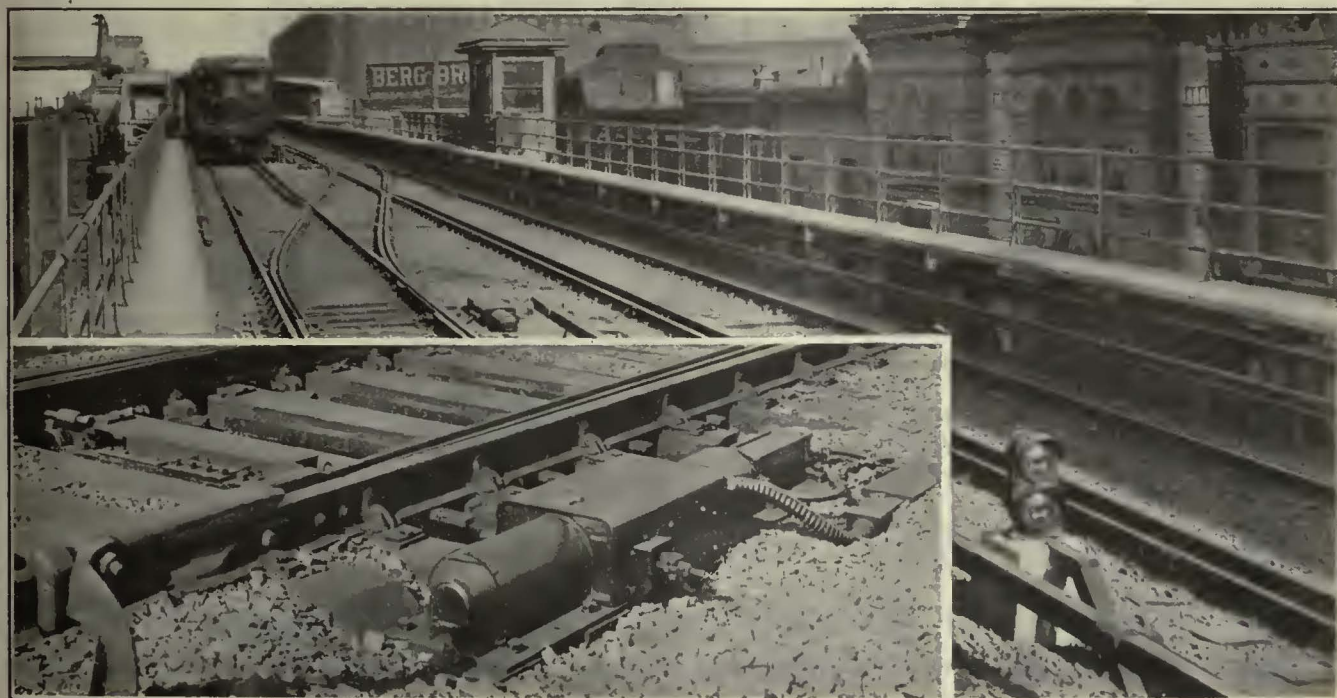
However, the junction at Front and Arch Streets is next to the Market Street station, which is served by the ferries of the shore lines of the Pennsylvania and Reading Railroads. During the summer these roads operate a frequent ferry service and most of their pas-



Electro-Pneumatic Interlocking Machine, with Lever Light Indicators and Illuminated Track Model and Clockwork Time Releases

sengers take the elevated cars. It frequently happens that when a train enters a station there will be waiting on the platform the passenger loads from three ferry boats, and while these are loading on the train a fourth boat arrives and delays the train even further. When the next train arrives the platform is empty. Delays of trains approaching junction points are unavoidable, and if the signals cannot handle the trains as they arrive from the two lines there will be congestion.

The necessity for capacity at the Front and Arch Streets junction is accentuated by the fact that there will be interference between trains going in opposite directions. The tracks for Frankford and those from the ferries cross each other at grade. This interference delays the service on one line and, therefore, of all cars in each direction that pass the junction. The signal installation must be such as to handle, without delay, trains running at very close intervals.



Electro-Pneumatic Interlocking, with Switch and Lock Movement, and Color Light Signals at Dauphin Street, on Frankford Elevated. Inset, Close-Up View of Switch and Lock Movement on Frankford Elevated

The grade and alignment of the road at this point make it difficult to signal the line for high capacity. Rules for laying out signals call for rear-end protection not less than the distance necessary to stop a train running at the highest attainable speed. A line where the stations are at the tops of grades is easy to signal for close traffic. On the down grades from the stations the block lengths must be long but the speeds are high so that heavy traffic can pass. On the up grades into the stations the speeds are low but the block lengths are short. Either of these combinations permits close running.

However, when the stations are at the bottoms of grades it is difficult to signal for high capacity. The trains can reach a high speed on the down grade, so that with the ordinary methods of signaling very long block lengths are necessary. Practically, on a steep down grade terminated by a station, the trains actually run at a very low speed as the motorman is afraid to let his train out of control. The combination of low speed and long blocks prevents close running.

The grade and alignment at this point are such as to present to the trains from Frankford a danger con-

into the station. Except for the curve at the foot there are no natural obstacles to high-speed running and it would be easy for a motorman to attain a speed on the grade from which it would be impossible to brake to a speed safe for the curve. The blocks on the curve should be long to avoid rear-end collisions. On the other hand, the trains must run slow to avoid disaster on the curve. With the usual signal layout the track capacity would be low, whereas, as has previously been pointed out, a high capacity is essential. Moreover the usual signal layout does not prevent high speeds. A signal system was necessary which would guarantee safety and capacity.

SPEED CONTROL SIGNALS SOLVE THE DIFFICULTY

The solution determined upon was to provide double overlap so as to space the trains closer and to install "speed control" signals. These are signals which normally display a danger indication, but are equipped with a time element which causes them to display a proceed signal a certain number of seconds after the time element has been energized. This time element is essentially a constant-speed motor.



High and Dwarf Color-Light Signals and Automatic Train Stops at Entrance to Market Street Subway, Junction of P. R. T. and Frankford Lines

dition which does not exist to the same extent for the trains from the ferries. As the ferry trains start from Market Street station they immediately encounter a curve of 140 ft. radius, with a total angle of 180 deg. by which the road reaches Arch Street. This curve terminates in a 5 per cent down grade leading into the subway. At the lower end of this grade is a curve of 200 ft. radius, with a total angle of 90 deg. at the end of which is the station. While these conditions are extreme, no accident has occurred here in the fifteen years of operation. The curve of 140 ft. radius is within full sight of the motorman as he starts from Market Street and he will not accelerate rapidly to it or run fast around it. Before the rear of his train is off the curve he is well down the grade and close to the 200-ft. radius curve. The layout itself guards against excessive speed on the grade.

For the trains from Frankford a different condition is presented. The grade terminates a long straight run. At the beginning of the grade is a 2.35 per cent slope; then there is one of 4.6 per cent which leads into the 5 per cent slope, at the lower end of which is the curve

The type of speed control usually installed is two-position, and has a single control. This is energized when the approaching train enters the block, immediately in advance of the signal. It is entirely effective in limiting the speed, but it is open to the objection that it keeps the speed of the trains to too low a value and makes it impossible to get the traffic over the line. The motorman, seeing the danger signal ahead, takes no chances of being tripped but runs at such a low speed that the signal clears well ahead of him. Experience shows that the average speed of trains over a line equipped with this type of speed control is only about half the permissible speed, and this reduction in speed cuts into the capacity in about the same proportion.

The speed control signals decided on for this installation are three-position with two controls. The time element becomes energized when the front of the approaching train enters the second block in advance of the signal, and the yellow proceed signal is displayed a certain number of seconds thereafter unless before this time has elapsed the front of the train has entered the block immediately preceding the signal. If it has en-

tered this block the signal under consideration will continue to display red and its trip will continue raised until a predetermined period of time has passed, after the train has entered this last-named block. These two periods of time are independently adjustable.

Experience in New York, where this type of speed control signal was developed, show that where it is installed the speed of the trains is very close to the limit for which the signals are set. Trains usually pass the signals just at the instant they flash from yellow to green and the one ahead changes from red to yellow. If the train runs too fast and passes a signal before it changes to green, the motorman checks the speed only slightly and the next signal is reached just after it changes from red to yellow and from that to green. It is almost as if the motorman accepts the signals as a sporting challenge to run the train at the speed for which the signals are set.

A criticism against this type of signals is that they do not make high speeds impossible. Theoretically this criticism is true. If the motorman is running at the correct speed the nearest raised trip is always the second one in advance. It is possible for him to accelerate over this space at the maximum rate and to attain a high speed before he is tripped. However, this criticism is more academic than real. The signals normally indicate danger at all times of the day and in all conditions of traffic. The motormen come to accept them as part of the existing conditions just as they accept the stops at stations. It is as difficult to conceive of a motorman throwing on full power and running into a signal which he knows always indicates danger as it is for him instead of stopping at a station to rush through it at full speed when he sees a train stopping just beyond it.

To sum up, the speed control signals are such as to cause the motorman to run no faster than the predetermined speed but to encourage him to run close to it, and in this way to obtain full capacity for the grade.

It will be noticed that these special precautions cover the safe operation down the grade of trains running at close headway. They do not cover safety at the grade crossing. The precautions to this end are simple. The crossing movement is between trains from the ferries and trains to Frankford. Safety for this movement is insured by mechanical locking in the lever machine so that the switch cannot be thrown for the train to Frankford if the position of the switch on the other track permits the passage of a train from the ferries. Before the route can be set up for the west-bound train from the ferries, the switch on the east-bound track must first be thrown and locked so that the only east-bound movement possible is to the ferries and a crossing is impossible.

As was mentioned at the end of the preceding article the contractor for the signal system of the Frankford Elevated was the Union Switch & Signal Company. This applies to the features covered in the concluding article as well as those described earlier.

During the four days of the Easter holiday this year the railway, omnibus and tramway lines forming the "Underground Group" in London carried more than 16,000,000 passengers. On one day the number was 5,000,000. In 1922, as stated earlier in this paper, the tramway cars of the London County Council carried 726,000,000 passengers, a record for traffic and 36,000,000 more passengers than in 1921.

Galvanizing vs. Painting of Exposed Steel Structures

THE editors of the *Electrical World* have recently conducted a canvass regarding the relative merits of painting and galvanizing steel used in structures exposed to the weather. While no definite conclusions were drawn, a summary of advantages and disadvantages of both practices was prepared. This is given in substance below:

Galvanizing—Advantages

1. Where parts of the structure are not readily accessible or dangerous to life—for example, near live wires—galvanizing has advantages.
2. Where the structures are widely scattered and the cost of a careful inspection would be heavy, galvanizing is also advantageous.
3. Where a permanent installation of sufficient magnitude to warrant a company doing its own galvanizing is made, the cost of galvanizing adds only 20 to 30 per cent to the cost of the steel.
4. In fabricated structures where bolts are used galvanized parts have a longer life.
5. In some structures it is possible to use lighter steel if it is galvanized than if paint is used.
6. The length of life of the galvanizing is from eight to fifteen years as compared with two to four years for paint.

Painting—Advantages

1. It is cheaper than galvanizing, and this makes it particularly advantageous for new installations in which the capital charge must be kept low until the load grows.
2. It costs little to have painting done by the normal line crew during odd moments.
3. Paint of different qualities can be found suited to peculiarities of the location of each structure as regards weather conditions, air conditions and a changeable environment.

Galvanizing—Disadvantages

1. First cost is high—reports give figures varying from 30 per cent greater to nine times the cost of painting.
2. The quality of galvanizing varies, necessitating rigid specifications.
3. In certain locations—for example, in a damp, salty atmosphere and in a sulphur-laden atmosphere—galvanizing has a very short life, so that its application is somewhat limited.

Painting—Disadvantages

1. It is difficult to obtain paint of the proper quality for each application.
2. Two or more kinds of paint must be used to obtain good results.
3. Repainting must occur in from two to four years, and in many cases this is a very costly operation, particularly if structures are brushed or scraped before repainting.
4. Repainting of live structures is hazardous and it is difficult to "kill" substations or lines.

17 per Cent Increase in Railway Competition

RECENT compilations of the National Automobile Chamber of Commerce show that in 1922 there were 12,239,114 motor vehicles registered, as against 10,464,005 in 1921, an increase of 17 per cent. The production of new motor vehicles in 1922 reached the startling total of 2,659,064, which passed the previous high mark of 1920 by 22 per cent. It was an increase of 60 per cent over the 1921 production.

The accompanying table giving the record of passenger car and motor truck production and the record of registration is something to contemplate. Where is the saturation point in the registration figures?

Indications for 1923, so far, are that production may exceed that of 1922. During April, 364,000 vehicles were manufactured and shipped, which is 66 per cent greater than April last year.

Year	Passenger Cars		Motor Trucks		Total Motor Vehicle Registration
	Number	Wholesale Value	Number	Wholesale Value	
1911.....	199,319	\$240,770,000	10,655	\$22,292,321	639,514
1912.....	356,000	335,000,000	22,000	43,000,000	944,000
1913.....	416,500	399,902,000	23,500	44,000,000	1,287,000
1914.....	534,679	413,859,379	25,375	45,098,464	1,711,339
1915.....	818,618	565,978,950	74,000	125,800,000	2,445,664
1916.....	1,493,617	797,469,353	90,000	157,500,000	3,512,996
1917.....	1,740,792	1,053,505,781	128,157	220,982,668	5,104,321
1918.....	926,388	801,937,925	227,250	434,168,992	6,146,617
1919.....	1,657,652	1,461,785,925	316,364	423,326,621	7,530,105
1920.....	1,883,158	1,809,170,963	322,039	423,756,715	9,177,129
1921.....	1,514,000	1,093,918,000	147,550	166,082,000	10,464,005
1922.....	2,406,396	1,567,003,041	252,668	222,635,324	12,239,114

Why One-Man Operation Is Popular in Binghamton

Better Service, Clean and Well-Painted Cars and Relatively Fewer Accidents Please the Public—The Passenger Revenue Increased 3 per Cent in 1922—Trainmen Prefer to Operate One-Man Cars

THE operation of one-man cars in many localities has not met with entire public approval, and the success of the Binghamton (N.Y.) Railway in avoiding the difficulties which have sometimes made such operation unpopular elsewhere is, therefore, worthy of note. All of the local service of this company, comprising nearly 90 per cent of the total daily number of trips, is now operated with one-man cars. These are, in the main, converted two-man cars, but on only one inter-urban line are two-man cars now used. Moreover, the public is well pleased with the service and has shown its approval by increased riding.

Several factors have contributed to produce this



Double Door Permits Simultaneous Loading and Unloading

situation. In the first place, one-man cars were inaugurated without any advance publicity. The management took pains to make no promises beforehand concerning improvement in the service, thus avoiding the risk of consequent dissatisfaction if it did not materialize. No opportunity was given to prejudiced persons to condemn the new cars without a trial. When they were ready the railway simply commenced operation of one-man cars, and left it to the public to judge them by actual performance.

Special care was taken that there should be no slowing up of service, as it was realized that such a thing would soon make the change very unpopular. Efforts to maintain speed have been so successful that with the same schedule for both types of operation the one-man cars are late less often than the two-man cars. At the same time particular attention has been given to the subject of maintenance, so that the service is reliable and the cars always present an attractive appearance inside and out, and every reasonable provision is made for the comfort of the passengers. The public has come to realize that it is getting a high-class service at a comparatively low rate of fare (6 cents).

The fact that there are no railroad crossings at grade is one feature that has been helpful in making one-man operation a success, as is also the fact that there is only one multiple-fare line. This goes to Endicott and uses two-man cars entirely. Another favorable circumstance is that no routes terminate in the congested district, all running through from one side of the town to the other, or in some cases looping near the center of the city. For that reason the problem of quickly changing ends at busy points with only one man to do the work has not arisen.

On the other hand, there are a number of local circumstances which tend to increase the difficulties of the operator of a one-man car. For example, all signals are thrown by hand. Many of the lines in Binghamton are single track after leaving the business section of the city, and the manipulation of the signals, therefore, makes considerable work. There are at the present time no electric switches, and hence switches, too, must be thrown by hand except at the intersection of Court and Chenango Streets, where a switchman is located during the rush hours. It is planned, however, in the near future to install an electric switch at this point.

No change whatever was made in the schedule speed when two-man cars were replaced by the one-man type. The present schedule varies from a little more than 8 m.p.h. on the slowest line to 11 m.p.h. on the fastest. All lines are checked during the entire period of operation by inspectors stationed at Court and State Streets. A summary of these checks showed that on twenty-two week days chosen at random and representing all sorts of conditions, the one-man cars were late less frequently than were the two-man cars.

In these checks one and a half minutes variation from schedule was the maximum allowed, and all cars two minutes late were so recorded. On that basis the one-man cars made a performance well over 99 per cent, while the two-man cars were only about 98 per cent on time. The average layover at the outer ends of the various lines was between two and three minutes, and it has been found that this time is sufficient for the operator of a one-man car to change ends. To facilitate this work all such cars have been equipped with fenders or life guards at both ends. A change of schedule was therefore unnecessary, and experience has proved that the one-man car can be operated at the same speed as the two-man, or even a little faster.

Pay-as-you-enter operation prevails on all lines, and the railway has installed a number of devices to increase speed. A large number prominently displayed and illuminated at night indicates at a distance what route a car is following, and all front entrance cars are plainly marked, as can be seen in the accompanying picture. The single-truck cars, although equipped with standard safety devices, are not the typical safety car, but are

of somewhat heavier construction and have a doorway of double width. This permits simultaneous loading and unloading and makes for more rapid service. On all cars except those of the 500 type, however, the controller and doors are interlocked and the latter manually operated. It is claimed that a quicker get-away can be obtained by leaving the controller handle on the first point and starting the car by closing the door than is possible when the door closing, brake release and power application have to be done successively.

There has been a reduction in the relative number of accidents since the inauguration of one-man service in Binghamton. Comparing the years 1920 and 1922, there has been a gain in the number of motor vehicles licensed in Broome County from about 7,000 to 16,000, or nearly 130 per cent. At the same time the number of collisions between street cars and automobiles has increased only 19 per cent. Moreover, there has been a reduction in the number of boarding and alighting accidents so that the net result is that, in spite of the tremendous growth of automobile traffic, accidents in 1922 were only 17 per cent more than in 1920. The relatively smaller number of accidents at the present time is attributed by the company to the door interlocking devices and the fact that on and off movement of passengers is directly under the eye of the motorman.

A large part of the success of the one-man cars is no doubt due to the attitude of the trainmen, who prefer them to the older type cars. Platform wages are 5 cents an hour higher in order to compensate for the slightly greater amount of work to be done. Johnson fare boxes are used with overhead registers. The fare being six cents, the operator must be prepared to make change and must grind down the box and ring the register. Tokens are not used to any great extent because they are sold without reduction in price.

In addition to the work already mentioned, the operator of a one-man car must record on his daily report card the register reading at the end of each half-trip, and upon the completion of his run the beginning and ending numbers of fare box and register, and the number of transfers, free riders, etc. He must also fill out a memorandum of any mechanical defects found and a report of the number of trips made with the car. This latter is for use of the shop department in figuring mileage for inspection and overhauling. It appears from the foregoing, therefore, that the keeping of necessary records has not been sacrificed to make the cars popular with the trainmen.

The popularity of the one-man operation with the public is not due directly to the cars themselves, but to the fact that the saving in operating costs has made possible an unusually high standard of maintenance. Every car is cleaned before it is sent out of the barn in the morning. The interior is swept and sprayed with West's disinfectant. The exterior is dry wiped every night and treated with Brooks renovator every sixty days.

Forty-three new cars have been purchased by the Binghamton Railway since 1916. A portion of these are single-truck cars, resembling the Birney car in design but of heavier construction, and with the wider doors described above. This car has a 9-ft. 6-in. wheelbase, weighs 19,000 lb. and seats twenty-eight people. It is claimed that the more sturdy construction saves maintenance costs, and permits carrying larger loads.

The non-rush time-table calls for forty-two cars on the road, and twenty-one additional trippers are sent out in the late afternoon. Even with this amount of

service it is important to carry as many passengers per car as can be done without undue crowding. The single-truck cars of the 500 type can easily accommodate seventy-five persons.

More recently, however, the company has purchased double-truck equipment. The latest design, of which seven additional units have lately been acquired, is a steel car built by the Cincinnati Car Company, weighing 32,500 lb. and seating thirty-eight. It has been found that these cars carry about the same number of passengers when operated by one man as when operated by two men. The explanation of this lies in the fact that passengers tend to gather around the entrance whether at the front or at the back, and in either case some will move into the body of the car when urged to do so and some will not. Accordingly, the carrying capacity of the car does not vary greatly, no matter which way it is used.

All cars are equipped with electric heaters and thermostats. Center lighting is used with 94-watt lamps and an emergency storage battery to supply current to the red lights in the rear in case the trolley leaves the wire. Cars are inspected every 1,000 miles, and overhauled every 50,000 miles. Painting is done



Cars of This Type Are Used Successfully
for One-Man Operation

regularly every second year, even though the car retains a fairly presentable appearance. Pratt & Lambert's standard Tuscan red is used.

The fact that the cars are clean, well heated, well lighted, well ventilated and bright and attractive looking has appealed to the people of Binghamton and stimulated the riding habit. Passenger revenue increased about 3 per cent in 1922 over the preceding year, and bus competition has been forestalled.

Traffic Congestion in Shanghai

SHANGHAI (China) claims to have the world's largest number of passengers carried annually per mile of track, 7,000,000. The total number increased from 11,000,000 in 1908 to 126,000,000 (21,750,000 first class) in 1922, with practically no increase in track mileage. The number of cars, however, increased from sixty-five to 194. The track mileage to day is only 2.43 per 100,000 population. In the period mentioned the annual car-mileage has trebled, i.e., increased from 2,000,000 to 6,000,000.

In the foreign settlement in Shanghai there are 15,000 public and private rickshas, 14,000 wheelbarrows, 3,000 motor cars and 2,164 hand carts.

Connection Triples Freight Business

THE Buffalo & Lake Erie Traction Company operates freight service between the cities of Buffalo, N. Y., and Erie, Pa., connecting with the Jamestown, Westfield & Northwestern Railroad at Westfield, N. Y. Until the latter part of last year, however, the two roads crossed, but had no connecting curve from one to the other. Through freight from points on one railway to destinations on the other had to be unloaded at the depot of the first road in Westfield, carted across town and reloaded onto the cars of the other road at the latter's depot. Whenever suggestions were made that a physical connection should be installed the authorities of Westfield raised the objection that it would make a freight yard of their town.

An agreement was finally reached, however, between the town authorities and the railway officials whereby the connecting curve was to be installed and if, after a fair trial, it was found to be a nuisance the companies practically promised to remove it. The connection was made on Nov. 6, 1922, and as a matter of fact there have been since that time fewer cars standing in the streets than formerly stood there, because through operation without the necessity of trans-shipping at Westfield is now possible.

The town authorities seem entirely satisfied with the new arrangement and the freight business has increased in a most gratifying way. Under the old conditions that part of the traffic handled by the Buffalo & Lake Erie Traction Company amounted to about \$10,000 annually. At the present rate the business done in 1923 will be well over \$30,000, and it is estimated that it will eventually develop to about \$75,000 a year.

California Railway Situation Improving

IN ITS REPORT recently issued for the year ending June 30, 1922, the Railroad Commission of California sums up the electric railway situation there as follows:

"The street railways of the entire country, during the last number of years, have gone through a trying and difficult period. Costs and wages have shown a disproportionate increase compared with the increase in traffic, and the lack of normal traffic increase was due largely to the competition of the private and public automobile. Even a substantial increase in fares failed to keep some of the weaker companies in operation.

"It seems as though in California, at least, this critical period has come to an end. With the fall in costs and with the private automobile competition apparently close to the 'saturation point,' the interrupted normal curve of traffic increase appears to have returned to its original and upward tendency. This has had the effect of improving street and electric railway service during the last year; with proper operating economies a number of requested rate increases proved unnecessary in the commission's opinion; and in general, the street and electric railways are in a healthier condition than they have been for a considerable period of years.

"The installation of the one-man safety car has proved a distinct benefit from the standpoint of service and cost of operation in several communities. Experiments with new forms of tickets and commutation rates have proved satisfactory in several instances and there has been a further effort on the part of the commission in all rate cases to do away with unjustifiable discrimination between classes of service and communities."

The Readers' Forum

Not Practicable to Manufacture Left-Hand Thread Lamps

THE ARROW ELECTRIC COMPANY

HARTFORD, CONN., April 25, 1923.

To the Editors:

We have read the communication on the theft of lamps shown on page 650. Of course the left-hand screw thread on receptacles and the left-hand threading on lamps could not prevent the removal of lamps; it would simply make the lamps useless, and perhaps that fact might not be recognized in time to prevent the actual theft but would be found out afterward and the lamp destroyed.

There are several socket manufacturers making lock sockets. The type manufactured by P. & S., the H. T. Paiste Company, Bryant Electric Company, G. E. Company and ourselves is a positive lock. In other words, the lamp cannot be removed without the use of a special appliance, in our case a key. It also prevents lamps jarring or vibrating out of the sockets or receptacles, which we should think would be an added advantage as far as trains or electric cars are concerned.

A locking arrangement of this kind which prevents the removal of the lamp would, it seems to us, be a better proposition than an arrangement which would make it possible to remove the lamp but make the lamp useless. There would be a considerable amount of theft before it was discovered that these were useless.

Another point is the fact that we have had some experience with left-hand screw threads with the result that we will not handle sockets or receptacles using such a thread. They become mixed in manufacture and cause endless trouble in the field. It is almost impossible to keep them separate from standard parts, so regardless of the merits of the left-hand threading as against the positive lock, our company for one would not care to take on a proposition to manufacture sockets or receptacles with left-hand screw threads. We think this would also be the opinion of other manufacturers in our line.

H. C. POND, Sales Manager.

Bayonet Sockets Would Prevent Lamp Thefts

THE DENVER TRAMWAY COMPANY

DENVER, COL., April 23, 1923.

To the Editors:

Referring to the letters published in your issues of March 24 and April 14 on the question of how to stop the theft of lamps on electric railway properties, I would be glad to give my idea on the subject. I might mention that my opinion is the result of thirteen years of continuous service in the lighting department of this company as foreman.

The lock sockets on series circuits are out of the question, as the additional time consumed in trouble shooting would cost more than the lamps by far. On multiple circuits sockets are twisted loose with added trouble for the maintenance man. The left-hand thread, as well as any over or under standard size sockets, would very likely have some effect in avoiding theft. This would necessitate a change in manufacture of lamp sockets, including the replacement of present installa-

tions. Furthermore, you will find a lot of different makes of sockets on the system that would make it hard to replace the screw portion only as the cost of tools for the makers to manufacture to fit these old types would prohibit this. The cost to change them alone would cost more than new sockets.

I would suggest the so-called double-contact bayonet socket and lamps of a size that would permit the socket manufacturers to use some of the dies and molds of present sockets for porcelain parts. This type would aid the trouble shooter in locating the bad lamp in a series circuit, as a change can be made faster than with the screw base. It would do away with the loose lamp trouble, which is a common thing on cars and poles, or any chattering condition. The destruction of sockets due to the arc drawn at the contact when connection is broken on a series burning lamp will be avoided.

The loss of time on the part of carhouse men when using pit lamps with extension cords is often due to a loose lamp in the circuit. The fire hazard of a series burning lamp circuit will be overcome, too, as loose lamps may ignite the installation of wires and result in a bad fire, in the event that the burning insulation drops in shavings or inflammable material. The safety in this respect alone would warrant the cost of gradual change on a whole system to the bayonet type, in addition to the gains in other respects.

Can any better solution be found?

W. C. WEFEL, Foreman.

Preventing Pavement Heaving Outside the Track Area

THE TOLEDO & WESTERN RAILROAD COMPANY
SYLVANIA, OHIO, April 26, 1923.

To the Editors:

I note on page 677 of the April 21 issue of the ELECTRIC RAILWAY JOURNAL an article relating to a design of pavement and substructure for street and interurban railways that overcomes the heaving of the pavement outside the track strip.

The general idea of this type of structure is not new. We do not claim that we originated it, although we built something over 1,000 ft. of track in the village of Metamora, Ohio, about 1915, designed in this same general way. Our track, however, was laid upon a 10-in. bed of concrete and a retaining curb of concrete 6 in. thick was built to the top surface of the paving. On the outside of this retaining curb we placed a $\frac{3}{4}$ -in. pre-molded expansion joint the full length of the job. Transversely across the track we placed a $\frac{3}{4}$ -in. expansion joint every 30 ft. In this trough of concrete we placed 2 in. of stone ballast, on top of which we laid our ties and rails to true grade. The crushed stone ballast was carried half way up the side of the tie and on top of this we then laid our concrete paving, which was reinforced with $\frac{1}{2}$ in. steel mesh wire, with openings about 1 in. square.

This paving today is in very good shape, and the adjoining paving outside the track, which was of reinforced concrete, shows practically no heaving at any point. The only place where the paving is failing at all is at the rail joints, where all that is necessary is to tighten the bolts and perhaps put in some new bolts.

Our experience has shown us that this type of construction is very satisfactory, and it has been used to a great extent in Toledo, Ohio, on the tracks of the Community Traction Company.

We hope that your article will be carefully considered by other railways, for it surely is a design which will, we believe, be more satisfactory to municipal engineers, as well as to railway engineers themselves, than that type which makes the track structure an integral part of the street paving.

A. SWARTZ,
Manager for Receivers.

Heat Signs in Brooklyn

THE cars in Brooklyn are equipped with electric heaters with coils connected so that three intensities of heat can be obtained. The regulation of the heat is controlled from the main offices of the company. When the temperature is between 30 and 40 deg. one point of heat is used; between 20 and 30 deg. two points and below 20 deg. three points.



Heat Signs in Brooklyn

At all depots, switch towers, principal terminals, and other important points, signs similar to the one shown in the illustration are installed to indicate the proper amount of heat to be turned on. The readings of a number of thermometers at various points on the system are telephoned in to the main office, the proper amount of heat to be used is decided upon and notice is sent to the men in charge at the points where the signs are displayed. The card showing the proper number of points of heat—0, 1, 2 or 3—is then slipped into the frame. The trainmen are expected to observe these signs as their cars pass and make any necessary changes in the position of the heater switches that may be indicated by the signs.

Where the signs cannot be seen readily at night they are illuminated.

A Consolidated Delay Report

ONE of the steps recently taken by the Chicago Surface Lines to remove the cause of delays to its service has been to establish a single department where every delay to cars, no matter from what cause, is promptly reported, with the length of delay, cause, etc. As notices of these delays are received a record is made of them, and the record for each day is submitted to the management on the following day. At present this record is made up to 7 p.m. at night, but within the next few weeks, when the company has moved to its new offices, there will be a night service by which all delays which occur up to midnight on any day will be typewritten and manifolded for submission to the proper officials when they reach their desks early the next morning. The classifications used are as follows:

- Time of delay (hour of the day).
- Line.
- Place of delay to service.
- Run number.
- Car number.
- Direction.
- Cause of delay to service.
- Time cars were delayed: — hours — minutes.
- Action taken to maintain or restore service.

Association News & Discussions

Fuel Determinations on Southern Pacific Steam Locomotives*

Road Tests on Oil-Burning Engines Set Standard for Comparison with Electric Locomotives—Discussion Shows Variation in Performance Computations

By A. H. BABCOCK

Electrical Engineer, Southern Pacific Railroad, San Francisco, Calif.

WHENEVER electrification of steam railways on a large scale is advocated one of the principal arguments advanced is the large saving in fuel sure to result therefrom; in fact, this was the initial point of attack in the early days of the art, long before overtime of train and engine crews had become the very real expense in train operation it is today.

Fuel consumption of steam locomotives using coal cannot be analyzed as can that of electric locomotives, because it is impossible to obtain accurate measurements. When fuel oil is used, much more precise determinations are possible.

Engine No. 3,614 was selected because the records of the fuel bureau showed it to be an "average performer" in through freight service. It is of the 2-10-2 type, having cylinders 27½-in. long x 32-in. stroke. The weight on drivers is 273,000 lb., on the leading truck 29,000 lb. and on the trailing truck 46,000 lb. The rated tractive power is 63,300 lb. The tender is of the cylindrical type. It weighs empty 64,900 lb. and has a capacity of 3,120 gal. of fuel oil and 10,030 gal. of water. The weight of the tender loaded is 173,460 lb.

On every run a different engine crew handled the train while making the tests, the selection being by the usual "first in, first out" method standard on the railway. A trained observer rode the engine and made all the readings. The train weights, taken from the yardmaster's reports at the initial points, were corrected, during the runs, for fuel and water consumed.

It was found during the test runs that all engineers handled the trains very much alike, changing throttle or cutoff at or near the flags that had been placed at the reference points given in Fig. 1. Meter readings and times were recorded at all such points and at all starts and stops. In the final analysis all fuel measurements were reduced to 60 deg. F. Approximate correction factors on the train

tonnage for water and fuel were made. The train tonnage, then, is the gross weight of the train, everything included.

The result is a complete record of fuel consumption. In the ordinary system of fuel records all fuel consumed in firing up, standing in the engine house and on the outgoing track

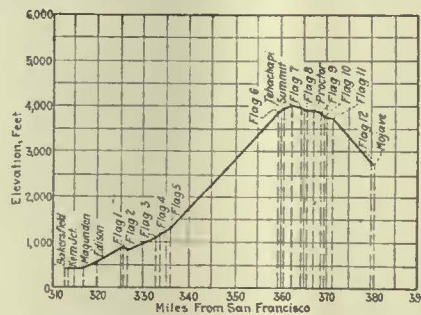


Fig. 1—Profile, Bakersfield to Mojave

up to the time the engineer assumes responsibility, i.e., thirty minutes before he is called to leave the terminal, is charged to engine house service; all consumed from that time until the engine is placed on the incoming track at the end of the run is charged to road service.

The fuel consumption may be divided into three groups:

1. Variation of fuel used in firing up, i.e., losses independent of the manner in which the engine is used after steam is raised.

2. Fuel burned in holding the engine under steam at terminals or on the road; i.e., losses dependent upon operating staff efficiency, and independent of speed.

3. Fuel consumption while moving; accelerating, running, entering and leaving sidings, etc., all of which depend largely upon tonnage and speed.

Group 1—For this determination the boiler was filled to ¼-gage glass, with water at 120 deg. F. Steam for oil atomizer and blower was taken from the house steam lines until the boiler pressure reached 70 lb. gage. Fig. 2 shows fuel with respect to boiler water temperature and steam gage pressure. A second curve shows fuel consumption with time.

From other tests it has been determined that the atomizer and blower add 14 per cent to the fuel consumption. Therefore, if 14 per cent of the 84 gal. used up to the time when the boiler furnished its own steam for these purposes be added to the 119 gal. to bring the boiler pressure up to 200 lb. gage, we have 131 gal. total fuel used to raise steam with feed water at 120 deg. F.

Assuming that the fuel consumption is proportional to the rise in temperature, the fuel per degree rise is 0.522 gal.; from which then can be determined the value of storing the heat from boilers being blown down for washing, to use in firing up other engines for the road. Thus, to fire up with feed water from the hydrant at 60 deg. takes 167 gal. of oil; similarly for feed water at 180 deg., from a hot water boiler washing and filling plant, 96 gal. With fuel oil at \$1.50 per bbl., the 71 gal. saved per engine fired up amounts to \$2.54, but the saving is even more, because the time of turning an engine washed and filled with hot water is, by record, three and one-half hours less than the seven and one-half to eight hours required when cold water is used. Heavy power represents an investment worth at least \$4 per hour. Hence the time saved adds \$14 per engine turned to the fuel saved, and the total economy then is \$16.54 per engine turned.

Group 2—The upward branch of the time-oil curve, Fig. 2, shows the fuel required to hold an engine under steam while standing in the engine house where these tests were made to be 17.4 gal. per hour, with no auxiliaries running. During the tests, placing this engine in the open yard, oil used averaged 36.6 gal. per hour. Air temperatures during this period ranged roughly from 20 deg. to 50 deg. F. Therefore, 19.2 gal. is the excess fuel consumed per engine-hour when standing in the open in ordinary weather.

Similarly, the fuel cost of standing on sidings with full tonnage train is found to be 42.8 gal. per hour. Since no steam was used for heating in either case, 6.2 gal. is the fuel cost per hour of maintaining air pressure in the train line, ready for service.

Group 3—To obtain results for the third group a more rigid treatment is necessary. R. S. Twogood, assistant engineer Southern Pacific Company, is responsible for the details of the test and the analysis of the results. In the reductions of the observations, the fuel oil density is taken at 0.96; the heat content, 18,000 B.t.u. per lb. The time, fuel meter reading, fuel temperature and location of train were recorded at

*Abstract of paper presented at the spring convention of the American Institute of Electrical Engineers, Pittsburgh, Pa., April 25, 1923.

every start, grade change or other important point, and stop. The speeds were determined by counting engine driver revolutions. All grade changes at other than station points were marked by white flags (see Fig. 1). Grade compensation for curvature is applied at 0.04 per cent grade per degree of curvature.

Total train resistance was based on Schmidt's tables, the value for level tangent track being taken at 7 lb. per ton. The average thermal efficiency was determined from the total horsepower-hours and the fuel burned when moving over sections where the total resistance was positive.

The average gallons of fuel per thousand ton-miles, in both directions, for every section of track, but not corrected for variations in speed within a section, are shown in Fig. 3 plotted against equivalent grade, wherein the curve as drawn has been adjusted to give fuel requirements for constant speed. Thus is shown the fuel cost of acceleration, and how, in the stop, provided the brakes are not used, a large proportion of the work done in accelera-

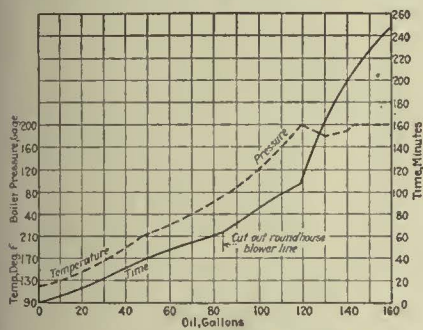


Fig. 2—Fuel and Time Required for Firing Locomotive

tion is made useful in moving the train over the track. This is indicated by points on the left of the curve; points on the right show increase in fuel consumptions during acceleration.

The dotted part of the curve, for grades less than 0.5 per cent, either positive or negative, should not be depended on for accurate results, because there is no section of level track between Bakersfield and Mojave.

A locomotive of lower thermal efficiency would burn more fuel for any given grade than that shown on the curve. The result would be a flatter curve. On the other hand a locomotive of higher thermal efficiency would burn less fuel than shown and the curve would be steeper. It is, therefore, apparent that the slope of the curve is a function of the efficiency, and the steeper the curve the higher the efficiency.

From the curve, the fuel required per 1,000 ton-miles on a 2 per cent grade equals 38.0 gal., and for a 1 per cent grade equals 23.3 gal. The difference, 14.7 gal., represents the fuel burned moving a 1,000-ton train 1 mile over a 1 per cent grade without friction because both figures are for grade resistance plus train friction. The train friction being the same in each

case, the difference is for a grade resistance of 1 per cent. A 1 per cent grade resistance is 20 lb. per ton. Then the work done in moving the given train 1 mile over a 1 per cent grade without friction equals 105,600,000 ft.-lb. This required 14.7 gal. of fuel or 1,647,082,080 ft.-lb. The thermal efficiency equals 6.41 per cent. This method of determining engine thermal efficiency is independent of train resistance at driver tires, which, at best, is difficult to determine accurately, and it should be very nearly correct.

The fuel burned on a 1 per cent grade for grade and train resistance is 23.3 gal., from which the train resistance equals 11.7 lb. per ton.

LOCOMOTIVE FRICTION IS LARGE ITEM

This does not check with the assumed 7 lb. per ton, because the 7 lb. covers only rolling friction, and the 11.7 lb. is for rolling friction plus locomotive internal friction, such as pistons, valves and other engine parts. If Schmidt's 7 lb. is correct for the rolling friction, then the difference, 4.7, is the locomotive internal friction. For the given train of 1,000 tons this is equal to a drawbar pull of 4,700 lb., or about 9.0 per cent of the total drawbar pull on the maximum grade of 2.31 per cent from Flag No. 5 to Flag No. 6.

As the negative grade increases, the fuel consumption is reduced until the negative grade resistance is numerically equal to the total frictional resistance of train and engine. The minimum fuel consumption of 2.5 gal. per mile as shown on the curve represents standby losses and should be about equal to the fuel burned standing on a siding with the train. For heavy negative grades the fuel consumption is again increased, for pumping air for braking purposes.

The over-all efficiency determined by this test, 5.57 per cent, is the ratio of the integrated foot-pounds of work done by the engine whenever the drawbar pull was positive to the total energy in the fuel used over the same time. Apparently it is constant for all grades greater than 0.5 per cent.

While drifting saves fuel, it is seldom possible to drift to rest except on positive grades. Fig. 4 gives a measure of the saving that may be made. The kinetic energy in terms of fuel in a 1,000-ton train moving at 50 miles per

hour equals 27.74 gal. If the engineer makes a sudden stop by heavy braking the greater part of this is lost in heat at the brake shoes. If his train schedule will permit him to drift down to 25 m.p.h. before applying brakes the fuel equivalent for kinetic energy is 6.93 gal., and 20.81 gal. of fuel will be saved. Drifting to one-half normal running speed before applying brakes saves 75 per cent of the fuel equivalent for kinetic energy. The fuel burned in actual train movements depends upon the efficiency of the locomotive and the skill of the engineer, while that burned for miscellaneous purposes depends upon traffic conditions and the general efficiency of the division organization in handling traffic. In this discussion the ratio between the fuel burned moving the train and the total fuel charged to road service is called "operating efficiency, fuel." Such a ratio is a measure of the operating efficiency of the division organization. The high value determined by this test, 92.5 per cent, indicates a co-operation between dispatchers and train crews not often realized. It indicates also a very small margin of possible gain

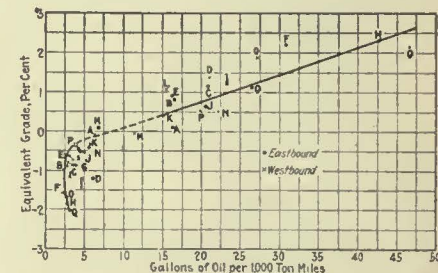


Fig. 3—Unit Fuel Consumption on Various Grades

between steam locomotives, well handled, and the theoretical limit of the electric locomotive, 100 per cent less engine auxiliaries.

Though the locomotive used for this test is one of the well known types for heavy mountain service, and was tested under its most economical load, yet the average thermal efficiency is less than 6 per cent; hence a slight numerical increase in this efficiency would result in a tremendous saving in fuel. The superpower survey showed an expected fuel saving of 67 per cent in freight service, which means a thermal efficiency of about 8.5 per cent. In making such comparisons it is necessary

TABLE I—GRADE AND CURVATURE—TEHACHAPI EASTBOUND

Points in Fig. 3	From Location	To Location	Distance, Miles	Rise, Feet	Total Curvature, Degrees
A	Kern Jet.	Magunden	3.4	17.8
B	Magunden	Edison	3.1	135.7
C	Edison	Flag 1	5.6	342.9	17.5
D	Flag 1	Flag 2	1.0	-68.9	99.3
E	Flag 2	Flag 3	6.2	268.9	589.5
F	Flag 3	Flag 4	0.9	89.0	376.3
G	Flag 4	Flag 5	2.2	115.0	417.5
H	Flag 5	Flag 6	23.4	2,575.0	6,751.0
I	Flag 6	Tehachapi	1.2	79.5	17.6
J	Tehachapi	Summit	1.8	58.5
K	Summit	Flag 7	2.1	-46.0
L	Flag 7	Flag 8	1.1	-65.0	13.6
M	Flag 8	Proctor	1.5	5.5	46.4
N	Proctor	Flag 9	1.5	-39.5
O	Flag 9	Flag 10	0.9	-80.0	98.3
P	Flag 10	Flag 11	1.9	-50.0	27.9
Q	Flag 11	Flag 12	8.6	-960.0	547.7
Total distance			67.8		

to take account of the ratio, revenue freight weight to total train weight. In this study it was 0.743. In electric service it may be very different. The efficiency determined during this test is lower than many published values, but, as a rule, such tests are made with picked locomotives, especially adjusted and operated by the best crews.

It is not desired to give the impression that the values of factors given as the result of this investigation are absolute and applicable to all conditions. It is believed that this method of testing attacks the problem from an entirely different angle, from which it is possible to make, of certain factors, analysis in detail that has not been possible by other methods.

DISCUSSION

Dr. Cary T. Hutchinson, in a written discussion, stated that the paper is the most noteworthy yet published on the subject, and that probably no one ever has attempted fuel determinations of similar accuracy. It is, however, not general in scope, being limited to conditions of service on this particular section of the Southern Pacific. No drawbar pull measurements were made, hence figures for efficiency are based on calculations of work done from the profile, under the author's assumptions.

Using the data presented, Dr. Hutchinson says he is led to certain results at variance with the author's. By a mathematical analysis it is shown that the straight part of the curve in Fig. 3 should be concave toward the axis of abscissas. From another series of equations it is deduced that for 53 lb. per ton resistance, the maximum value found in the tests, the oil burned was 0.4 gal. and the efficiency 5.93 per cent. The author's maximum thermal efficiency of 6.41 per cent is declared to be erroneous. The actual maximum thermal efficiency, as based on the author's curves, is thus 0.5 per cent less than the figure he gives. Referred to the drawbar the efficiency is reduced still further to 4.45 per cent.

The author says the over-all efficiency determined by this test was 5.57 per cent, and apparently was constant for all grades greater than 0.5 per cent. The derivation of this figure is not given, but it may be taken to represent the average thermal efficiency when the engine is doing work, based on the oil used during those periods, and eliminating all oil used at terminals or when the tractive force is negative. This efficiency is referred to the rim of the driver and not the drawbar. Using the given values, the following is found:

	East-bound	West-bound	Both
Total oil, for positive tractive force.....	1,550	547	2,097
Total oil, stand-by and negative tractive force.....	291	409	700
Total oil for the run.....	1,841	956	2,797

The thermal efficiency, based on total oil used referred to the drivers, is 4.17 per cent. But the only "efficiency" that

is significant in comparison with any other form of motive power is that referred to the drawbar. From the data given, the weight with the tender about two-thirds loaded is 250 tons for engine and tender, with 750 tons trailing. The average efficiency at the drawbar is then 3.12 per cent, while the maximum, likewise referred to the drawbar, is 4.45 per cent. In a word, assuming the author's fundamental result, "5.57 per cent over-all efficiency," the correct statement is an over-all thermal efficiency at the drawbar of 3.12 per cent, with a maximum of 4.45 per cent.

Several minor errors in the paper are pointed out.

Dr. Hutchinson states that the electric drive to replace this steam service would be a four-axle, 110-ton electric locomotive for 750 tons trailing weight; at 15 m.p.h. on the limiting grade the input would be less than 2,000 kw. Taking the efficiency from power house to drivers at 63 per cent (the author

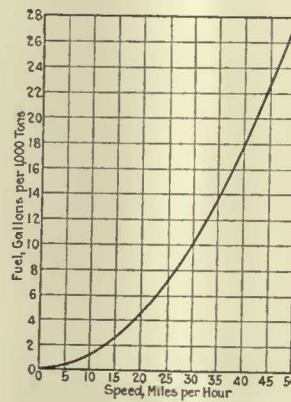


Fig. 4—Fuel Required to Accelerate 1,000 Tons

assumes 70 per cent in an earlier paper), the ratio of power at drawbar to that at power house will be 0.55. This section is ideal for regeneration. Under such conditions the comparative figures for energy used are given in the following tables:

TABLE II—WORK DONE AT DRIVERS, STEAM DRIVE

	Eastbound	Westbound
Weight of train, tons.....	1,000	1,000
Work at drivers, kw.-hr.:		
(a) Grade.....	2,760	985
(b) Curve.....	250	25
(c) Track.....	690	240
Total.....	3,700	1,250
Available for regeneration (a) — (b + c).....	1,820	720
Deliverable to contact system (75 per cent).....	1,365	540
Deliverable at driver (80 per cent).....	1,090	430
At driver as per cent of total work.....	29.4	34.4
	Per cent	per cent
Same, for round trip, same tonnage both ways.....	30.6 per cent	

TABLE III—RELATIVE HEAT REQUIREMENTS STEAM AND ELECTRIC FOR SAME SERVICE

	Steam	Electric
Weight of train, tons.....	1,000	860
Energy at driver, total kw.-hr.....	4,950	4,250
Energy at driver, from oil, kw.-hr.....	4,950	2,970
Energy at driver, from oil, per cent.....	100	60
Heat required at drawbar per kw.-hr., B.t.u.....	109,000	45,500
Total heat required, 10.6 B.t.u.....	540	135
Total heat required, per cent.....	100	25

This means that in comparison with the author's test result, electric drive would reduce the fuel required by 75 per cent, a ratio of steam to electric of four. If allowance be made for the difference between test and service conditions this ratio will be even greater. These results are in practical agreement with the estimates of the superpower report.

N. W. Storer commended the completeness of the test made, but said that 7 lb. per ton was too high a train resistance for a whole run, so the work calculated was more than would be the case. He also questioned the accuracy of the determination of locomotive resistance.

W. J. Davis pointed out that the results were better than could be expected from a coal-fired locomotive, stating that the cinder loss varied from 10 per cent to 18 per cent in coal-fired locomotives with the rate of coal burning varying from 100 lb. per square foot per hour to 125 lb. per square foot per hour.

Mr. Davis's principal point was that even though there were fuel savings, the fixed charges of electrification might easily offset them, but that the chief reason for electrification still existed in the advantages in conducting transportation. He cited increased capacity of tracks, reduction of overtime, very great savings in locomotives, repairs per locomotive and reduction of number of locomotives, because the average steam locomotive was available for service only 25 per cent of the time, whereas the average electric was available 95 per cent. Mr. Davis concluded that because of greater serviceability and because electrics could be made larger, one electric might actually replace four to five steam locomotives. Thus, said Mr. Davis, even with the fuel saving counterbalanced by fixed charges the saving in maintenance of locomotives, in maintenance of ways and structures, and the saving in wages, total transportation economies of 25 to 50 per cent might be realized.

Mr. Twogood, in replying for Mr. Babcock, said that they had tried all sorts of mathematical analyses, especially for the derivation of the curve of Fig. 3, and while that was an average curve drawn through the points, they could come to no other conclusion than the one given. He admitted that fuel was not the determining factor. He pointed out that operating officials were interested in the weight of the locomotive as well as of the train because eventually it was net revenue freight which paid the bill.

C. E. T. A. to Meet in Detroit

THE Central Electric Traffic Association will meet at the Wolverine Hotel, Detroit, Mich., on Wednesday and Thursday, May 16 and 17. The first session will be called at 10 a.m., Eastern standard time, and will be in the nature of a round-table discussion. Committee reports and other business will occupy the remaining sessions.

American Welding Society Annual Meeting

A Four-Day Meeting Was Filled with Many Reports of Committees Which Indicated that the Art of Welding Is Progressing Rapidly

THE annual meeting of the American Welding Society was held in the Engineering Societies Building, New York, N. Y., April 24 to 27. Reports of committees showed that much valuable work has been done by the society during the past year. At the business session on Wednesday morning a review was presented of the progress made during the past year in electric arc, gas, thermit and resistance welding. W. L. Warner, assistant to the chairman of the electric arc welding committee, covered the recent developments in the arc-welding field. He outlined the results accomplished in the direction of standardizing tests for welds, referring to the differences in details of procedure which have caused such widely divergent results. A set of standards submitted by the committee marks the starting point of standardization in this line.

An important work accomplished was that in connection with welding-wire specifications, on which a report was published last December. It included specifications for iron and steel bare electrodes and iron and steel gas welding rods. Recommended standards for coated or covered electrodes and gas welding rods for welding high-carbon steel and non-ferrous metals were also included.

Another work of standardization accomplished was in connection with standard definitions. A list of these, together with a classification of apparatus and an outline of the information required to be furnished by both the supplier and purchaser of arc-welding apparatus, was included in a report of this committee.

A report on welded rail joints showed that welding is being used extensively by electric railways for rail joints and that trouble has been experienced in all types through breakage. In order to secure information of various processes, a questionnaire was sent out by the committee, and a critical summary of these replies was compiled. The A.E.R.A. standard girder rail is being welded generally but the prevailing opinion seemed to be that a T-section is welded more readily than a girder section.

Practical data were given for joint plates, filler rods, electrodes, fluxes, protective accessories, methods of preparation of weld and preheating. The general opinion was that joint plates should be of low-carbon steel, possessing a fair ductility, and that the filling material should be of the same nature.

The high points of development in the oxyacetylene processes of welding were given by G. O. Carter, consulting engineer Linde Air Products Company. The welding of pipes in long stretches was considered as the outstanding feature of last year's work in this field.

A considerable extension of oxy-

acetylene welding to maintenance and repair work has resulted during the past year. Engineering investigations have been conducted to determine causes of failure, and recommendations of improved practices for handling similar problems in the future have resulted. Oxyacetylene cutting is being used more extensively than ever.

Developments in thermit welding were outlined by J. H. Deppeler, chairman of the research committee on thermit welding. Mr. Deppeler said that the particular advances were in connection with more economical use of thermit. Considerable study has been given to the construction of molds so as to reduce the quantity of material necessary, and also to provide a construction which will permit the "washing" of the welded joints by the thermit metal so as to require less material. Improvements in the construction of molds for welded rail joints have been described in previous issues of the *ELECTRIC RAILWAY JOURNAL*.

A report on resistance welding was given by Hermann Lemp, chairman of the resistance welding committee. Special effort has been devoted during the past year to the technical problems and to the processes which will undoubtedly aid in extension of the work.

Two inspection trips were arranged for the members attending the convention. Wednesday afternoon was spent at the shops of the Third Avenue Railway and Friday afternoon at the plant of the Oxyweld Company in Newark, N. J. A large delegation witnessed numerous electric railway welding operations in the shops of the Third Avenue Railway. This included welding truck side frames, motor cases and broken truck parts, together with the building up of bearing fits and other wearing parts. The second annual dinner of the society was held at the Park Avenue Hotel on Wednesday evening.

The program of the technical session held on Thursday evening included a paper by Prof. H. L. Whittemore, chairman of the pressure-vessel welding committee, on the work done by this committee during the year. A review showing what the course of training of welding operators will include was given by J. C. Wright, director of the Federal Board of Vocational Education. It is expected that this course will prove the best so far prepared and its adoption is predicted for all the training schools in welding.

The new officers elected for the society were T. F. Barton, president; A. V. Thompson, vice-president of the Pacific Coast division; C. L. Jones, vice-president of the Southern division, and the following directors at large for a term of three years: C. A. Adams, H. S. Smith, A. M. Candy and C. J. Holslag.

A.S.T.M. Issues Provisional Program

As usual, the annual convention of the American Society for Testing Materials will be held at Atlantic City. The headquarters will be the Chalfonte-Haddon Hall, and the dates Monday, June 25, to Friday, June 29. A synopsis of the tentative program follows:

MONDAY
Morning and afternoon, committee meetings.
Evening, non-ferrous metals and alloys.

TUESDAY
Morning, corrosion, fatigue of metals and magnetic analysis.
Afternoon, wrought and cast iron, coal and coke, and heat treatment.
Evening, presidential address, informal dance and smoker.

WEDNESDAY
Morning, steels and methods of testing—reports of administrative committees.
Afternoon, committee meetings.
Evening, symposium on consistency—testing of glue.

THURSDAY
Morning, road materials, waterproofing and thermometers.
Afternoon, timber, rubber and textiles.
Evening, preservative coatings, cement, lime, gypsum and nomenclature.

FRIDAY
Morning, petroleum products, electrical insulating materials, slate and concrete.
Afternoon, golf and tennis tournaments.
Evening, symposium on the properties of, and methods of making concrete which require further investigation.

Safety Promoted in Massachusetts

A VERY successful congress of the Massachusetts Safety Council was held in Boston this week. Edward Dana, general manager Boston Elevated Railway, presided. Elton S. Wilde, vice-president and general manager Union Street Railway, New Bedford, Mass., made an address on "Collisions as the Motormen See Them."

Canadians Will Meet in Toronto

JUNE 27 to 30 will be the period of the 1923 convention of the Canadian Electric Railway Association, which will be held in Toronto. Headquarters will be at the King Edward Hotel and Charles L. Wilson, Toronto & York Radial Railway, is chairman of the convention committee. Details of the program will be announced shortly.

New Yorkers to Meet at Bluff Point

THE forty-first annual meeting of the New York Electric Railway Association will be held on Saturday, June 23, at the Hotel Champlain, Bluff Point, Lake Champlain, N. Y. The program will be announced later.

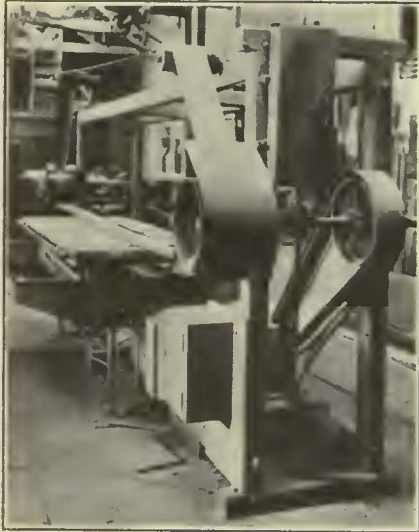
Educational Meeting at Providence

THE New England Street Railway Club will meet with the local section of the A.E.R.A. at the Biltmore Hotel, Providence, R. I., on May 10. Dinner will be served at 6:30 and the program will follow. Prof. W. H. Timbie, Massachusetts Institute of Technology, will speak on the educational work for employees of the Boston Elevated Railway.

Maintenance of Equipment

Home-Made Sander

THE accompanying illustration shows a home-made sander which has been constructed in the shops of the Lehigh Valley Transit Company, Allentown, Pa. The sanding belt is driven by a small motor. The motor is located on a framework near the floor and has a housing to protect it from the dust of the shop. The driving shaft has two 12-in. pulleys, one of which is used by the belt from the motor and the other for driving the sanding belt. The pulleys have sheet-



Home-Made Machine in the Shop of the Lehigh Valley Transit Company

iron guards for the safety of employees.

The sanding belt passes from the driving pulley around a similar pulley at the opposite end of the table, then up to a smaller diameter pulley mounted on a lever with a spring attachment to keep the sanding belt tight. A similar small stationary pulley is used at the opposite end above the driving pulley. The pulleys and necessary shaftings are mounted on a substantial wooden framework.

The table of the sander is made of 2-in. x 2-in. strips held in place by sheet-iron bands. The front edge of the table is provided with a long handle for moving the table back and forth as the sanding operation progresses. The table is mounted on rollers which operate on a track sup-

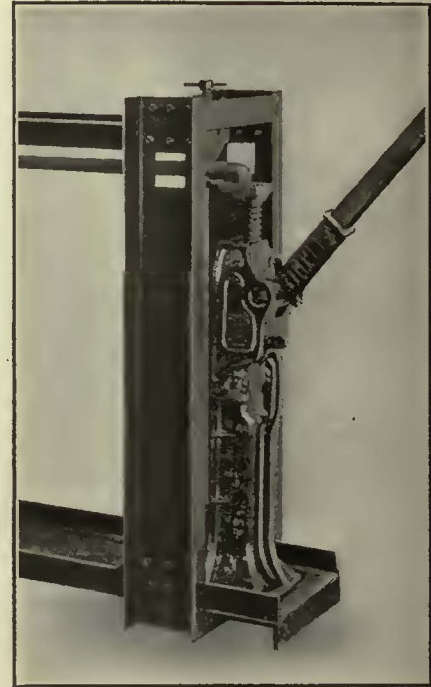
ported by sheet-iron plates at either end of the table. These tracks are bent upward at the ends to provide stops, so that the table cannot be pulled off the track.

The height of the table is adjusted by moving the sheet-iron plates which support the track up or down as desired. The vertical shafts attached to the plates have screw threads, and beveled gears cause these to rotate so as to raise or lower the table. The two screws at the end are connected through beveled gears at the center, so that they work in unison by turning a hand wheel at the center underneath the table.

Testing the Lifting Power of Jacks

FOR the purpose of testing the lifting power of Simplex jacks, which they manufacture, Templeton, Kenly & Company, Ltd., Chicago, Ill., have devised and used the machine shown in the accompanying illustrations. This machine measures accurately the force which must be applied to the jack lever to lift any given load, that is, it shows the "man power" of the jack. The drawing shows the set up for testing a jack under 1 ton load. The jack shown has a capacity of 15 tons.

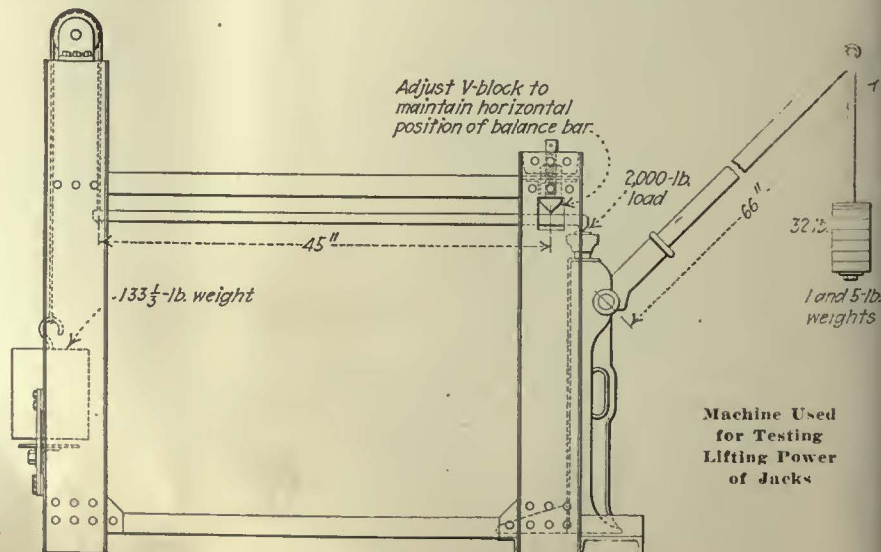
The apparatus consists simply of a lever, of which the fulcrum is a hardened knife edge placed 45 in. from one end and 3 in. from a sec-



Close-Up View of Jack in Position for Testing

ond knife edge at the other end. This is mounted in a substantial frame. Force applied upward by the jack at the right-hand end in the drawing is resisted by the pull on a cord passing over a pulley and carrying a weight which, in this case, is $3/45$ or $1/15$ of a ton.

For convenience in testing, a lever 66 in. long is used, and the test is made with the lever in the starting position, as in this position the max-

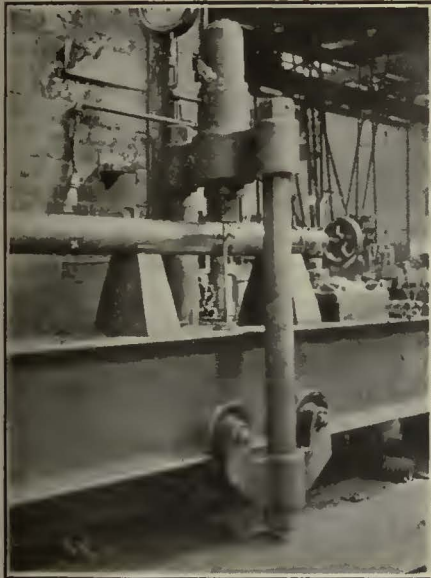


imum effort is required and the number of men required for the stroke is determined.

In the No. 29 jack, which is largely used by electric railways, the pawl center is 31 in. distant from the fulcrum center. When a lining bar weighing 25 lb. and having a length of 66 in. is used as the operating lever, 32 lb. force is required to lift 1 ton.

Testing Axles for Flaws by Hydraulic Pressure

GREAT care in the testing of axles is exercised by the United Electric Railways, Providence, R. I. For this purpose the Watson-Stillman hydraulic straightening press shown in the accompanying illustration is used. The axle is carried on the machine by means of centers



Hydraulic Axle-Straightening Machine Used for Testing Axles for Flaws

mounted as in the tailstock of a lathe. Hydraulic pressure is applied to the axle from point to point, by means of a plunger forced against its upper side by pressure in a cylinder cast in a yoke, this forming the upper part of a traveling carriage. This carriage is moved from point to point by means of flanged wheels which roll on the lower flange, of heavy I-beams forming the bed of the testing machine.

During a test the axle is supported on two pillow blocks, one about 2 ft. on each side of the point of application of the force. The axles are cleaned of all surplus oil and dirt. When pressure is applied oil will show on the axle where there are any cracks. Inspection is made at all shoulder reductions and keyways.

Good Motor Record Through Hard Winter

NOTWITHSTANDING the fact that an unusual quantity of snow fell in Binghamton during the past winter, amounting to about 60.7 in. altogether, the railway had comparatively few motor failures. The total car-miles operated during the winter months was 565,993 and the total number of motor failures was twenty, or approximately 3.53 per 100,000 car-miles. In this respect the modern ventilated motors made a better record than the older type non-ventilated motors, there being 2.32 failures per 100,000 car-miles with the former and 7.1 with the latter.

The ventilated motors in service on the Binghamton Railway are of two types: Thirty-two Westinghouse 506-A are used on sixteen single-truck two-motor cars weighing 20,000 lb. Six armatures were grounded due to overexertion in snow, and four fields were grounded, one being an interpole field and three being main field coils grounded by water. Sixty-eight Westinghouse 323-V motors are used for twenty two-motor cars equipped with maximum traction trucks and weighing 32,500 lb. and for seven four-motor cars weighing 36,700 lb. With the 323-V motors three armatures were grounded due to exertion in snow and five fields were grounded, four being interpole and one main field coil.

The total number of non-ventilated motors in operation is seventy, of which thirty-two are GE-80, sixteen GE-67 and twenty-two GE-1,000. All the General Electric motors have the top and bottom motor covers off the year around. The GE-1,000 motors are on two-motor single-truck cars weighing 20,000 lb. and used only as trippers. There were no failures of this type motor during the past winter. The GE-67 motors are used on single-truck cars weighing 26,000 lb. and on some two-motor double-truck cars weighing 35,000 lb. Two armatures grounded on account of exertion in snow were the only failures with this type motor.

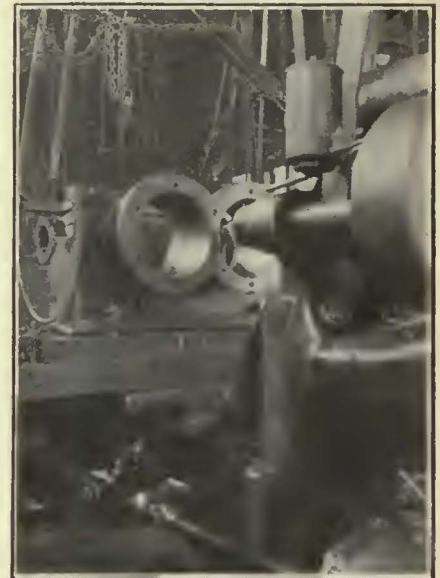
All of the GE-80 motors are used on double-truck cars, some being 32,000-lb. cars equipped with maximum traction trucks and the remainder being 35,000-lb. cars with Brill 27-G trucks. These motors had during the winter four grounded armatures and four field coils grounded on account of water. The fact that

the non-ventilated motors are all of older design than the ventilated motors accounts to a considerable extent for the relatively greater number of failures of the former.

A factor that has made it particularly important to prevent motor failures is the very small number of spare cars available. The Binghamton Railway ordinarily has 95 per cent of its rolling stock on the road in the afternoon rush hours. In order to do this an unusually large supply of spare parts is kept on hand, and whenever inspection shows a part to be worn, it is replaced rather than risk a failure by attempting to get additional service.

Milling Machine for Boring Compressor Cylinders

THE United Electric Railways, Providence, R. I., had in its shops a milling machine that was not working at 100 per cent output. The best routine job for it seemed to be the boring out of compressor cylinders, and the machine is now continuously at work on this job. The accompanying picture shows the cylinder casting of a compressor bolted to a cast-iron platen suitably drilled to receive the different types of compressor cylinders. The platen, in turn, is bolted to the table of the



Compressor Casting on Carriage of Milling Machine Ready for Reberling of Cylinders

milling machine, while the latter does the duty of a boring mill.

While undoubtedly in many cases it would be profitable to purchase a two-spindle boring mill for this job, in this case the milling machine was available and it turns out a fine piece of work.

Simple Combined Screen and Sand Drier

THE accompanying illustration shows the plan used in the carhouse of the Eastern Massachusetts Street Railway at Fall River for screening and drying sand.

The drier consists of a stove surrounded by a conical hopper. Below the hopper is a conical spreader or deflector on which the sand flows out as it dries. This addition was



Combined Screen and Sand Drier Used at Fall River

placed at the bottom to spread sand and to prevent it from going through before thoroughly drying.

Above the drier is a motor-driven, cylindrical screen covered by a piece of sheet iron to guide the sand from going anywhere but into the screen. The bottom part is shaped so that it guides the sand into the drier. The stones or any foreign material other than the fine, screened sand roll toward the rear of the screen into a pipe and are carried through the wall to the outside of the building.

Soft coal is used for heating purposes. The motor is one taken from an air compressor removed from an obsolete car. As workmen or the watchman pass through the sand room in the course of their work they throw a few shovelfuls of sand into the screen and in that way assure an ample supply.

Maintaining Electrolytic Lightning Arresters

THE Lehigh Valley Transit Company, Allentown, Pa., was one of the first electric railways to use the electrolytic type of lightning arrester and has been obtaining very satisfactory results. All arresters are installed inside the cars so that it is unnecessary to remove them during the winter months. In most cases space has been found for the arresters in the headlining or sides

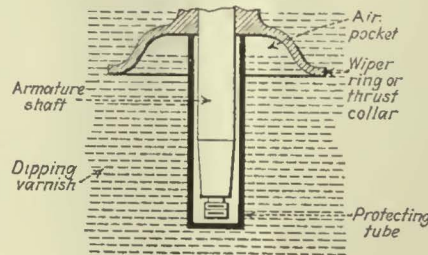
of the vestibule platform. In a few cases where there was not room for these on the platform they have been installed inside the passenger portion of the car body by providing a wooden box for holding the arresters. This box is painted and varnished to correspond to adjacent woodwork. The wiring to the arresters is run in either conduit or in circular loom. Particular attention is given to make the lead from the trolley base to the arresters as short as possible.

In the spring, before the lightning season starts, all arresters are inspected and are filled up with solution. From that time on to the end of the season they are inspected each time the car is in for repairs or inspection.

Convenient Tackle Aids in Dipping Armatures

BY JOHN S. DEAN
Renewal Parts Engineering, Westinghouse Electric & Manufacturing Company

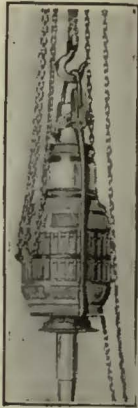
IN CONNECTION with the dipping and baking of armatures to increase the life of the windings, experience has shown that it is essential to dip them with the commutator end up. This keeps the varnish from getting inside of the commutator, where it is likely to cause trouble, as it is difficult to dry it out thoroughly during the baking process. One master mechanic has devised a very simple and effective clamping device for holding armatures in a vertical position, with the commutator end up, while dipping them, and which is also arranged to receive the hook from the chain hoist used in handling, as shown in one of the accompanying illustrations. The two



Tube Over Armature Shaft During Dipping Operation

swinging side arms of this clamp are bent over at the lower end to engage the pinion end coil support extension or the end bell. The top of each of these two arms is provided with a number of holes, making the clamp adjustable to take armatures of different sizes without danger to the winding or the commutator.

In connection with this operation, the question of keeping the varnish from the pinion end of the armature shaft has been given considerable thought. One method employing a tube over the shaft was described in the ELECTRIC RAILWAY JOURNAL for April 21, 1922, and a similar sleeve method is used by the same master mechanic who designed and built the above clamping device. After dipping several of his armatures he noted that the portion of the shaft inside of the wiper ring was never touched by the varnish. He reasoned that this was, no doubt, due to the air pocket formed by the wiper ring, so he conceived the idea of slipping a small tube, closed at the lower end, over this end of the shaft. This tube is slipped over the pinion end of the shaft just before the armature is dipped, which keeps this part of the shaft free from varnish. This saves the necessity of cleaning with benzine or naphtha or scraping the shaft after the dipping and baking process, and also keeps the varnish out of the threads of the shaft, thus reducing the expense of handling the armatures while giving them this treatment.



Adjustable Hooks Hold Armature in Vertical Position for Dipping

New Equipment Available

A Blueprint Drying Machine

THE C. F. Pease Company, Chicago, Ill., which manufactures automatic blueprinting machinery, has brought out a drier for blueprints and photographic prints. The wet prints are drawn around a heated cylinder by means of an endless canvas belt and delivered into a receiving tray. The delivery speed of the machine is stated to be up to 8 or 9 ft. per minute. A thermostatic control is provided where the cylinder is heated with gas, whereas for an electrically heated cylinder there is an arrangement of switches by means of which the temperature can be readily controlled.

The News of the Industry

Virginian Railway to Electrify

**\$15,000,000 Contract Placed with Westinghouse Company Covers Locomotives and Power Supply for 213 Miles of Track—
Single Phase System Adopted**

THE Virginian Railway has announced its decision to electrify 213 miles of track between Roanoke, Va., and Mullens, W. Va., at a cost of \$15,000,000. The division to be electrified crosses the Allegheny Mountains. The a.c. single-phase system will be used. The order for the electric locomotives, power house, transformer stations, and other apparatus has been awarded to the Westinghouse Electric & Manufacturing Company and is said to form the largest railroad electrification contract ever placed.

"The Virginian Railway, one of the newest systems, is a leader in heavy operation, and this undertaking will be epochal in the history of American railroads," said Frank H. Shepard, director of heavy traction for the Westinghouse Company. "Built by the late Henry H. Rogers, of the Standard Oil Company, in accordance with the most modern engineering practice, it has been renowned for the excellence of its construction, the immense size of its trains and its low ton-mile costs ever since it started operations in 1909. The Virginian, as a matter of consistent policy, has regularly increased the size of the trains with every improvement in railroad equipment, until today this railroad is operating the heaviest trains in the world and hauling them by the most powerful of steam locomotives. It is now moving 7,000,000 tons of coal per annum, but this capacity is not enough. Still further increasing the size of the trains is impossible with steam, for the limit in the motive power appears to have been reached. Hence it has been decided to electrify with the alternating-current system this limiting mountain grade division.

"The chief advantage of electric operation is the greater power that can be applied to each train. The largest steam locomotives now in use on the Virginian are the articulated Mallet type, three of which are used to move 5,500-ton trains over the grades. Their combined power does not exceed 7,000 hp., and their speed on the grades is only 7 m.p.h. The new electric locomotives, however, developing 20,000 hp. per train will haul 9,000-ton trains up the grades at the rate of 14 m.p.h., and it will be entirely practicable to increase this power so that 12,000-ton trains can be handled at the same speed.

"This electrification is one of the largest railroad projects since the world

war. It is undoubtedly the forerunner of other similar undertakings, because it is generally recognized that the traffic-carrying capacity of a number of our leading railroads must be increased.

"A feature will be the use of regenerative braking on the down grades, which will not only reduce wear on the brakeshoes and wheels and improve operation, but will save 15,000,000 kw.-hr. of electric energy per year.

"Power will be obtained by a 90,000-hp. generating plant to be erected on the New River, supplying 88,000-volt current to the transmission line. This is to be stepped down to 11,000 volts by transformer stations placed along the line."

Ottawa Board of Conciliation Formed

The employees of the Ottawa Electric Railway, who are members of the Amalgamated Association, on April 16 applied to the Minister of Labor for a board of conciliation under the industrial disputes investigation act. A board has been formed. George D. Kelley of the firm of Ewart, Scott, McLaren & Kelley, Ottawa, has been appointed for the company, and Harold J. Burns, barrister, Ottawa, for the employees. The demands of the employees are that all employees shall belong to the union; that the eight-hour day be established in all departments of the company's business, and that hourly rates of wages be increased by 25 per cent. The board will probably begin its sittings shortly.

Detroit Officials Opposed to Wage Increase

At a meeting on April 28 of platform men of the Detroit Department of Street Railways, members of Local No. 27, a letter from the street railway commissioners to the officers of the union was read which explained the attitude of the municipal officials in regard to the 20 per cent increase in wages asked by the men.

The communication advised the men that their request for a wage increase was untimely and could be discussed more properly after May 15, on which date the Department of Street Railways will have completed one full year of operation. It is explained that a study of a report for the year will enable the members of the commission to go more thoroughly into the request

of the platform men and study the conditions.

The request, which was practically refused by the commission, will be taken up with Mayor Doremus at some future date by a committee of the local organization's officers appointed by the men at the meeting. The date of the proposed conference with the Mayor has not been decided. The men have decided to ask Judge E. J. Jeffries to represent them in case the petition for the increase in pay is submitted to arbitration.

Wages of Pacific Electric Trainmen Raised 3 to 6 Cents an Hour

An increase in wages of trainmen of the Pacific Electric Railway, Los Angeles, Calif., approximating \$350,000 annually and effective April 16, 1923, was announced on April 12 by D. W. Pontius, vice-president and general manager. The change will have the effect of increasing the present scale 3 to 6 cents an hour, according to the class of train service. In making this announcement, Mr. Pontius states that the new rates are partly a restoration of the rates in effect prior to Oct. 1, 1921, at which time a reduction was made in the wages because of economic conditions.

Mr. Pontius stated that the work in the train service was more trying and confining than in any other branch of railway service, as the hours, in a great many instances, were irregular and that the increase was made with the view of keeping in the company's employ a good class of men.

At the time of the wage reduction in 1921 other departments of the company were not affected. This increase in trainmen's wages will not affect other departments of the company.

Following is the schedule of the new rates in cents per hour:

Street Car Service	Hourly
First three months	49
Next nine months	50
Second year	51½
Third year	52½
Fourth year and thereafter	53½
Double-Track Interurban	
First year	52½
Second year	55
Third year	56
Fourth year and thereafter	57
Single-Track Interurban	
First year	55
Second year	57½
Third year	58½
Fourth year and thereafter	59½
Freight and Work Train Service	
Motormen and conductors (flat rate)	66
Brakemen and switchmen (flat rate)	60
Trolleyman (flat rate)	55
Yard foreman (flat rate)	66
Minimum rate for new men entering the service \$125 per month.	

Commissioner Convinced Railway in Birmingham Is Right

The Birmingham Railway, Light & Power Company, Birmingham, Ala., is nearing a settlement of all its disagreements of the past over street paving, fares and the Jim Crow law recently adopted by the City Commissioners. According to D. E. McLendon, chairman of the city commission, the differences may be settled within a few days.

It is believed that the company will agree to reduce its fares from 8 to 7 cents, to pave certain streets which have been in dispute, and to partition all cars, thus separating the whites from the negro passengers.

It is also possible that the jitneys will go. In speaking of the jitney Mr. McLendon said:

If Birmingham's growth is not to be retarded, it is time that we take the jitneys off the streets. In justice to the Birmingham Railway, Light & Power Company the present situation must be remedied quickly. It is time and more than time to take a definite stand. The stand I take is that the jitney must go. Birmingham has given the jitney a fair trial, and I cannot see where it has been of any advantage. Of course, there are individual and group instances where the jitney has been a convenience, but that does not offset the great cost it entails in direct financial loss to the city, and in keeping our biggest public service institution in bankruptcy.

Commissioner McLendon was referring to the railway, which has been in the hands of a receiver for some time, and according to him the jitney is largely responsible for this condition of the company.

Mr. McLendon declared:

In direct cash revenue the city is losing \$12,000 a year because of the curtailment of income to the city from the company. The company is sustaining a dead loss of \$60,000 every year. The jitneys are the cause of this loss.

In speaking of the paving matter, over which the company and the city have been squabbling for some time, Mr. McLendon said:

It is not fair for the company to have to pay many thousands of dollars for the maintenance of streets used by the jitneys. Immediate steps should be taken to relieve the present intolerable situation. Every visitor coming to Birmingham, every prospective factory, is at once made aware that our most obvious public utility is in the hands of a receiver. That cannot but react to the city's discredit.

We should take into consideration the great sums of money the company has paid out for permanent improvements in Birmingham. It has paid much for street surfacing in practically every section of the city and its only return on the investment is community improvements which make more passengers. I don't think it just for the jitneys to step in without paying one cent toward these improvements and reap the rewards. It is time to enact laws that will take the jitneys off the streets and forever prevent them coming back.

Wage Agreements in New York Being Effectuated

Fears of a strike among trolley workers in Syracuse, N. Y., are rapidly being dispelled as new agreements are being approved by the workers. One of the matters that remain to be adjusted, however, is the new scale for New York State Railways men. The men on these lines have ratified a demand for a 30-cent increase.

The Empire State Railroad Company, operating lines from Syracuse to Bald-

winsville, Fulton and Oswego, has renewed an agreement with its men on practically the same terms as last year with the rate remaining at 53 cents. Some of the working conditions have been slightly changed.

This agreement is fundamentally the same as that just executed between the Rochester & Syracuse Railroad and its employees. Only one interurban wage problem is unsettled and that is between the men and the Syracuse Northern. These employees are asking an increase to 53 cents from 48 cents an hour.

The Auburn & Syracuse has settled its differences with its men. The new rates for city men will be 49 cents an hour and 50 cents for interurban employees. Freight and express employees are to get 52 cents.

Pittsburgh Wage Matter Remains Deadlocked

The matter of wages and working conditions for employees of the Pittsburgh Railways has been hanging fire now for several weeks and up to May 3 the deadlock remained unbroken. As was reported in the ELECTRIC RAILWAY JOURNAL, issue of April 14, the receivers of the property had requested the employees to modify their demands on the ground that the 10-cent cash fare now in effect would not be sufficient to meet the proposed 20 cents an hour increase in pay.

On May 2 the employees voted 2,177 against 9 to reject the offer of the receivers to increase the wages 10 per cent or 6 cents an hour. This would bring the maximum to 66 cents. The executive board of Division 85 representing the 3,000 motormen and conductors employed by the Pittsburgh Railways was still in session on May 3 and had reached no decision on the question of ceasing work.

The receivers on May 2 reiterated their proposal to place the entire question of working conditions and a wage increase before the Board of Arbitration, but this the international vice-president and the secretary of the local union refused to approve. Two problems are being passed on by the executive board.

They are: (1) How to avoid arbitrating the controversy which the receivers of the Pittsburgh Railways proposed on May 2 as an alternative to the rejection of the offer of a 10 per cent increase, and (2) how to win the receivers of the company over to restoring the 1920 and 1921 wage rate of 70 cents an hour.

The employees are asking a 33½ per cent increase or a maximum rate of 80 cents an hour, which is 10 cents an hour more than was received during the war. It is reported that the executive committee has authority to call a strike without further vote by the members of the union.

It is believed that if the receivers of the company will offer 70 cents, the peak wage paid during the war, the men will accept it.

Will Disclose Operation in Spartanburg Under Commission Management

The South Carolina Gas & Electric Company, Spartanburg, S. C., now operated by the South Carolina Railroad Commission, was scheduled to be the subject of a public hearing in Spartanburg on April 27, at which time the company was to submit statements as to its operating costs and earnings, with a view to letting the public know how it is getting on under the Railroad Commission management.

The Railroad Commission in announcing the hearing stated that it was considered at the request of the Spartanburg company. The Railroad Commission says, however, it does not know whether the company desires a discontinuance of the present plan of operation or desires some amendment to it. The petition for the hearing states that it is asked in the interest of the rights of the public.

The commission is asked to "issue such orders as in its judgment it deems expedient and necessary to protect the rights of the public and the interests of those who avail themselves of or are dependent upon the service of the company."

The Railroad Commission has instructed the railway company to submit at the hearing a complete financial statement and planned to hear any representative of the public.

Some months ago the Spartanburg company discontinued its cars, announcing that losses made the move necessary. The Railroad Commission ordered service resumed, on long schedules, and the commission has since been in charge of the situation. Recently regular schedules were ordered restored, and a 5-cent rate of fare was put into effect.

City and Railway in Toronto Appeal Arbitration Award

The Toronto Railway and the city of Toronto have appealed against the majority award of the arbitration board appointed to determine the value of the Toronto Railway Company's property taken over by the city on the expiration of the franchise on Aug. 31, 1921. The railway's notice of appeal asks that the city appeal be set aside, that the whole matter be sent back to the arbitration board with the instructions that it include in the amount the value of the main office building at King and Church Streets, the Scarborough Beach property and the St. Lawrence Street property and other items which the arbitrators rejected. The price to be paid by the city for the properties had been fixed by the board at \$11,188,500. An abstract of the arbitration finding was published in the ELECTRIC RAILWAY JOURNAL for Feb. 10, page 247. It is stated that there is no dispute between the parties with regard to items making up about \$7,000,000 out of the \$11,188,500 awarded by the majority board.

Bus Franchise Defeated

McAdoo Interests Lose in Los Angeles
—Railway Will Have Opportunity
to Make Good

The so-called McAdoo-Hellman twenty-one year motor bus franchise was defeated on May 1 by Los Angeles voters by more than 12,000 votes. The proposition for repealing the present jitney bus ordinance was also defeated by more than 4,000 votes. As a result public motor carriers will continue to be banned in the down-town district.

The People's Motor Bus Company, conceding defeat, filed an application with the local Board of Public Utilities immediately after the election withdrawing all its propositions for motor bus lines in Los Angeles over some nineteen routes paralleling all railway lines and reaching practically every section of the city. The withdrawal, however, is given as temporary. The Hellman-McAdoo interests, back of the People's Company, state there is no necessity of their company entering the field again now, as railway companies have promised Los Angeles adequate bus lines and improved railway service to relieve the transportation congestion.

After the election the railway officials declared the promises made by them to the people of Los Angeles before the election would be fulfilled at once. Work will be started immediately on improvements to cost in excess of \$6,000,000.

The failure of the voters to grant a twenty-one year irrevocable motor bus franchise and the decision not to repeal the present jitney ordinance are generally interpreted to mean that the voters were unwilling to cripple the Los Angeles railway lines.

Under the present laws of Los Angeles the Board of Public Utilities can grant motor bus permits for operation outside of the downtown district, but evidently Mr. McAdoo's company did not see fit to spend \$1,000,000 for bus equipment and operate under thirty-day permits or even yearly permits.

Prior to the election the two railways filed a joint application with the Board of Public Utilities for permission to install motor bus service in the Hollywood district on a 6-cent fare basis with interchangeable transfer. This application outlined that the two railways would be consolidated and promised an extension of the Los Angeles Railway lines into Hollywood and the establishment of universal transfers. The application stipulated a 6-cent fare between bus and Pacific Electric Railway cars and a 10-cent fare between Los Angeles Railway cars and buses within defined districts. The statement filed with the board practically admits that when the State Railroad Commission completes its survey of the local railway systems they will be consolidated as one system and that upon consolidation provision will be made for the extension of the Los Angeles Railway lines into Hollywood territory.

"Independents" are filing applications for revocable bus permits for operation in various sections of the

city, but the substantial element of the city is demanding the Los Angeles Motor Bus Company, which was organized by the two railway companies, be given all permits for motor buses to be operated in co-ordination with the railway lines. The majority members on the local city Board of Public Utilities are inclined to give permits to the independents and the railways.

William G. McAdoo of the Peoples' Motor Bus Company made the following statement:

My Eastern clients have withdrawn their application to establish a motor bus system in Los Angeles, and I think they have rendered a genuine service to the community in focusing the attention of the public on the city's imperative transportation problem. The railway monopoly under threat of competition has made various promises to meet the transportation necessities of the community. Those comprehend consolidation of the two street car lines, the building of subways, the extension of railway lines and the operation of motor buses. Everybody will await with interest performance in accordance with these promises.

Wage Advance in Cleveland

The wages of motormen and conductors of the Cleveland Railway were increased 5 cents an hour, starting May 1, as a result of arbitration between the Cleveland Railway and the street car men's union. The wage increase makes the new wage scale for the Cleveland trainmen—55 cents an hour for the first three months service, 58 cents an hour for the next nine months and 60 cents at the end of the first year.

The decision of the arbitrators was not unanimous, the men's representative, Judge Frederick Walther, dissenting from the award, which was concurred in by Judge Fielder Sanders, former City Street Railway Commissioner, and Thomas P. Schmidt, representing the company.

Following announcement of the 5-cent wage increase there was much dissatisfaction among the trainmen because they had asked for an advance of 15 cents an hour.

Meeting with the executive committee of the car men's union, John J. Stanley, president of the company, intimated that the company soon might have a proposal for establishing a pension system for employees who have long been in the service.

Oil City Men Get Increase

To show appreciation for the efficiency of its trainmen and also to attract the best type of man for service on its lines the Citizens Traction Company, Oil City, Pa., has voluntarily raised the wages of all motormen and conductors 5 cents an hour. The new scale is retroactive to April 16.

Under the present arrangement for the first six months of service men will receive 46 cents an hour; for the second six months, 48 cents, and for the third six months and thereafter, 50 cents an hour. One-man car operators will receive 5 cents an hour additional.

The old scale of 41, 43 and 45 cents became effective on June 1, 1921, and was a 10-cent reduction from the schedule which went into force on April 26, 1920.

Foreign News

Liverpool Plans \$1,500,000 Overhaul Shop

It is proposed by the Liverpool Tramways Committee to erect a car overhauling depot capable of dealing with about twelve cars weekly, so that the whole stock of 650 cars may pass through the shops in a year. The estimated cost is £300,000.

In consequence of a further fall in the official index figure of the cost of living, the National Joint Council for the British tramway industry has, in accordance with the sliding scale agreement, announced that from the first full pay period in May a reduction will be made in tramway employees' wages of 1s. per week. This makes the total reduction since the maximum period of 15s. per week. The index figure is now 74 per cent over the figure for August, 1914.

The British Minister of Transport announces that he proposes to include the tramways (temporary increases of charges) act in the expiring laws continuance bill of the present session. This means that the operation of the act, which authorizes higher fares than the statutory maxima and which would expire this year, will be prolonged till December, 1924. The act was a temporary one passed to meet post-war conditions of high working expenses. The latter have now come down somewhat, but not sufficient to justify a return to pre-war fares. The index figure of the cost of living is still 74 per cent above the pre-war basis.

The rapid increase in the number of aerials for use in connection with the wireless broadcasting is giving some apprehension to British tramway authorities. In connection with post office wires the regulation is that when these cross above tramway overhead conductors efficient guard wires must be erected. The Council of Tramways & Light Railways Association has written to the Ministry of Transport on the question of what would be the position of a tramway undertaking in the event of accidents to third parties arising from a wireless aerial falling across the trolley wire and coming into contact with a person. The Council maintains that it is unreasonable that a tramway undertaking should be liable to put up guard wires in any case except where they arrived on the scene subsequently to the people against whose property the guard wires are required to give protection. The Council urges that a regulation should be framed so that those arriving on the scene with their wires subsequent to the construction of the tramway shall themselves be under the obligation to bear the cost of providing any necessary protection for the prevention of accidents. The Ministry of Transport is in communication with the Postmaster-General on the subject.

Financial and Corporate

\$167,403 Increase in Net

Trustees of Eastern Massachusetts Street Railway Present Figures Covering 1922 Operations

The public trustees of the Eastern Massachusetts Street Railway, Boston, have presented the following report for the year ended Dec. 31, 1922:

EASTERN MASSACHUSETTS STREET RAILWAY EARNINGS

Combined financial statement of the seventeen operating districts included in the system.

	1922	1921
Passenger revenue.....	\$9,989,729	\$10,681,352
Freight and other revenue.....	56,464	36,899
Rentals, advertising, etc.....	252,892	265,122
Interest; other income.....	413,578	334,891
Total revenue.....	\$10,712,663	\$11,318,294
Expenses:		
Way and structures.....	\$1,879,506	\$1,768,078
Equipment.....	1,250,715	1,518,279
Power.....	1,082,151	1,350,996
Car operation.....	2,345,373	2,658,888
Injuries and damages.....	356,701	362,312
Insurance.....	162,588	153,966
Law expense.....	13,546	9,912
Rent of tracks.....	77,258	79,017
General wages and expenses.....	247,121	263,910
Miscellaneous expenses.....	343,131	288,745
Operating expenses.....	\$7,758,090	\$8,454,103
Taxes.....	396,823	348,750
Gross income.....	2,557,749	2,513,410
Interest and rentals.....	1,497,956	1,623,021
Net income.....	\$1,059,792	\$892,389

Operating expenses include charges for depreciation amounting to \$848,753.00 in 1922 and \$992,847 in 1921.
\$95,215 was added to the insurance fund in 1922. The corresponding charge in 1921 was \$80,000.

Gross receipts from car fares in 1922 were \$9,989,728, a decrease of \$691,622, or about 6½ per cent compared with 1921. Other items of revenue and income increased \$86,021, so that the net decrease in total revenue was \$605,601. On the other hand, operating expenses, including taxes, decreased \$647,939 and there was, therefore, an increase in gross income of \$42,338, notwithstanding the large loss in revenues. Fixed charges and rentals showed a decrease of \$125,065. The final result was an increase in the net income for the year, compared with 1921, of \$167,403. It was not until toward the end of 1922 that passenger revenues equaled those of the corresponding months of 1921. This improvement is traceable principally to better industrial conditions in several of the cities and towns served by this company, which have been in a state of depression since early in 1921.

The \$1 punch-card reduced-rate ticket continues in effect in most of the cities and towns. It is interesting to note that it is being used almost exclusively except by transients and casual riders.

General operating expenses, excluding taxes, were \$696,012 less than in 1921. The cost of operating cars was reduced more than \$300,000. This was due to numerous economies and increased efficiency, and the use of one-man cars throughout the twelve months

as against the general use of one-man cars only during the latter part of 1921.

The cost of maintenance of equipment was reduced \$267,568 through better repair shop conditions and because the electrical equipment of cars suffered comparatively little damage during the mild winter of 1921-1922.

Power costs were decreased \$268,845 chiefly as a result of cheaper coal during most of the year and the substitution of fuel oil for coal at the Quincy Point power station, which serves practically the entire system south of Boston.

The tax liability of the company for the year increased \$48,000 and amounted to \$396,823, or more than 36 per cent of the net income of the company after paying interest on its obligations.

During the year eight modern snow sweepers and other units were added to the snow-fighting equipment and the company now has in first-class working order thirty-seven sweepers, forty-five double-truck plows, forty-four single-truck plows and fifteen sets of scrapers. This comprises the most formidable snow-fighting equipment this company has ever had.

During the year there was no abatement of the work of rehabilitating the roadway, and in addition to the expenditures for maintenance of track, shown in the financial statement as "Way and Structures," \$367,000 was expended for reconstruction.

Twenty-five double-truck cars of the latest type, suitable for one-man operation, were purchased during the year at a cost of \$252,000. Orders for twenty-five and possibly a larger number of new double-truck cars will be placed in 1923.

EMPLOYEES' INSURANCE

The trustees have extended employees' insurance so as to include every person regularly employed by the company.

There has been a substantial reduction in the number of accidents, claims arising from them, and the cost of settlements. Collisions with vehicles, particularly automobiles, are still a serious problem.

For the first time in a number of years the wage agreement with the Amalgamated Association representing the union employees was entered into without arbitration. At the request of the various local unions the public trustees agreed to renew for another year the agreement expiring on May 1, 1922, which was founded upon an award by the State Board of Conciliation and Arbitration the previous year.

The financial readjustment plan announced early in the year met with very general response from all classes of security holders and is now more than 95 per cent complete. During the prog-

ress of this readjustment plan, \$611,000 par value of common stock was distributed in lieu of accumulated dividends and has been charged to surplus.

In addition to the distribution made under the readjustment plan, dividends were declared during the year by the payment of 3 per cent on the first preferred and sinking fund stocks on Aug. 1 and by the appropriation of surplus accumulated to Dec. 31 to pay 3 per cent on these stocks as well as 6 per cent on preferred B stock on Feb. 1, 1923.

During the year funded obligations of the company to the amount of \$463,000 were retired and canceled.

In May the company elected not to exercise its option to extend \$479,000 Lowell, Lawrence & Haverhill bonds due on June 1, 1923, and provision has been made to pay them on that date.

Abandonment in Ohio Approved by Court

Following action of the Ohio State Supreme Court in Columbus on May 1 sustaining the order of the State Public Utilities Commission which authorized the Indiana, Columbus & Eastern Traction Company to abandon the branch between Columbus and Orient, F. A. Healy, secretary-treasurer of the company, announced at Springfield that the company would apply at once to Federal Judge J. E. Killitts at Toledo for an order of abandonment to carry out the commission's ruling.

The traction company filed a petition and secured the necessary consent of the commission to the abandonment of the branch some months ago, but residents attacked in court the right of the commission in the matter. The decision of the Supreme Court brings an end to the controversy and permits abandonment.

The Columbus-Orient branch is about 14 miles in length. Petition to abandon service was filed after the company had lost considerable revenue in late months due to automobile and bus competition.

Extends Time for Payment of Ohio Branch Line

Extension of fifteen days has been granted by Federal Judge J. E. Killitts at Toledo to C. D. Taylor, Norwalk, Ohio, for the final payment of \$112,500 for the 40-mile Lima-Defiance branch of the Indiana, Columbus & Eastern Traction Company line. The original time limit for payment of the final sum was set for April 30, but counsel for Taylor appeared and asked extension saying that certain details of the financing remained to be cleared. Taylor had paid down \$12,500 to bind the contract.

Application for purchase of the branch was made after the traction line had filed a petition and secured an order from the state to abandon the division, due to loss in revenue. Taylor proposes to operate gasoline cars over the branch to connect with the traction line, and has been selling stock in the enterprise to persons resident along the branch.

Eight Months Operation in Ashtabula Shows Increased Traffic

The municipally owned railway at Ashtabula, Ohio, for the eight months period ended April 1, showed receipts of \$71,159 and operating expenses of \$88,865. For a similar period the year previous, when the lines were owned by the Ashtabula Rapid Transit Company, the receipts were \$55,675 and the operating expenses \$60,305. Revenues from transportation for March of this year were \$9,658, as against \$6,430 in 1922.

Since the city took over the lines a considerable amount of track renewal and overhead work has been done.

Ten new safety cars, a bus and a 2½-ton truck have also been purchased by the lines at a cost of \$73,792, covered by an issue of bonds. Total disbursements since the city took over the lines on Aug. 1 last have been \$162,657. Since last August the municipally operated lines have carried 808,757 passengers as against 670,055 carried in the same eight months the year previous.

West Chester Street Railway Sold

Kelly, Cooke & Company, engineers, with offices at 424 Chestnut Street, Philadelphia, Pa., have acquired the controlling interest in the West Chester Street Railway.

The transfer was made on April 30, the majority stock holding having been purchased from the John W. Woodside estate, Philadelphia.

The new officers are as follows:

President, Charles B. Cooke, Jr., Philadelphia, Pa.; vice-president, Col. A. M. Holding, West Chester, Pa.; treasurer, Thomas L. Hodge, Philadelphia, Pa.; secretary, Jonas Rice, Philadelphia, Pa.

The officers and William F. Kelly, Philadelphia, Pa.; Marriott A. Good, Philadelphia, Pa., and J. V. Pennegar, Coatesville, Pa., comprise the board of directors.

The Philadelphia office of the railway will be discontinued and all business of the company transacted at its general office in West Chester, Pa.

Arkansas Central Power Co. Successor at Little Rock

The Little Rock Railway & Electric Company, Little Rock, Ark., has been succeeded in ownership and operation of the local traction and electric lines by the Arkansas Central Power Company, which filed articles of incorporation and agreement with the Secretary of State on April 10, 1923. The reorganization was carried out under the terms of the no-par-value act passed by the recent Legislature.

The operation of the company will continue under the old management, the following officers being re-elected:

D. H. Cantrell, president; A. Brizolara, vice-president and treasurer; W. J. Tharp, secretary and auditor; C. J. Griffith, general manager; and H. U. Wallace, assistant general manager.

H. C. Abell, New York, was elected chairman of the board of directors of the company.

Allowed Return Being Earned in New Orleans

The Public Service, Inc., New Orleans, La., has reported for the first six months of the trial rates fixed under the agreement effected recently with the city of New Orleans. The statement shows that its earnings above all operating expenses were \$1,953,125, or a little over 7.5 per cent, which was the rate of return agreed upon by the company and the city authorities.

The six months report shows the company has now on hand in cash \$4,129,439, of which \$1,701,369 is in ready cash and \$2,428,069 in loans and notes receivable. There is also \$1,339,899 in liquid assets, in addition to these cash assets.

The railway department is shown to have earned during the six months \$748,819, the electric light and power department \$721,416 and the gas company \$482,889.

With the adoption of the changes recommended in the Beeler report it is expected that an annual saving of \$853,717 will be effected, thereby guaranteeing a rate of return of 7.5, assuming that the succeeding six months will make as good a showing as has been made in the first six months of the trial rates.

Final Receivership Report of Fort Wayne Property Made

Robert M. Feustel, receiver for the Fort Wayne & Northern Indiana Traction Company, has filed his final report in the receivership action. It has been approved by Charles J. Ryan of the Superior Court. The report shows that Mr. Feustel took in \$2,619,911 and that he expended the same amount. The suit for receiver was filed by the Evans Coal Company in February, 1919, and Mr. Feustel as receiver had charge of the affairs of the company for more than four years.

The record in the receivership case is said to be the longest in the history of the Fort Wayne courts.

The Indiana Service Corporation, Fort Wayne, Ind., is the successor of the old company and Mr. Feustel is the president of the Service Corporation.

Auction Sales in New York.—At the public auction rooms of A. H. Muller & Sons, New York, on May 2 there were sold 200 shares of New York City Interborough Railway, \$215 lot.

Gold Bonds Offered.—Hoagland, Alum & Company are offering at 93 and interest to yield 6½ per cent \$1,000,000 of first and refunding mortgage 6 per cent gold bonds, series of 1923, of the Iowa Southern Utilities Company. The bonds are dated Feb. 1, 1923, and are due Feb. 1, 1943. The company owns the electric interurban railway connecting Centerville, Mystic and Albia.

Interurban Pays Preferred Dividend.—The Fort Dodge, Des Moines & Southern Railroad, Boone, Ia., declared a quarterly dividend of \$1.75 a share on preferred stock, payable on May 1. Previous to this declaration, the last dividend on the preferred was paid in scrip on May 1, 1921. The directors of the company did not act on the matter of the 12½ per cent accumulation on the preferred. The gross earnings for the year ended Dec. 31 were \$2,244,501, increase \$44,102 over 1921. Net earnings were \$615,504, increase \$256,247. Interest charges were \$295,391, leaving a balance after interest available for depreciation and dividends of \$320,112.

Small Accumulated Deficit for Los Angeles Railway.—The Los Angeles Railway Corporation reports to the California Railroad Commission for the year 1922 that its operating revenue was \$11,118,873 and operating expenses \$7,623,646, giving a net operating revenue of \$3,495,227. Miscellaneous non-operating revenue amounted to \$130,863. Interest, rent, taxes and other deductions totaled \$2,247,313. The net corporate income for the year was \$1,378,777. The deficit at the beginning of the year amounted to \$1,165,064. Miscellaneous additions to surplus for 1922 amounted to \$8,421 and miscellaneous deductions were \$235,151, leaving an accumulated deficit at the end of the year of \$13,017.

\$10,000,000 of 7 per Cent Debentures Offered.—Public offering is being made of a new closed issue of \$10,000,000 of 7 per cent sinking fund debenture gold bonds of the Illinois Power & Light Corporation at a price of 100 and interest, to yield 7 per cent. These bonds are a direct obligation of the corporation, which covenants to place no additional mortgage on its properties unless they are ratably secured by the lien thereof, and to issue no additional debentures if the holders of one-third of the principal amount of the present issue object thereto. The company is the successor to the Illinois Traction Company and other properties as noted previously in the *ELECTRIC RAILWAY JOURNAL*.

Company Making Progress.—During March the Boston (Mass.) Elevated Railway carried 34,691,068 paying passengers and collected \$3,027,502 in fares. This was the largest month's business in the history of the company. It set a new mark for railway results. It brought its reserve fund, for the repayment of a debt, up to \$958,648, and there is every indication now that the company will have more than \$1,000,000 to pay on July 1 to the communities which taxed themselves some years ago to cover the company's deficit from operation. Total receipts in March amounted to \$3,097,995 as against \$2,868,518 during the corresponding month a year ago. The company is making such good progress, financially, that it is in a position this year to start its trackwork on time. It had an excess of receipts over cost, for March, of \$335,937.

Traffic and Transportation

Ten Cents in Seattle

Council Votes a Return to Higher Cash Fare with Fifteen Tokens for One Dollar

The City Council has voted to return to the 8½-cent ticket fare on the Seattle Municipal Railway after an experiment since March 1 with a 5-cent fare. Council members agreed unanimously on the return to the higher fare on the recommendation of Superintendent Russell. Corporation Counsel Kennedy has been instructed to draft an ordinance restoring the former fare of 10 cents cash or token fares of 8½ cents, the only concession over the previous fare to provide fifteen tokens for \$1, or seven for 50 cents.

The new fares cannot become effective before June 15 or July 1, as Mayor E. J. Brown has announced that he will veto the ordinance. However, the Council has enough votes to pass the measure, but it will take about thirty days to put it in effect after it is passed. In the meantime, if the present losses continue, the deficit will reach approximately \$500,000 before the change can be made.

Mayor Brown states that he will continue his efforts to have the purchase bond redemption date extended. Corporation Counsel Kennedy advised the Council that if necessary the present issue of revenue bonds issued in payment for the street railway may be refunded. Few city officials believe that the bondholders will agree to any refunding or other method of extension of their bonds.

Losses through operation under the 5-cent fare during the early part of April showed an increase of \$102 a day over the average for the month of March. This brings the average daily loss to \$4,577.

Courtesy Week in Los Angeles Accomplished Good Results

Co-operating with the Kiwanis Clubs International in "Courtesy Week," April 15 to 21, the Los Angeles Railway accomplished good results toward mutual courtesy between trainmen and employees. Three days before courtesy week began posters were displayed in the cars announcing "next week is Courtesy Week."

During courtesy week an appropriate car card was displayed in the cars and ribbon badges with the words "Courtesy Week, April 15 to 21," were issued to trainmen with the request that they wear them while on duty. The wearing of the badge was not, however, compulsory.

A contest, in which cash prizes were given for the best ideas in promoting courtesy between trainmen and passengers, was conducted in the week pre-

ceding courtesy week and served to direct the thoughts of trainmen along the lines of courtesy. These ideas were relayed to passengers through "A-Z-U-R-I-D-E," a pamphlet distributed on the Los Angeles Railway cars by the public relations department.

Members of the Kiwanis Club were given the courtesy week badges and requested by their officials to wear them.

Newspaper publicity supplemented the other efforts to keep the campaign before the public.

Bus Regulatory Bill in Ohio Now a Law

The Public Utilities Commission of Ohio will hereafter control bus operation. The House and the State Senate recently passed the bill, which became a law without the signature of the Governor. It will become effective in ninety days.

The bill gives the commission the power to supervise and regulate all motor bus companies, fix their rates, regulate the service and safety of operation, require filing of annual reports and provide uniform accounting systems. The commission is to have authority over the bus companies to the exclusion of local communities.

Double-Deck Cars Suggested for Detroit

The use of double-deck street cars has been suggested to the Street Railway Commission of Detroit by W. F. Evans, president of the Detroit Motorbus Company. As Mr. Evans sees it, such cars in operation would reduce operating costs and aid materially in solving the problem of mass transportation.

Mr. Evans pointed out that the \$5,000,000 bond issue recently authorized by the city cannot buy all the cars and build all the extensions needed. By purchasing double-deck cars such as were built for experimental use along Broadway in New York and running buses hired from the Detroit Motorbus Company for 25 cents a bus-mile, Mr. Evans holds that the city would be in a position to make that \$5,000,000 really aid materially in improving the Detroit street railway service.

Mr. Evans lists the principal items of economy in the use of the double-deck car from a strictly cost standpoint. These, he maintains, are lower maintenance cost per passenger, less power cost per passenger, less platform cost and less investment per passenger. Double-deck cars also afford a reduction in the schedule running time due to the fact that less time is consumed per passenger in loading at the start.

\$9,000,000 Valuation Upheld

Superior Court of Pennsylvania Finds State Commission Was Correct in Deciding Scranton Rate Case

As was reported in the *ELECTRIC RAILWAY JOURNAL*, issue of April 28, the Superior Court of Pennsylvania on April 19 affirmed the findings of the Public Service Commission in the matter of the valuation and rates of the Scranton Railway. This means that the court upheld the commission valuation of \$9,000,000 on the property of the company as a basis for the 8-cent fare. The present decision is the result of the city's appeal against the commission's ruling. The fare problem had its beginning in the franchise ordinance which limited the rate to be charged by the company within the city of Scranton to 5 cents. In 1917 the company filed a 6-cent rate with the commission and in 1918 a second schedule was filed increasing the fare from 6 cents to 8 cents. Against both increases the city of Scranton complained on the ground of their being illegal and unjust.

The Public Service Commission then filed a preliminary report holding that the fare limitation prescribed by the ordinance had been superseded by the passage of the Public Service Company law. It suggested a conference of engineers representing the railway and the city to decide on the valuation of the property, but meanwhile established a temporary fare of 7 cents cash or four tickets for 25 cents. From this order the city appealed to the Superior Court. That court affirmed the order of the commission. The Supreme Court has now in turn affirmed the lower court ruling.

Proceeding with the matter of the valuation the commission after careful consideration arrived at a value of \$9,000,000. The Scranton Railway was then directed to advertise a new tariff providing for an 8-cent cash fare, with tickets to be sold at the rate of four for 30 cents, this schedule to remain in force for a period of twelve months. The city of Scranton did not appoint an engineer to represent it at the valuation conference, but it did appeal from this determination of the commission. In its brief the city stated that the questions involved were:

1. The determination of the fair value of intervener's property used and useful in the public service, under the public service company law of 1913.
2. A determination of a just and reasonable rate of fare on respondent's lines within the city of Scranton.

The court referred to the public service company law, which conferred on the commission power to determine the facts and conditions in each case which must control in the fixing of rates to be charged. Further, the court contended, the public service company law empowered the commission to determine the fair value of the property and to revalue such property from time to time. In the case of the Scranton Rail-

way the court ruled the commission complied with the provisions giving all interested parties a patient hearing. Further, the court said that it was without authority to set aside a finding of fact by the commission which was supported by substantial evidence when no constitutional question was involved.

One of the main points in the controversy was the question of the original cost of construction and the reproduction cost of the property. The engineering conference submitted a figure of \$7,899,965 for the original cost of construction. The city contended that the original cost of the property was only \$5,585,334. The city also contended that the engineering conference in its report as to reproduction cost included items which ought not to have been considered and put an extravagant estimate upon others. The engineering conference submitted a report upon the cost of reproduction new of the property based upon three different unit prices. These were:

1. Prices as of Nov. 1, 1919.
2. Average prices for 1914 to 1919, inclusive.
3. Current prices for the year 1914.

The commission did not accept in its entirety the report of the engineers as to the reproduction cost of the property, but reached the conclusion that the reproduction cost new, exclusive of going concern value and accrued depreciation, as of the several dates, should be fixed as follows:

- As of Nov. 1, 1919, at \$10,075,000.
- As of unit prices for the period 1914 to 1919, inclusive, at \$7,000,000.
- Under 1914 prices at \$6,300,000.

Figuring that the cost of reproduction of the plant as of prices prevailing in November, 1919, would have been \$10,075,000 and that depreciation amounted to \$1,219,715 the commission arrived at a construction cost less depreciation of \$8,855,285. The court concluded that if to this was added the cost of financing—which the engineers found should be allowed—the property was valued at more than \$9,350,000 without any allowance for going concern value, although the engineers testified to an amount for going concern value.

To the argument of the city that the 1919 prices were abnormal the court responded as follows:

That may be possible, but to what extent they are abnormal we cannot say, under the evidence in this case, with that certainty which ought to characterize judicial action. Furthermore, the commission did not fix the valuation of the company's property at \$10,000,000 nor did it base its findings upon the unit prices prevailing in 1919. Should prices hereafter decline more rapidly than they have since 1919 it may be that there should be a revaluation of the property here involved, that the statute authorizes that to be done. We are not convinced that the finding of the commission was without substantial evidence to support it.

The city finally argued that even if the valuation of the property of the railway is sustained, the rates of fare fixed by the final order of the commission will produce a revenue in excess of a reasonable return upon the property used in the public service. The court ruled that that argument de-

pendent upon the assumption that there would be a very considerable increase in travel after people get used to paying the 8-cent fare and that the revenues of the company would thus be greatly increased. Further, that this was largely a matter of speculation and theory and that it would not be warranted in placing upon a foundation so insecure a decision that the determination of the Public Service Commission is unreasonable and not in conformity with law.

The order of the commission was therefore affirmed and the appeal dismissed.

West Penn Railways Men to Be Rewarded for Accident-Prevention Effort

Although comparative records indicate that the West Penn Railways, Pittsburgh, Pa., is relatively free from accidents, an effort is being made still further to decrease the number of accidents by an accident prevention contest started at the beginning of the year.

In this contest trainmen on each division of the system are divided into teams and at the end of each quarter the team having the fewest number of accidents on the respective divisions is given a dinner by the company.

Some teams have come through the first three months without an accident. This is all the more remarkable in view of the fact that many slight collisions and unusual occurrences are considered as accidents.

The company's past experience was that most accidents occurred among passengers trying to board or alight from a moving car. This class of accident has been practically eliminated by the use of closed vestibule cars and side mirrors. Most accidents involving the cars are now caused by collisions with automobiles. Records of the West Penn Railways indicate that approximately 60 per cent of its accidents are due to this cause, and that while accidents due to all other causes are constantly decreasing, this is more than offset by the increased number of automobile accidents. The majority of these are of such a nature that they can only be prevented by co-operation of automobile drivers.

Because of its appreciation of what has been done and to give encouragement to further effort the company recently announced that, effective May 1, cash rewards would be made to trainmen for each no-accident month. This reward will increase progressively with each consecutive no-accident month so that a trainman will be able to earn a total of \$100 for the first twelve months of no-accident record. Trainmen continuing a no-accident record beyond twelve months will be rewarded \$150 for second twelve consecutive months of no-accident record. The same rate as for second twelve months period will continue indefinitely for each consecutive twelve months of no-accident record.

Trainmen waiting to take out their runs have been stimulated by the contest to discuss among themselves ways and means of predicting the unexpected moves of pedestrians and motor vehicle drivers.

Common Sense Returning on Jitney Problem, Says Norfolk Paper

In commenting on the recent decisions with respect to the regulation of jitneys in Norfolk, Va., and vicinity the *Norfolk Dispatch* said in part in its issue of April 12:

Two votes cast in Tidewater Virginia yesterday demonstrated the welcome fact that common sense is getting the upper hand in the matter of dealing with municipal and suburban transportation in general and with jitneys in particular.

One of these votes was cast in Newport News by the people themselves, who, according to the jitney men and their apologists, are all for the jitneys and all against whatever railway may be operating in any given community. In Newport News the jitney men demanded the right to fix their own routes, while the city administration considered, of course, that jitney regulation should be in the hands of the Council. Under the charter of the city, the question was submitted to the voters. They voted against unregulated jitney operation and, by implication, for councilmanic regulation.

The other significant vote was cast unanimously by the members of Norfolk's Council, upholding the recommendation of the City Manager that jitney operation between Norfolk proper and Ocean View be prohibited. If there had been no public interest in the proposed line to Ocean View, Council's vote would not have been especially significant—because it was so obviously right. But the fact that numerous residents of Ocean View and the vicinity asked for the operation of such a line made Council's firm stand on the matter significant.

Council very wisely, and to the ultimate advantage of Ocean View and that entire section, decided that the jitneys must suspend and the railway must continue to give service—improved service, too.

Railway Opens Another Bus Line.—Jamestown Street Railway, Jamestown, N. Y., has opened its North Side bus line loop. Transfers issued on the North Side line are accepted on the other bus lines and on the cars of the railway.

Bus Matters in Poughkeepsie Awaited.—The Poughkeepsie City & Wappingers Falls Railway, Poughkeepsie, N. Y., is said to be considering the advisability of going over to bus service. The city is awaiting the railway's decision with respect to buses as agents in the city's transportation field. The City Council has refused heretofore to grant franchises to bus applicants, but the independent operators in urging their case have called attention to recent court decisions.

Runaway Car in Brooklyn Injures Many.—Thirty-six persons were injured on May 1 when a car of the Manhattan Bridge Three-Cent Line, New York, jumped the track of the "S" curve near Nassau Street at the Brooklyn end of the bridge. The vestibule of the car was demolished and great holes ripped in both sides as it bumped and rocked and wayed for more than 600 feet over the cobblestones of Flatbush Avenue extension, finally crashing into an iron pole and coming to a stop in front of the Technical High School at Concord Street.

Personal Items

J. A. Carmody Advanced

New York Central Railroad Has Appointed Him to Post of Superintendent of Electrical Equipment

J. A. Carmody has been appointed superintendent of electrical equipment, electric division New York Central Lines, to succeed C. H. Quereau, retired on pension. Under the scheme of organization of the department he reports to E. B. Katté, chief engineer of electric traction.

Mr. Carmody comes to his new job with an unusually all-round preparation. He is now in his forty-fourth year, and has had something to do with railway cars practically ever since he finished high school in Elizabeth, N. J., near which is his birthplace, Linden. After some preliminary training with the Crocker-Wheeler and the Diehl Companies, he became chief electrician of the John Stephenson Car Company. Leaving this concern he pitched right into the railway and railroad electrification game with the General Electric Company, for which he worked on car equipment in different parts of the country and on the fitting up of the first New York Central locomotive, the famous "6000," still running. Refusing an offer as master mechanic of an important interurban railway, he joined the New York Central force, in 1906, as general foreman of car equipment. This involved a lot of interesting work, for the railroad was having cars built by the American Car & Foundry Company at Berwick, Pa., and the St. Louis car company, equipped at the car works and tested on the General Electric Company's test track at Schenectady. Mr. Carmody had charge of inspection until the cars were accepted by the operating department of the railroad and put into service.

MR. CARMODY RETURNS AFTER TEN YEARS

Mr. Carmody left the New York Central in 1909, and there is a gap of thirteen years to be accounted for until his return in 1922, this time in the valuation department. He held several jobs in the interim. One was as valuation engineer with J. G. White & Company, appraising the property of the Capital Traction Company. Another was with the Safety Car Heating & Lighting Company, on railway, train lighting equipment. In the war-time period he was production manager at the Long Island City Works of the Wright-Martin Aircraft Corporation.

The return of Mr. Carmody to the New York Central was primarily for the purpose of appraising the traction lines of the New York & Harlem Railroad, but his preparation as outlined indicated him to be the logical man to succeed Mr. Quereau. His work now includes the direction of the shops at

Harmon and North White Plains, where the seventy-three locomotives and the 286 motor cars are maintained.

A. J. Clarkson has succeeded Mr. Carmody, as general inspector, electric division, New York Central Lines. He is a graduate of the University of Illinois, where he spent five years, completing a combined course in electrical engineering and electric railway engineering, leading to the degree of B.S. in E.E. Passing up the opportunity for taking a vacation after graduation he immediately entered the employ of the New York Central on July 1, 1916. Since that date he has progressed steadily. Beginning as junior draftsman in the electrical department he was afterward successively draftsman, senior draftsman, inspector and as-



J. A. Carmody

sistant engineer. His work for the first 4½ years was on the design and inspection of electrical equipment for cars and locomotives. For the remaining time he has been engaged in the supervision of design and installation of new shop machinery and other improvements, and studies of shop operation in connection therewith. He has also made investigations of electric equipment in service. In his present position he is virtually assistant to the superintendent of electric equipment.

Mr. Clarkson was brought up on an Illinois farm. He worked his way through college, where he made an excellent record.

Commission Engineer Will Become Railway Manager in Wausau

E. J. Steinberg, resident engineer in Milwaukee for the Wisconsin Railroad Commission for the past ten years, will resign on June 1 to become connected with the Milwaukee Electric Railway & Light Company. Mr. Steinberg joined the railroad commission engineering force in 1910 as a utility inspector. Three years later he was

transferred from Madison to Milwaukee as resident engineer. Since then he has had charge of promulgating schedules upon which the street cars of the Milwaukee Electric Railway & Light Company are operated, as well as other administrative and regulatory duties involving public utility properties in the Milwaukee district. Mr. Steinberg was graduated from the University of Wisconsin in 1909, receiving a B.S. degree and in 1919 the university conferred upon him the degree of E.E.

James D. Andrew Becomes Vice-President of Stevens & Wood, Inc.

James Andrew has returned to his old love—the public utility engineering and construction fields—by accepting the post of vice-president and district manager of Stevens & Wood, Inc., with offices at New York and Youngstown, Ohio. Mr. Andrew's headquarters will be at Youngstown, and one of his first activities will be to take charge of the construction of the 200,000-kw. super-power plant to be erected by his firm on the Ohio River.

In returning to the public utility field Mr. Andrew resigned as president of the American Balsa Company, a subsidiary of the American International Corporation, with which organization he became connected in war times. Indeed, at the height of the shipbuilding period Mr. Andrew had the satisfaction of seeing 122 ships come into being while he was manager of hull construction. But before the ships could be built, it was necessary to have a shipyard. At that task he served in the vital position of general superintendent of plant construction for the American International Shipbuilding Corporation at Hog Island. It was the famous Hog Island problem that lured him in 1917 from his position as superintendent of station engineering for the Edison Illuminating Company, Boston.

Mr. Andrew was born in 1874. He was graduated from the Columbia School of Mines in 1897. His first three years in the workaday world were spent in erecting and testing engines for the E. P. Allis Company, Milwaukee. For the next three years he was mechanical engineer of the Metropolitan Street Railway, New York; and then he moved over for a like period with the New York Edison Company as chief engineer. Tempted by the commercial side, he next became general manager of the Virginia & Alberine Soap Stone Company in charge of production and manufacture. The public utilities claimed him again when the Boston Elevated Railway made him superintendent of power.

Once more Mr. Andrew left a railway to join a central station company—this time the Boston company as noted above. During 1916, however, he received leave of absence to go to South America for the Chile Copper Company to build a 40,000-kw. power plant and then place it in operation. Shortly thereafter his talents were placed at the disposal of his country.

F. H. Brown Placed in Charge of Pawtucket Lines

In order still further to better public relations there and to afford the Pawtucket system closer supervision, with an object of increased efficiency, the United Electric Railways, Providence, R. I., has opened an office in that city with a superintendent in direct charge of that division. Under this plan the people of Pawtucket find an official representative at hand where before it was necessary for them to journey to Providence.

F. H. Brown has accordingly been made superintendent of the Pawtucket Division. He has been with the United Electric Railways for nearly seventeen years. He gained his first railway experience in Worcester, where he worked as a conductor, gradually advancing until he was placed in charge of one of the carhouses of the Worcester system. Later he entered the employ of the Public Service Corporation in New Jersey as an inspector. He worked his way up to district superintendent in Elizabeth, N. J. In October, 1906, he went to Rhode Island as superintendent of the Northern Division and continued in that capacity up to the time of his appointment to the Pawtucket post.

Edward J. Coffield has been appointed superintendent of the Woonsocket division of the United Electric Railways. The lines in Woonsocket had been cared for previously by Mr. Brown as part of the Northern division.

Mr. Coffield was advanced to this position from that of inspector on the Woonsocket lines. His railway training and knowledge of operating conditions in Woonsocket and vicinity qualify him for these duties. Mr. Coffield is thirty-five years of age. He has been connected with the company since April, 1907, at which time he entered the employ as a motorman.

The system of the United Electric Railways embraces the cities of Providence, Pawtucket, Central Falls and Woonsocket and also a vast amount of suburban territory. The city of Pawtucket, with a population of 64,248, has many lines operating entirely within its borders and several lines running into Providence.

W. C. Fankhauser Appointed Examiner of Commission

W. C. Fankhauser, chief of the division of finance and accounts of the California Railroad Commission, has been appointed an examiner of the commission, in addition to his other duties. This will permit him to conduct examinations into financial matters in connection with the applications to the commission for authority to issue stock and bonds and other financial matters in connection with the commission's work.

Mr. Fankhauser has been associated with the commission since April, 1912. He began his work in the department of statistics and accounts, and was

transferred to the stock and bond department in 1913. He was placed in charge of that department in 1917. In 1920 he was placed in charge of the department of finance and accounts, which was formed by consolidating the department of statistics and accounts and the stock and bond department.

Mr. Fankhauser is a graduate of Pomona College, Class of 1909, and in 1912 was given the degree of Ph. D. by the University of California. He is the author of "Financial History of California and a Study on Railroad Reorganization and Receiverships," prepared in 1917 for the Newlands committee of the United States Congress.

A. J. Anderson Made Manager of Tennessee Road

A. J. Anderson has recently been appointed general manager of the Union Traction Company, Nashville, Tenn. Attainment of this post has long been Mr. Anderson's silent ambition, but no



A. J. Anderson

providential concatenation of circumstances has had anything to do with his achieving it. Ever since Mr. Anderson entered the employ of the company in 1902 as a section hand he has had his eye on the post next ahead as his ambition, not a covetous ambition, but as a step in the achievement of things still greater. Thus it has been that Mr. Anderson, since his first job on construction, has served the company successively as conductor, motorman, ticket agent and assistant to the general manager. Up from the ranks often means just that and nothing more, but when, as in the case of Mr. Anderson, it means through the ranks with a turn of service in each step sufficient for the mastering of the details of the separate jobs, it has a meaning all its own. Opportunity is dead only to those who believe it to be dead. Mr. Anderson's career is a fair example of what may be accomplished by diligence and hard work, and proves that opportunity is ahead in electric railway work even for those non-technically trained. The road of which Mr. Anderson is the manager operates 25 miles of line, mostly suburban, and owns Rockland Park, a popular pleasure resort near the city.

New Manager at Taunton Promises 100 per Cent Service

James H. Murphy, long a prominent street railway figure in Taunton, Mass., has been given operating control over the East Taunton Street Railway. The directors have voted him manager and elected him treasurer also. In fact, Mr. Murphy will do what he wants with the road, as he will have full authority for an indefinite period.

The East Taunton Street Railway has been in operation for twenty-five years. It was a good proposition up to four years ago, but then it slumped and has not paid a dividend since. In fact, it almost looked as though the permanent home of the Toonerville Trolley was in Taunton. But the East Taunton Street Railway is going to pay dividends, give fine service, etc., because Mr. Murphy says it will. There are Great Expectations in Taunton. Track improvements, overhauled rolling stock, better service than patrons have had for years, are only some of Mr. Murphy's plans. He will welcome suggestions and complaints, too, but after Mr. Murphy has had his way with the road for a time "there ain't going to be no complaints."

Many years ago Mr. Murphy was a tow boy in Taunton. Later he went into the machine shop. He served as driver on the horse cars and as starter and dispatcher. One of his big jobs was superintendent of Division 2, South of the Bay Street Railway, with offices in Taunton. This position was followed by his temporary appointment in 1916 as general superintendent of that division, succeeding in that capacity George F. Seibel.

In 1919 Mr. Murphy was made manager of the Taunton division of the Eastern Massachusetts Street Railway, at the time when the properties of the company were segregated with a manager as the operating head of each division.

Mr. Murphy's new position will in no way interfere with his management of the Taunton division of the Eastern Massachusetts Street Railway. In fact, an agreement has been reached between the two companies. The East Taunton Street Railway is to rent space in the carhouse of the Eastern Massachusetts Street Railway in Taunton and close up its own carhouse. The system comprises more than 10 miles of line.

J. I. Searles, who has been in charge of the railway systems of the Menominee & Marinette Light & Traction Company, at Marinette, Wis., and Menominee, Mich., since he joined that company in September, 1922, has become superintendent of the railway system of the Lake Superior District Power Company, formerly the Ironwood & Bessemer Railway & Light Company. His headquarters will be at Ironwood, Mich. Mr. Searles was formerly connected with the electric railway at Clinton, Iowa, and the railway at La Crosse, Wis., and Winona, Minn., of the Wisconsin Railway, Light & Power Company.

H. V. Jones has succeeded H. M. Myers as auditor of the Northeast Oklahoma Railroad, Miami, Okla.

Marion McMillan has been added as one of the vice-presidents of the San Antonio (Tex.) Public Service Company.

H. M. Preston, secretary of the Warren & Jamestown Street Railway, Warren, Pa., has also assumed the duties of vice-president.

C. J. Moor has succeeded A. L. Farquharson as general manager and purchasing agent of the Fort William (Ont.) Electric Railway.

E. W. Ford, formerly general superintendent of the Memphis Street Railway, has been elected vice-president and will have jurisdiction over general operation.

A. D. McWhorter, formerly superintendent of equipment and overhead lines of the Memphis Street Railway, has been elected general superintendent with jurisdiction over transportation, mechanical and overhead line departments.

W. Angus Reid is now secretary and treasurer of the St. Johns Light & Power Company, St. Johns, Newfoundland. The position was formerly held by F. J. Hunter, who was superintendent in addition to his being secretary and treasurer.

D. R. Ainsworth has resigned from the office of general manager of the Shelburne Falls & Colerain Street Railway, Shelburne Falls, Mass., which he has held for the past ten years. He will continue as clerk and treasurer. Edward S. Hunter becomes general manager and assistant treasurer.

Frank Kell has been promoted from vice-president to president of the Wichita Falls (Tex.) Traction Company. J. A. Kemp, who was formerly president, will take Mr. Kell's place. L. L. Allbritton, in addition to his duties as general manager and purchasing agent, will also act as secretary and treasurer.

Mark Barkwell has been made general manager of the Northern Cambria Street Railway, Patton, Pa., succeeding C. L. Calahan, resigned, the latter accepting a position in Maryland. The new official of the railway was for the past six years manager of the Clearfield Supply Company at Barnesboro and Clymer.

Charles A. Mead, chief engineer of the division of bridges and grade crossings of the Board of Public Utility Commissioners of New Jersey, has been appointed a representative of the American Society of Civil Engineers on the American Engineering Standards Committee, succeeding Martin Schreiber.

F. D. Jackson is now secretary and treasurer of the Port Arthur (Ont.) Civic Railway. The duties of treasurer were formerly performed by D. McIver and those of secretary by M. M. Inglis.

Mr. Inglis, however, will continue as general manager and purchasing agent, which positions he formerly held along with the secretaryship of the property.

William Darbee has replaced D. F. McGee as a vice-president of the Panama Electric Company, Panama. Edmund George Ford, formerly auditor, has taken on the duties of assistant treasurer, and E. P. Summerson, secretary, has also become treasurer of the property. D. G. Beachler is engineer. In this capacity he succeeds W. F. Grimes, Jr., who was known as the electrical engineer.

Fred W. Putnam of Red Wing has resigned from the Minnesota State Railroad & Warehouse Commission, effective on May 1. He will practice law in Minneapolis. Charles Sterling, chairman of the Ramsey County Republican committee, was appointed by Gov. J. A. O. Preus to succeed Mr. Putnam, who was appointed in 1917 and re-elected in 1918 for six years, his term expiring January, 1925.

F. Raymond Latta, who for many years has been superintendent of transportation of the New York State Railways, Syracuse, N. Y., has been promoted to be assistant to John Duffy, general superintendent. The position of superintendent of transportation has been abolished. The move is to centralize all operating direction. The transportation department was organized about five years ago.

W. P. Strandborg, of the Portland Railway, Light & Power Company, Portland, Ore., president of the Public Utilities section of the Associated Advertising Clubs of the World, has been appointed a member of the general reception committee to receive 100 or more representative advertising and business men of the British Empire who will arrive in the United States the latter part of May for a tour of the Eastern and Middle Western sections of the country. The delegation will be composed of publishers, advertising specialists and representatives of large British industrial concerns. The party will attend the annual convention of the Associated Advertising Clubs of the World at Atlantic City early in June.

Col. Charles Keller, who has been engineer commissioner and chairman of the Public Utilities Commission of the District of Columbia, has become associated with the Byllesby Engineering & Management Corporation, Chicago. Colonel Keller's immediate assignment will be business manager of the El Dorado hydro-electric project, now under construction by the Western States Gas & Electric Company on the south fork of the American River near Placerville, Calif. This water power will have an initial installed capacity of 27,000 hp. and an ultimate capacity of more than 100,000 hp. Colonel Keller is an honor graduate of the United States Military Academy at West Point, having been graduated as No. 2 in the class of 1890. After graduation he took the usual post-graduate course,

and for a number of years served as an assistant in various engineering districts throughout the country.

Henry R. Trumbower, member of the Wisconsin Railroad Commission since 1918, has resigned to accept an appointment with the United States Department of Agriculture in charge of an investigation of the economics of transportation as it relates to marketing and distribution of farm products. The regular term of Mr. Trumbower on the Railroad Commission expired on Feb. 1, but he was retained by the Governor. In his new position Mr. Trumbower will make a special study of the possibilities of extension of motor truck transportation of farm products. His work will be done in connection with the bureau of agricultural economics and the bureau of public roads of the Department of Agriculture. Mr. Trumbower was appointed to be a member of the Railroad Commission by Governor Philipp in 1916 to succeed Halford Erickson for the unexpired portion of his term. In February, 1917, he was reappointed to a full six-year term. Mr. Trumbower was a professor of economics at the University of Wisconsin from 1910 to 1918.

Obituary

Donald Strode Barton, former general manager of the Canadian Electric Light Company, Levis, and consulting engineer of the Quebec Railway, Light, Heat & Power Company, is dead. Mr. Barton was born in India and was educated in England. He went to Canada in 1900. He settled in Montreal and practised his profession there for five years, when he accepted the appointment as general manager of the Canadian Electric Light Company, and at the same time became consulting engineer of the Quebec Railway. When the Levis company was absorbed by the Quebec Railway he remained with the company in the capacity of consulting engineer.

Frank E. Russell, general manager of the Tucson Traction Company and the Tucson Gas, Electric Light & Power Company, Tucson, Ariz., died at his home in that city on April 15, at the age of sixty years. Mr. Russell suffered a breakdown in health in July, 1922, being taken with a severe attack of sciatic rheumatism which finally developed into pneumonia, from which a complication of diseases resulted. Mr. Russell began his public utility career with the Western Union Telegraph Company, subsequently becoming active in the organization of the Tucson Gas, Electric Light & Power Company in 1892. Shortly thereafter he was appointed general manager and remained as such until the time of his death, a period of more than thirty-one years. In 1910 the Tucson Company became a unit of the Federal Light & Traction Company, New York.

Manufactures and the Markets

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

Extensive Car Rehabilitation Plan for D. U. R.

An extended program of car rehabilitation has been laid out by the Detroit United Railway for 1923. Eight trailers which were purchased three years ago for the Pontiac line will be equipped with motors, as the company has adopted the policy of using no more trailers on the Pontiac line. Fifteen of the older type of interurban motor cars are also being pushed through the shop for rebuilding into modern-type cars. The company is also rebuilding two of its 60-ton locomotives with box bodies so that they can be used for freight carrying in addition to hauling cars.

The shop program also includes the rebuilding of eight trail cars which were originally designed for p.a.y.e. entrance and exit at the front end. These will be changed by the elimination of the large front platform and the construction of a rear platform and a smoking compartment. There will also be a rearrangement of the heater system. In this way the cars can be used p.a.y.e. in the city and the fares can be collected in the usual way on the interurban run. Fifteen of the older type of city cars with a side aisle are also being remodeled and fitted with front and rear bulkheads and a change of the aisle to the center.

Two locomotives are being added to the equipment. The bodies are being built by the Cincinnati Car Company and Standard C-80 trucks are being used with 34-in. wheels. The electrical equipment will consist of Westinghouse 562-A-5 motors with H.L.F. control. Each locomotive will be able to haul fifteen trail cars. These engines will bring the locomotive equipment of the company up to sixteen.

Existence of Trade Associations Approved by Chamber of Commerce

Approval of the existence of properly functioning trade associations for each important branch of industry and commerce in the country was voted by business organizations affiliated with the Chamber of Commerce of the United States in a preliminary referendum canvas on April 13. Eight separate propositions relative to the activities of trade associations were submitted.

The propositions were taken from the report of the special committee created by action of the board of directors of the national chamber in 1922 to "make a general survey of trade associations, consider activities of trade associations which are in the interest of the public

and of the fields of enterprise which are represented."

Philip H. Gadsden, Philadelphia, vice-president of the United Gas Improvement Company, headed the committee as chairman.

The committee expressed itself as of the opinion "that, while a minority of trade associations may have engaged in practices which have laid them open to complaint under the law with respect to restraints of trade, the vast majority have proved their great value for the advancement, day by day, of the processes of production and distribution."

In expressing opposition to government control of trade associations, the committee said:

The possibility that a trade association may err by violating a statute no more justifies any attempt on the part of governmental authority to control trade associations in all their activities than the possibility of illegal acts on the part of individuals warrants like supervision over all their actions. Such supervision would inevitably restrict the freedom of action of trade associations in meeting the problems which they exist to solve.

The committee laid down as its recommendations three rules with relation to the statistical activities of trade associations, as follows:

Reports of members to their association should be accurate and sufficiently complete to prevent misconstruction.

As distributed to the membership, the statistics should not be accompanied with

any interpretation or other comment which could induce or facilitate concerted action on the part of the members.

All statistics regarding prices should be confined to closed transactions, and should not refer to pending transactions or future transactions.

In summarizing its conclusions the committee said:

The committee believes that trustworthy information concerning capacity, production, stocks, sales and prices is essential to the effective operation of industry and trade under competitive conditions. The voluntary reporting of such information to trade associations and the subsequent publication and dissemination of such information in a manner which makes it available not only to contributors but also to consumers and to the public generally is beneficial alike to the field of business and the public and does not constitute a restraint of trade.

\$1,000,000 for New Buildings

Real estate and building activities of the Indiana Service Corporation, Fort Wayne, Ind., will involve nearly \$1,000,000 before the completion of present plans. Half of this sum has been set aside for the erection of the first unit of the Spy Run Avenue-Kamm Street carhouse.

When complete with carhouses 290 ft. x 90 ft. and a washhouse 290 ft. x 25 ft. there will be an initial investment of \$100,000. These buildings, together with twenty-eight tracks to be located between the carhouse and the Randolph Street side of the company's property, will be completed this year.

The first carhouse to be erected will be of the two-story type, the lower floor to be used for car repair and barn work while the second floor will contain the offices of the city lines, superintendent and clerks and rooms for the employees. In the second building to be erected will be the wash shop and other departments.

ELECTRIC RAILWAY MATERIAL PRICES—MAY 1, 1923

Metals—New York

Copper, electrolytic, cents per lb.	16.50
Lead, cents per lb.	7.65
Nickel, cents per lb.	27.50
Zinc, cents per lb.	7.10
Tin Straits, cents per lb.	45.25
Aluminum, 98 to 99 per cent, cents per lb.	25.75
Babbitt metal, warehouse, cents per lb.:	
Fair grade	65.00
Commercial	40.00

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	\$6.25
Somerset mine run, Boston	3.175
Pittsburgh mine run, Pittsburgh	2.00
Franklin, Ill., screenings, Chicago	1.95
Central, Ill., screenings, Chicago	1.575
Kansas screenings, Kansas City	2.625

Track Materials—Pittsburgh

Standard Bessemer steel rails, gross ton	\$43.00
Standard open heart rails, gross ton	43.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	3.15
Tie plates (flat type), cents per lb.	2.575
Angle bars, cents per lb.	2.75
Rail bolts and nuts, Pittsburgh base, cents per lb.	4.375
Steel bars, cents per lb.	2.575
Ties, white oak, Chicago, 6 in. x 8 in. x 8 ft.	1.50

Hardware—Pittsburgh

Wire nails, base per keg	3.00
Sheet iron (28 gage), cents per lb.	4.00
Sheet iron, galvanized, (28 gage), cents per lb.	5.25
Galvanized barbed wire, cents per lb.	3.80
Galvanized wire, ordinary, cents per lb.	2.75

Waste—New York

Waste, wool, cents per lb.	12-16
Waste, cotton, (100 lb. bale), cents per lb.:	
White	11-13.50
Colored	8-13

Paints, Putty and Glass—New York

Linseed oil, (5 bbl. lots), cents per gal.	1.17
White lead, (100 lb. keg), cents per lb.	13.125
Turpentine, (bbl. lots), per gal.	\$1.42
Car window glass, (single strength), first three brackets, A quality, discount*	84.0%
Car window glass, (single strength), first three brackets, B quality, discount*	86.0%
Car window glass, (double strength) all sizes, A quality, discount*	85.0%
Putty, 100 lb. tins, cents per lb.	5.05

*These prices are f.o.b. works, boxing charges extra.

Wire—New York

Copper wire base, cents per lb.	19.375
Rubber-covered wire, No. 14, per 1,000 ft.	7.75
Weatherproof wire base, cents per lb.	19.50

Paving Materials

Paving stone, granite, 4 x 8 x 4, f.o.b. Chicago, dressed, per sq. yd.	\$3.50
Common, per sq. yd.	3.10
Wood block paving 3 1/2 x 16 treatment, N. Y., per sq. yd.	3.19
Paving brick 3 1/2 x 8 1/2 x 4, N. Y. per 1,000 in carload lots	54.00
Crushed stone, 1-in., carload lots, N. Y., per cu. yd.	1.75
Cement, Chicago consumers net price, without bags	2.20
Gravel, 1-in., cu. yd., N. Y.	2.25
Sand, cu. yd., N. Y.	1.25

Old Metals—New York

Heavy copper, cents per lb.	13.75
Light copper, cents per lb.	11.75
Heavy brass, cents per lb.	7.50
Zinc, old scrap, cents per lb.	5.00
Yellow brass, cents per lb. (heavy)	7.50
Lead, heavy, cents per lb.	6.75
Steel car axles, Chicago, net ton	24.25
Old car wheels, Chicago, gross ton	26.25
Rails (short), Chicago, gross ton	24.75
Rails, (relaying), Chicago, gross ton	33.50
Machine turnings, Chicago, net ton	14.25

Rolling Stock

Chicago Surface Lines will shortly purchase seven trailers to replace those lost by fire.

Wisconsin Public Service Company, Green Bay, Wis., expects to receive soon six new cars being built by the St. Louis Car Company for service in Green Bay.

Chickasha (Okla.) Street Railway is remodeling a nine-bench open car for one-man operation by placing the seats lengthwise, installing hand-operated gates and steps, closing the ends and sides with wire netting and installing fare boxes.

New York Central Railroad, New York, N. Y., has ordered thirty new multiple-unit cars, delivery to be about July 1. They are practically the same as the last lot ordered. This brings the total up to 286. The road has seventy-three locomotives. None has been added since 1916.

Lake Superior District Power Company, Ashland, Wis., recently lost an interurban car by fire which broke out when the car was midway between Bessemer and Ironwood. Interurban service will not be decreased as the company will operate on this line new equipment which it has just received.

Track and Roadway

Detroit Municipal Railway has a budget this year of \$650,000 for special trackwork. This will include pieces all the way from a single frog to a grand crossing.

Montreal (Que.) Tramways will proceed shortly with a double-track extension on Rosemount Boulevard between Papineau Avenue and First Avenue, Rosemount.

Los Angeles (Calif.) Railway has installed a new crossover on Central Avenue north of Sixth Street for the convenience of cars operating out of Division 1.

Tennessee Electric Power Company, Chattanooga, Tenn., is at work on a program of improvements which calls for an expenditure of about \$355,000. Of this amount \$106,000 will be spent in the railway department.

Easton (Pa.) Transit Company will soon extend its lines to Twenty-fourth Street. H. H. Paterson, vice-president of the Lehigh Valley Transit Company, will go to Easton in the near future to attend a conference regarding the extension.

Trenton & Mercer County Traction Corporation, Trenton, N. J., will relocate the tracks on Pennington Avenue, from Prospect Street to Parkway, and place them in the middle of the street. A double track will be laid on Princeton Avenue, a distance of about a half mile.

Philadelphia (Pa.) Rapid Transit Company will be in a position to build several additional lines because Mayor

Moore has permitted the five ordinances providing for cross-town trolley lines to become laws without his signature. In allowing the bills automatically to become laws, the Mayor yielded to the suggestions made by many persons who reside in the neighborhoods which will be served by the proposed lines.

Power Houses, Shops and Buildings

Hydro-Electric Power Commission of Ontario this year will spend about \$1,000,000 for electric railway improvements. This includes a new carhouse and terminal in Toronto to be used jointly with the Toronto Transportation Commission. A new power house will be erected at Lake Simcoe and one or more new substations are on the program.

New Orleans, La.—The two 72-in. pipes which supply water for the plant of the New Orleans Public Service, Inc., at the foot of Market Street, in New Orleans, have been found inadequate since the installation of the new 20,000 kw. turbine. In consequence it has been decided to build a new reinforced concrete intake tunnel, 8 ft. x 10 ft., to cost with connections about \$500,000. When in operation at its full capacity, the plant requires 11,570,000 gal. of water an hour. The work on the tunnel will be started when the water in the Mississippi River recedes to a lower level. The Commission Council and the Orleans Levee Parish Board have authorized the construction of the tunnel.

Trade Notes

W. J. Jeandron, American representative of Le Carbone brushes, sailed for Europe recently for a six weeks' visit to the factory at Levallois-Perret.

Borne Scrymser Company, New York, N. Y., announces the removal of its New York offices to the Whitehall Building, 17 Battery Place, N. Y.

Bridgeport (Conn.) Brass Company has announced the removal of its New York offices from the Woolworth Building to the Pershing Square Building. F. Morton Clark has been made district sales manager and Arthur J. Nelson sales manager of the fabricating division at the main office in Bridgeport.

Pure Carbon Company, Wellsville, N. Y., announces the recent establishment of a Minneapolis representative, the Charles A. Ettem Company, 917-A Marquette Avenue, Minneapolis, Minn. This representative is in an excellent position to give personal engineering service on all brush problems and requirements in this territory.

Musashino Railway of Japan has placed an order with the Westinghouse Electric & Manufacturing Company, through Takata & Company, agents for the Westinghouse Company in Japan, for three electric locomotives, two motor car equipments and two trail car

equipments. Each locomotive will be equipped with four Westinghouse 100-hp. motors geared direct to the driving axles, and will weigh 33 tons. The locomotives will be controlled by standard electro-pneumatic control and will operate over a 1,200-volt system. The mechanical parts for the locomotives will be furnished by the Baldwin Locomotive Works.

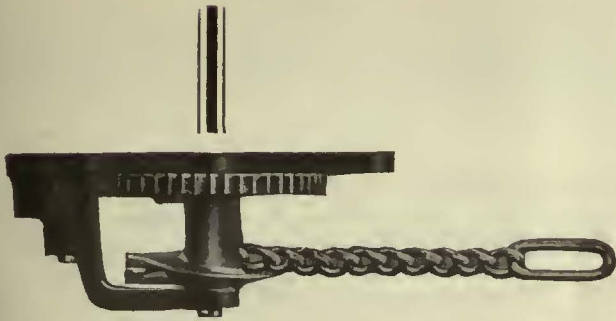
Allen B. Coffman has resigned as sales engineer for Crouse-Hinds Company, to become manager of the Philadelphia district for the Reliance Electric & Engineering Company, Cleveland, Ohio, manufacturer of electric motors. For the past three years while connected with Crouse-Hinds Company, Mr. Coffman made a study of different types of electrical installations in various industries from Pennsylvania to Florida. Previous to his association with Crouse-Hinds Company, he was assistant electrical engineer for the Philadelphia & Reading Railroad for approximately four years, having gone with it from the Pennsylvania Railroad electrical department. Mr. Coffman will continue to make his headquarters in Philadelphia and will be located in the Reliance Electric & Engineering Company's office in the Perry Building, Sixteenth & Chestnut Streets.

Chausse Oil Burner Company has been incorporated in Michigan to manufacture oil burning apparatus for asphalt street repairing, installation in electric railway cars, production of house furnace burners and the manufacture of oil burning hand torches. The company is incorporated for \$100,000. Its officers are W. McK. White, president; W. G. Chausse, vice-president; Wray P. White, secretary. Offices have been opened at 206 Lincoln Building, Detroit, and plans are being made for location of a factory either in Detroit or in a near-by city. The apparatus which the Chausse Company will make has been produced in a small way for several years for use by steam and electric railways, street paving contractors and municipal boards of work. The 3-gal. Chausse torch, used for thawing switches and signal mechanism, has been a standard in steam railway signal departments for several years.

New Advertising Literature

Mica Insulator Company, New York, N. Y., has issued a circular, together with a revised price list and discount sheet, of its electrical insulating materials. The price list is got up for the convenience of jobbers, dealers and all those using insulation materials.

Lebanon Boiler Work, Philadelphia, and Lebanon, Pa., is distributing Bulletin 23-A, describing its Uniflow improved return tubular boilers. Among other things the bulletin points out that of 465,000 stationary boilers in the United States in 1920 (omitting those in the contracting field), 60 per cent were of the fire-tube type, mostly horizontal return tubular boilers.



The correct principle is there!

PEACOCK

Improved Brakes

utilize an eccentric winding drum

LEVERAGE applied when required and in the amount required, is the underlying reason for the striking success of Peacock Brakes.

The ordinary hand-brake system, winding chain, as it does, on a little spindle or a circular drum, entirely misses the fundamental requirements for an adequate hand brake. That requirement is that it shall apply maximum braking power in the shortest possible time. With its fixed radius winding spindle, the ordinary hand-brake unit sacrifices either speed or braking power, or it must compromise between the two.

Both speed and braking power are gained with the Peacock patented eccentric chain-winding drum. The *eccentric* is right in principle. It gives fastest winding on the largest radius while the chain is loose—then as the chain tightens up, the smallest radius becomes effective in giving maximum pull on the brake chain.

Actual competitive tests have proved that the Peacock Improved Brake stops the car in the shortest time under practical service conditions.

Try them out yourself!

National Brake Co., Inc.

890 Ellicott Sq., Buffalo, N. Y.

Canadian Representative:

Lyman Tube & Supply Company, Limited, Montreal, Canada

Bankers and Engineers

Ford, Bacon & Davis

Incorporated

Business Established 1894

115 BROADWAY, New York

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SAN FRANCISCO

THE J. G. WHITE ENGINEERING CORPORATION

Engineers—Constructors

Industrial Plants, Buildings, Steam Power Plants, Water Powers, Gas Plants, Steam and Electric Railroads, Transmission Systems

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ON

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OPERATING, TRAFFIC AND RATE INVESTIGATIONS
SCHEDULES—CONSTRUCTION—VALUATIONS
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76 West Monroe Street,

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THE ARNOLD COMPANY

ENGINEERS—CONSTRUCTORS
ELECTRICAL—CIVIL—MECHANICAL

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Consulting Engineer

Appraisals, Reports, Rates, Service Investigation,
Studies on Financial and Physical Rehabilitation
Reorganization, Operation, Management

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ELECTRIC RAILWAY ENGINEER

WORCESTER, MASSACHUSETTS

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Consulting Transportation Engineer

*Specializing in Traffic Problems and in Methods to
Improve Service and Increase
Efficiency of Operation*

PIQUA, OHIO

JAMES E. ALLISON & CO.

Consulting Engineers

Specializing in Utility Rate Cases and
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1017 Olive St., St. Louis, Mo.

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CONSULTING ENGINEER

Rate, Traffic and Reorganization
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Fort Wayne, Indiana

STEVENS & WOOD, INC.

ENGINEERS

Design and Construction of Steam and Hydro-Electric Power Stations,
Transmission Lines: Railroad Electrification and Industrial Plants.

Reports and Valuations

Management and Financing of Public Utility and Industrial Corporations.

Mahoning Bank Bldg.
Youngstown, Ohio

120 Broadway
New York

WALTER JACKSON

Consultant on Fares, Buses, Motor Trucks

*Originator of unlimited ride, transferable weekly
pass. Campaigns handled to make it a success.*

143 Crary Ave., Mt. Vernon, N. Y.

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Engineers—Constructors—Managers

Hydro-electric Railway Light and Industrial Plants
Appraisals and Reports

CLEVELAND
1570 Hanna Bldg.

NEW YORK
84 Pine St.

**Byllesby
Engineering & Management
Corporation**
208 S. La Salle Street, Chicago
New York Tacoma

KELLY, COOKE & COMPANY
Engineers
149 BROADWAY NEW YORK 424 CHESTNUT STREET PHILADELPHIA

Dwight P. Robinson & Company
Incorporated
Design and Construction of
Electric Railways, Shops, Power Stations
125 East 46th Street, New York
Chicago Philadelphia Youngstown Los Angeles Montreal Rio de Janeiro

J. ROWLAND BIBBINS
Engineer—921 Fifteenth St., WASHINGTON, D. C.
TRANSPORTATION
Complete Transit Surveys and Development Programs, adapting Motor-Transport, R.R. Terminal and City Plans. Traffic, Service, Routing, Operation and Valuation.
EXPERIENCE IN 20 CITIES

**Transmission Line and Special Crossing
Structures, Catenary Bridges**
WRITE FOR OUR NEW DESCRIPTIVE CATALOG
ARCHBOLD-BRADY CO.
Engineers and Contractors SYRACUSE, N. Y

 **DAY & ZIMMERMANN, INC.**
ENGINEERS
*Design, Construction
Reports, Valuations, Management*
NEW YORK PHILADELPHIA CHICAGO

ANDREW SANGSTER & COMPANY
Consulting Accountants
New York and Chicago
Rate Investigations Consolidations
Depreciation Studies Reports to Bankers
25 Broadway, New York

THE P. EDWARD WISH SERVICE
50 Church St. Street Railway Inspection 131 State St.
NEW YORK DETECTIVES BOSTON

When writing the advertiser for information or prices, a mention of the Electric Railway Journal would be appreciated.



BY virtue of its success as manufacturers of railroad car fixtures during the past thirty-five years, the O.M. Edwards Company is qualified to design and make bus equipment of a very high standard.

Edwards Fixtures Complete the Comfort of Passengers

Edwards Bus Window Fixtures are designed for ease of attachment, freedom from trouble, beauty of appearance and enduring service.

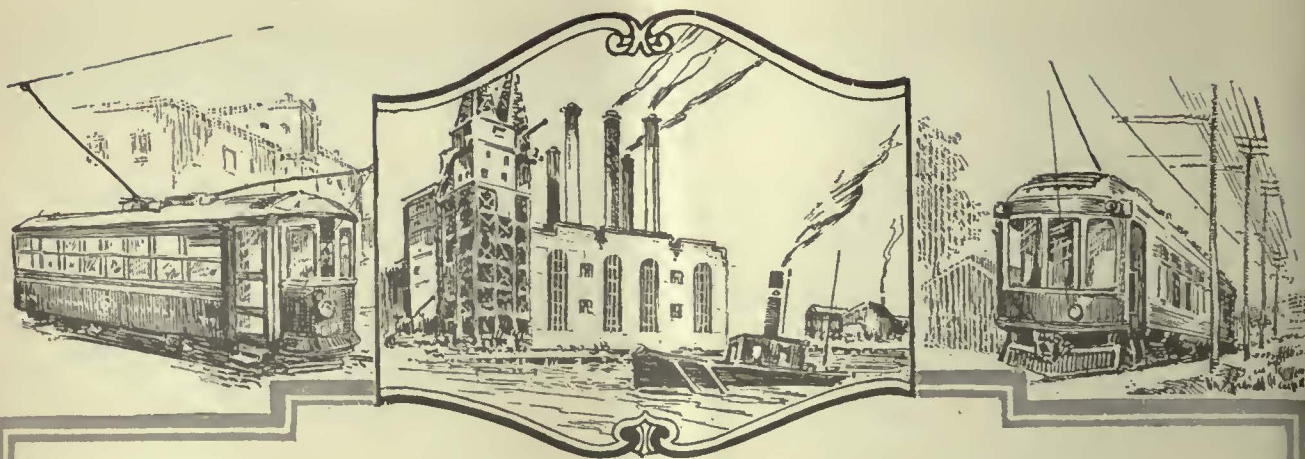
Edwards Anti-rattle Devices stop the jarring racket of loose window sash so annoying to passengers, and protect the glass from breakage because of too rapid dropping.

*Used By Many Of The Best Known
Bus Lines In America*

- Window fixtures
- All metal sash balances
- Sash locks and racks
- Sash lifts
- Anti-rattle compression devices
- Metal stop casings and parting stops
- Top, bottom and side weather stripping
- Steel vestibule trap doors
- Trap door locks and latches

The **EDWARDS** Co. Older Office and Factory
O.M. **EDWARDS** Inc. Syracuse, N.Y.
Canadian Representative: CHICAGO NEW YORK
Lyman Tube and Supply Co., Ltd., Montreal and Toronto





Give 'Em Air

Air brakes are adjusted to operate best at certain definite pressures.

To get those pressures—and maintain those pressures, there should be no leaks.

Leaks in the air lines can be found and quickly remedied.

But most air is “lost” because of worn rings in the air compressor.

There you have it—it’s all a matter of clearance.

For if the clearance permits the air to leak past the rings, it’s like trying to carry water in a leaky bucket.

If the rings are badly worn there’s no cure but new rings.

If the wear is not great, it can be stopped by the use of the correct grade of Lubricating Oil.

This is so. And we have proven it on thousands of cars by providing the right grade of *Texaco Electric Railway Compressor Oil*.

Texaco Electric Railway Compressor Oils are made in two grades—a summer grade and a winter grade—because the use of oils adapted to seasonal conditions is just as important on compressors as on any other piece of equipment.

Compressors lubricated with Texaco Electric Compressor Oil don’t “smoke.” This splendid lubricant holds compression so well that no excess oil is carried over to vaporize or cause that blueish cloud of “smoke.”

This condition of perfect lubrication prevents wear as well as carbon in the cylinders. When air compressors are imperfectly lubricated the rings wear; oil leaks past—carbonizes. Carbon scratches rings and cylinder walls—more wear; more oil leakage and continual loss of compression.

On the other hand in a Texaco lubricated compressor the rings fit snugly after many miles of service. THAT means an efficient air compressor—one that delivers the full amount of air with each stroke.

You can tell a Texaco lubricated air compressor by its action. A few crisp beats and the air receiver is filled up to the required pressure. Your motormen don’t have to wait for the air—it’s there when they need it.

Remember this:—A leaky air compressor is like a boy filling a tank with a leaky bucket. He can do it but it takes more trips to get the work done.

There is a Texaco Lubricant for Every Purpose.

and they are unexcelled for the Lubrication of Street Railways, on Rolling Stock, in Power Plant or Shop.



THE TEXAS COMPANY
DEPT. R-J · 17 BATTERY PLACE · NEW YORK CITY
HOUSTON · CHICAGO · NEW YORK
OFFICES IN PRINCIPAL CITIES



THERMIT RAIL WELDS



Making a Thermochemical weld in Indianapolis—The Thermochemical reaction

No Joint Troubles for Indianapolis!

"Our experience based on four years is very favorable and is proven by our increased orders for 1922"—so says the Engineer of the Indianapolis Street Railway, which has already installed about 2,000 Thermochemical Welds.

The rapidly growing appreciation of street railways in favor of the Thermochemical Rail Weld is emphatically proved by the large number of Thermochemical welds ordered in 1922, which increased almost 300% over the previous year. An analysis of this increased business brings out some very striking facts:

1—A very large part of the increase is traceable to re-orders from customers who have been using the process for years, some for ten years or more, and who used it on a still greater scale in 1922 because of the excellent results previously obtained.

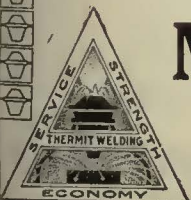
2—A very great part of the increase is due to business from properties who have never used the process before but who adopted it when they found out how efficient and economical it has proved to be on the other properties. Most of these new properties adopted the Thermochemical Rail Weld not because of solicitation on our part but on the recommendation of other customers.

If you contemplate any track construction tell us the approximate number of joints and section number of rail so that we can submit an estimate on the cost of eliminating your joints and prolonging the life of your track.

Metal & Thermochemical Corporation

120 Broadway, New York

PITTSBURGH CHICAGO BOSTON S. SAN FRANCISCO TORONTO



Report of Investigation of
“INDIANAPOLIS”
 Type of Welded Rail Joints

They Meet All Requirements

To Wit as Follows:

1. **Conductivity**—138%—United States Bureau of Standard Test.
2. **Strength**—Over 100%—Robert W. Hunt & Co., Testing Laboratories.
3. **Endurance**—11 Years in Service—Still Intact.
4. **Dependable**—Less than 1% Failure. When installed as directed by manufacturer.
5. **Economical**—Cost Less Than Bolted and Bonded Joints.
6. **Available**—Any road. Any quantity—from One (1) to Ten Thousand (10,000).
7. **Universal**—In use on over 125 Different Rail Sections.
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WHY?

Because —

They are Scientifically Designed
 A Special Product for a
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Completely and Perfectly Effecting the
“CONTINUOUS RAIL”

*“Perfection in Principle Proven
 in Performance”*

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MERITAS LEATHER CLOTH

The Leading Leather Substitute

Endorsed as superior, after U. S. Army Tests

Meritas Leather Cloth has been a leader in this field, in both quantity and quality production for the last twenty years. It has been tried and consistently proved superior, in thousands of severe tests.

A digest of a report made by the Air Service, U. S. Army, contains a statement that Meritas Leather Cloth stood up better than any other ever seen at that testing station; that Meritas looks and works like real leather, and after many severe tests was found very satisfactory.

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No service can be required of a leather cloth that is more severe than the thorough and exacting tests of the U. S. Government.

Samples for your specific requirements will be sent, on request.

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Dept. E. R. J.



The Heat Test

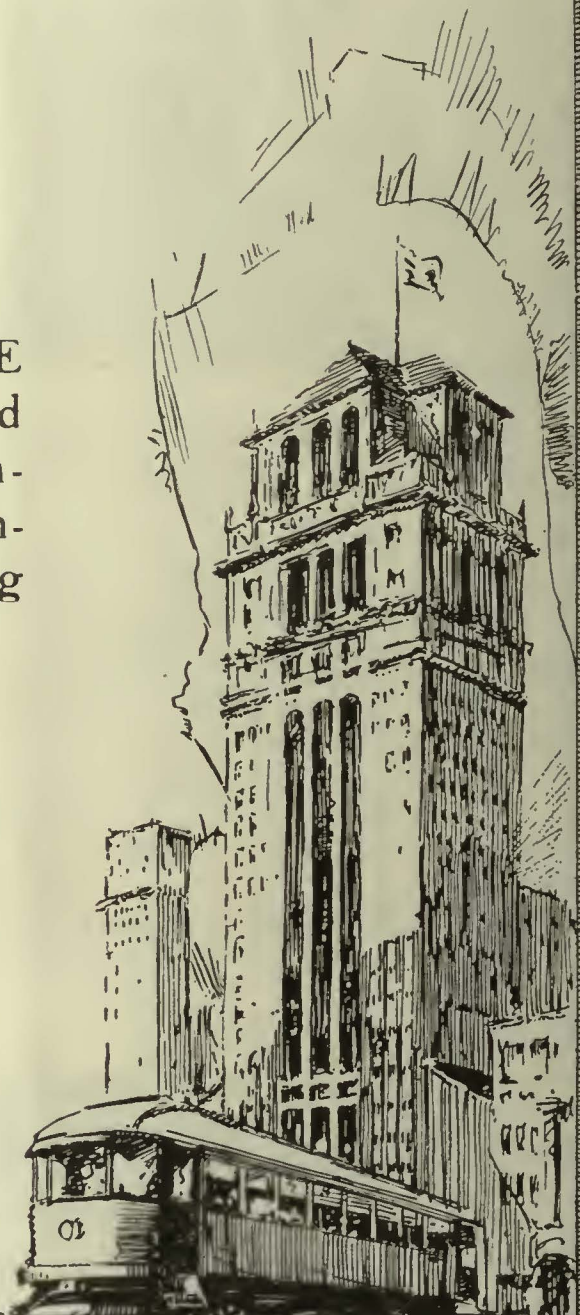
Hold a lighted match under corner of Meritas Leather Cloth. Notice there is no rim of free oil preceding flame. There is no non-drying oil in Meritas to come to the surface, get sticky or stain clothes. Try this on other materials and see what happens.



The Abrasion Test

Rub the edge of a coin across the surface of Meritas Leather Cloth. Press hard. Do it repeatedly. No surface coating comes off and very little impression is made on the embossing. Try this on other goods and prove for yourself which stands the hardest wear.

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Barron G. Collier
 INCORPORATED

CANDLER BLDG NEW YORK

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"Or Equal" is a dangerous way of specifying when desiring Consolidated Car Fender Equipments.

To cheapen the quality of materials construction and workmanship—to make something that covers the law—is not our policy. The Consolidated Car Fender Company's H-B Lifeguards and Fenders are built to save life, to withstand exposure, abuse and hard service to which equipments of this kind are subjected.

The name Consolidated Car Fender Company is your protection as it is our greatest asset.

When ordering or specifying stipulate that the guards or fenders be manufactured by the Consolidated Car Fender Company. It will pay you, and make a difference in your maintenance costs.

Send to us for prices and information when in the market for repair parts. We are ready to serve you promptly.



The
COLUMBIA
Armature
Stand

The Columbia Armature Stand is a patented stand with a ten-inch height adjustment. It protects the equipment and because of its square thread screws, is easy for the workmen to handle.

The roller bearings are in cradles and there are pockets for table irons.

It can also be adapted to many shaft repair jobs about the shop, and will be found useful in other ways.

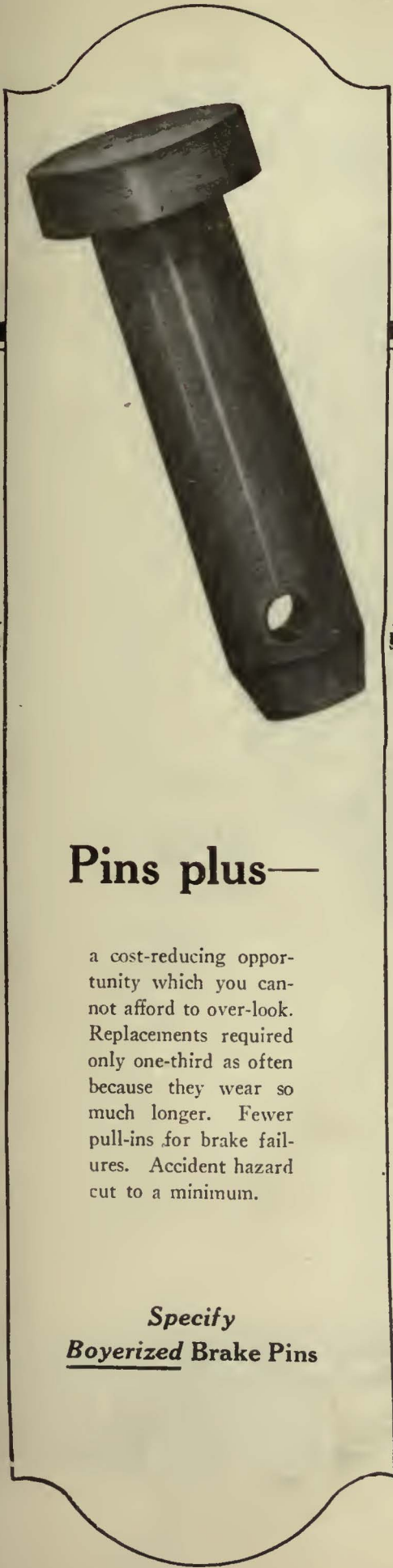
If your shop is not equipped with an adjustable armature stand, you will find it worth while to investigate the Columbia Adjustable Armature Stand.

*NOTE—Our telephone number
has been changed to
Applegate 3200-1-2*



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N. Y.



Pins plus—

a cost-reducing opportunity which you cannot afford to overlook. Replacements required only one-third as often because they wear so much longer. Fewer pull-ins for brake failures. Accident hazard cut to a minimum.

**Specify
Boyerized Brake Pins**



“It’s a hard world!”

That’s why—

we make Boyerized Parts so tough and durable. Rubbing up against a hard World, they need be. The life of brake pins, bushings and other wearing parts on a railway car truck is no easy one. There’s no room there for delicate soft-skinned equipment. It’s the tough, lasting, glossy-finished surface given by our patented Boyerizing Process, that more than triples the life of Boyerized parts.

The BOYERIZED List

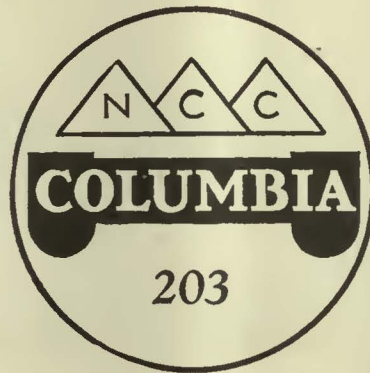
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|----------------------|-----------------------|
| Brake Pins | Spring Posts |
| Brake Hangers | Bolster and Transom |
| Brake Levers | Chafing Plates |
| Pedestal Gibs | MacArthur Turnbuckles |
| Brake Fulcrums | Manganese Brake Heads |
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|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

Boyerized Parts cost slightly more because they last three or four times as long as parts of ordinary untreated steel. Let us quote you on your requirements.

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Reliable Brushes for Electric Traction



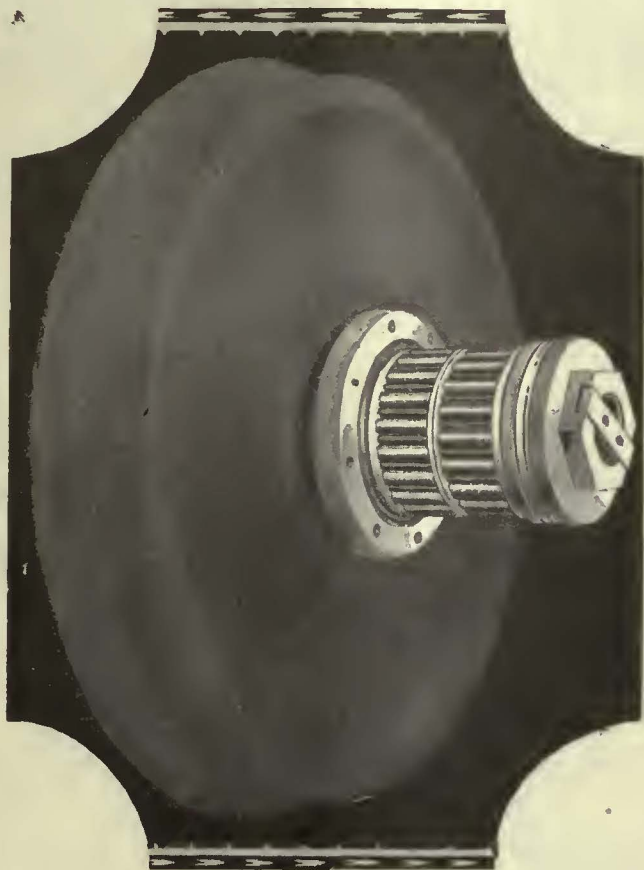
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The Stafford Roller Bearing has a double row of staggered rollers. This exclusive—and revolutionary—feature of design prevents the weight of the car from being constantly lowered and raised as each roller approaches and passes the crown of the journal, as is the case with ordinary roller bearings.

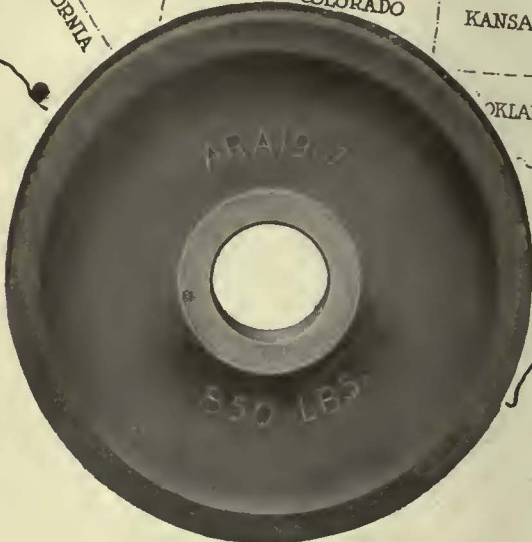
Let us show you the Stafford Roller Bearing so you can prove the truth of this statement yourself.

Stafford—guaranteed three years

STAFFORD ROLLER BEARING CORPORATION
CAR TRUCK  **CORPORATION**
 LAWTON MICHIGAN
 "IT ROLLS THE FRICTION AWAY"

50

Delivery Points



CHILLED IRON WHEELS
for railway and street car service. Capacity 20,000 per day. 25,000,000 in service.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
1847 McCormick Bldg., Chicago

THE map above shows the location of the 50 foundries in the United States and Canada, represented by the Association of Manufacturers of Chilled Car Wheels.

- | | |
|-------------------|--------------------|
| Chicago, 4 | Sayre, Pa. |
| St. Louis, 2 | Berwick, Pa. |
| Buffalo, 4 | Albany |
| Pittsburgh, 2 | Toronto |
| Cleveland, 2 | New Glasgow, N. S. |
| Amherst, N. S. | Madison, Ill. |
| Montreal, N. S. | Huntington, W. Va. |
| Mich. City, Ind. | Wilmington, Del. |
| Louisville | Houston, Tex. |
| Mt. Vernon, Ill. | Hannibal, Mo. |
| Ft. Wayne, Ind. | Reading, Pa. |
| Birmingham | Baltimore |
| Atlanta | Richmond, Va. |
| Savannah | Ft. William, Ont. |
| Boston | St. Thomas |
| Detroit | Hamilton |
| St. Paul | Ramapo, N. Y. |
| Kansas City, Kan. | Marshall, Tex. |
| Denver | Los Angeles |
| Tacoma | Council Bluffs |
| Rochester, N. Y. | |

American Railroad Association Standards

- | | |
|-------------------|-----------------------|
| 650 lb. wheel for | 60,000 Capacity Cars |
| 700 lb. wheel for | 80,000 Capacity Cars |
| 750 lb. wheel for | 100,000 Capacity Cars |
| 850 lb. wheel for | 140,000 Capacity Cars |

The Standard Wheel for Seventy-Two Years

CHILLED IRON WHEELS



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Governor for
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The dependability of this governor has led to its adoption by railways and other users of air compressors.

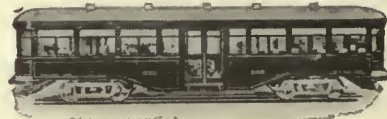
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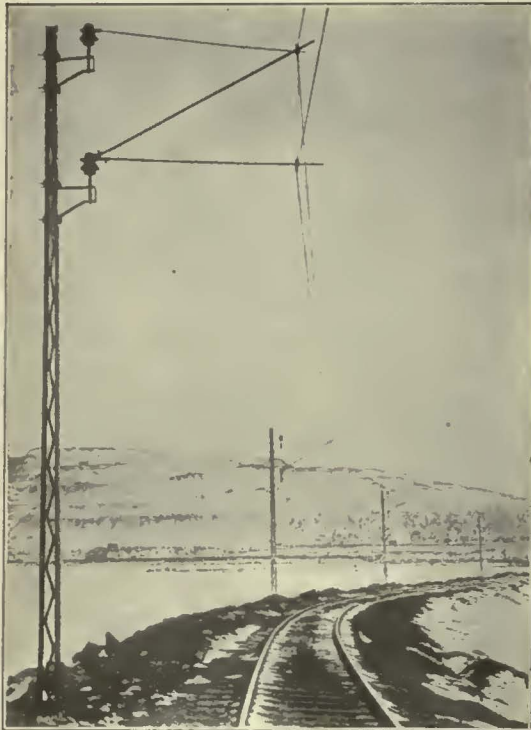
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"Pole Value"

Every buyer of poles is concerned primarily with securing the most obvious "pole value" for the minimum investment.

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Suspension



Adjustable Insulated
Crossover

Albert & J. M. Anderson Mfg. Co.

Established 1877

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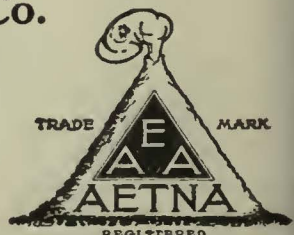
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They give an arrestive warning at the highway against the approach of your interurban trains by loud ringing bell and flashing red lights. Before he reaches the crossing they give the motorman a special indication that he has started the bell ringing. Made also with swinging wig-wag. Operated entirely from trolley power, and at the highest possible car speeds. Their cost is but little—and by their insistent warning they save damage suits and expensive litigation.

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Remember Nachod Spells Safety!

Nachod Signal Company, Inc.
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Also manufacturers of Block Signals, Automatic Headway Recorders.



Insulating with the Dayton Air Brush

2—Armatures and Fields

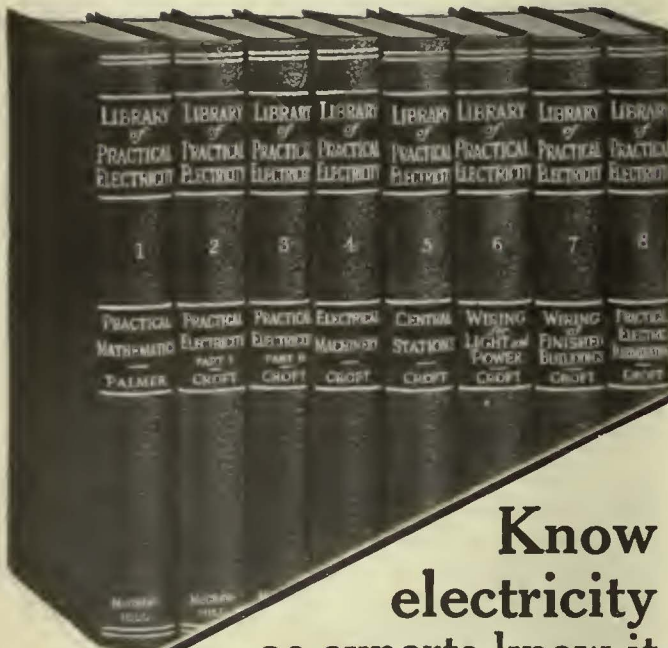
Deep penetration, uniform and complete covering are assured when insulating varnishes and baking enamels are applied with the Dayton Air Brush. Experience on many properties has proven that field and armature coils treated this way will last longer without overhauling, and cost far less to do. The Dayton Air Brush method is the quick efficient and economical method.

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You have to belong to the family to really see and appreciate a lady's charms.

Communtation is a similarly shrouded affair.

If you use cheap brushes you get a veiled sort of communtation.

But unless you become one of the Morganite family—you can't get a really close-up view of, and enjoyment from, good communtation.

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S. A.
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Bases with Detachable Pole Clamps

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Given by Two
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Clear and Distinct
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Sunlight will not make them
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Operating mechanism low on pole for easy inspection.
Indicators placed where best seen by motorman.

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No. 2



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THE "WIRE LOCK" / THE CHAMFERED JOINT
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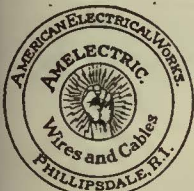
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COMPLETE LAYOUTS

IMPROVED ANTI-KICK BIG-HEEL SWITCHES

HARD CENTER AND MANGANESE

CONSTRUCTION

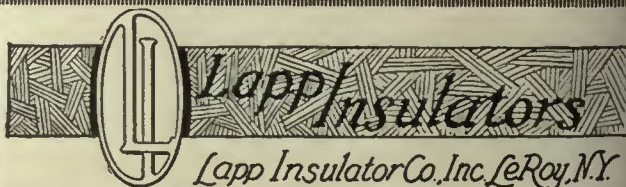
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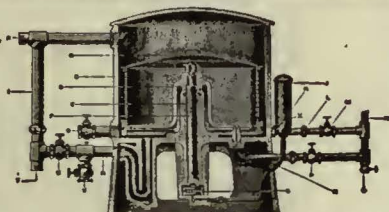
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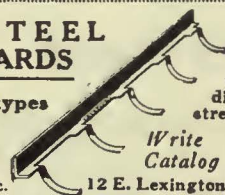
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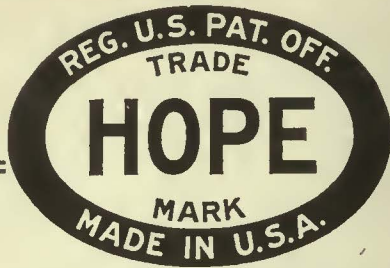
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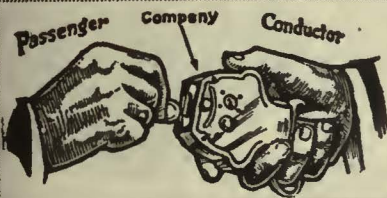
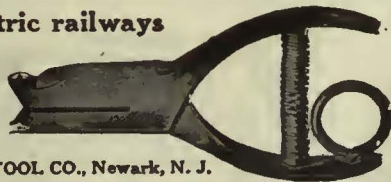
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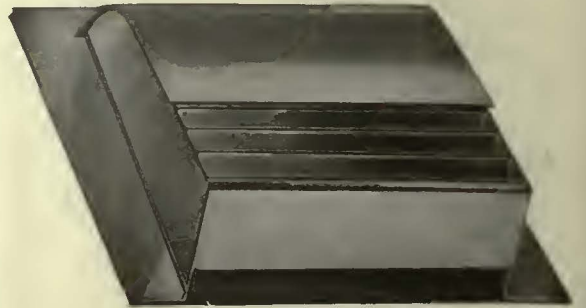


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Electric Service Supplia Co.
Ears
Ohio Brass Co.
Electric Grinders
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Indianapolis Switch & Frog
Co.
Railway Track-work Co.
Electrodes, Steel
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Co.
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Roebblings Sons Co., J. A.
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Beckwith-Chandler Co.
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& Douglas
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Nat'l Ry. Appliance Co.
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Fence Posts
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Frogs, Track. (See Track
Work)
Frogs, Trolley
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Pittsburgh Electric
Furnace Corp.
Furniture, Metal Office
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Western Electric Co.
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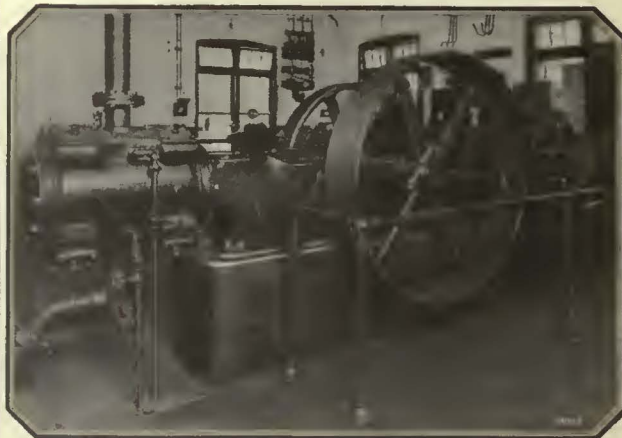
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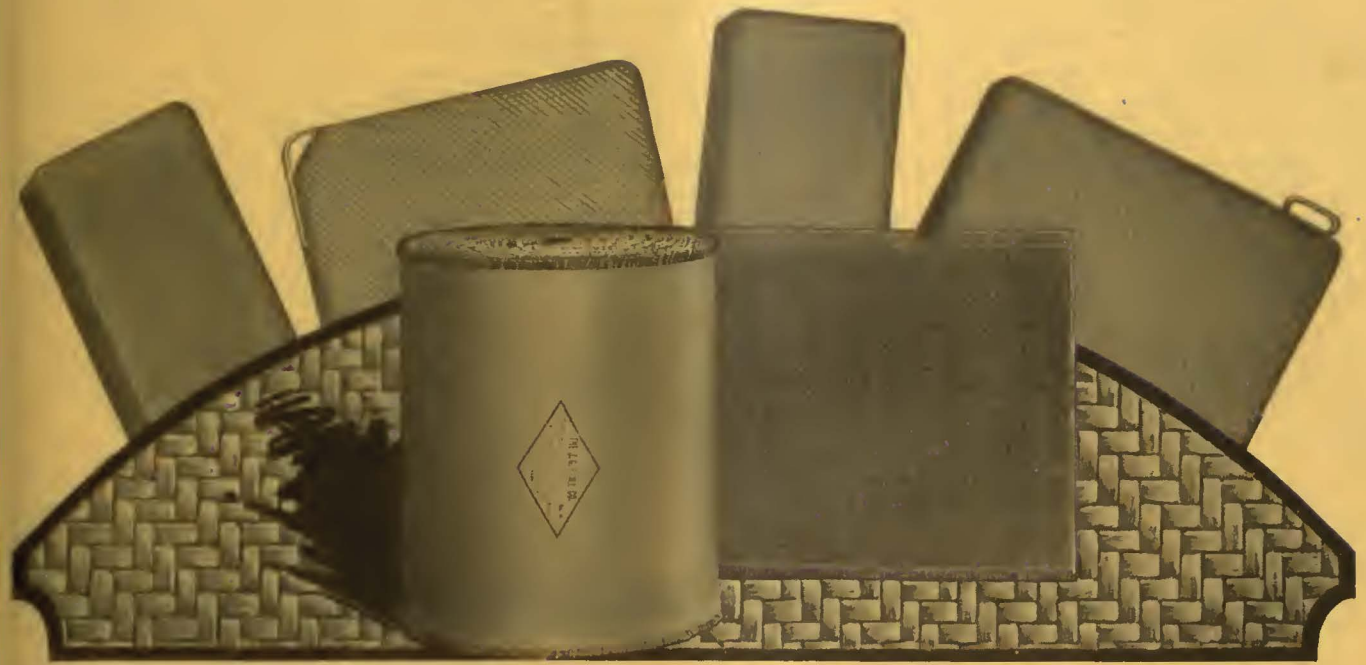


The No-Staff Brake for any size and type of car

Apply the advantages of the staffless brake with its space-saving features, to all your cars. Ackley No-Staff Brakes are adaptable to any kind of service. The eccentric chain-winding drum insures quickest applications and maximum power.

Price only \$32.00





Old Seats Made New

Brill Twill-Woven Seating Rattan

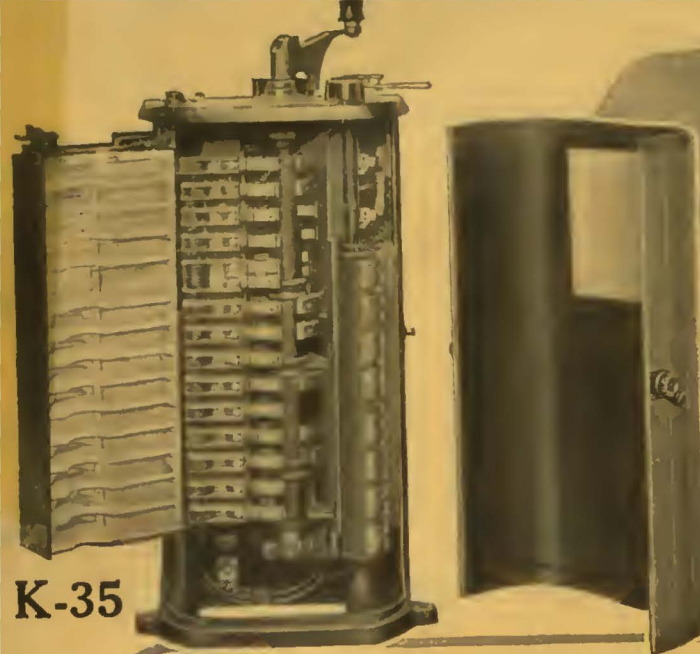
Old and worn looking seats will always detract from an otherwise attractive service. To maintain the clean and attractive appearance of your cars bright new seat covering of Brill Twill-Woven Seating Rattan will prove a valuable asset.

Manufactured from specially imported cane in our own plant both the canvas-lined and unlined Rattan is ready for shipment to you in widths from 14 to 36 inches.

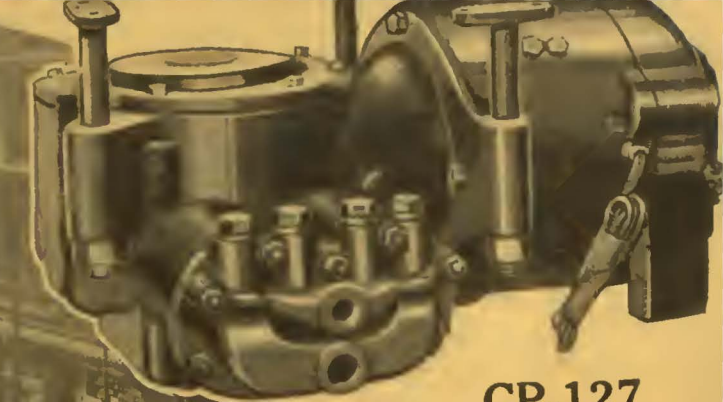



THE J. G. BRILL COMPANY

 PHILADELPHIA, PA.
 AMERICAN CAR CO. — G.C. KUHLMAN CAR CO. — WASON MAN'G CO.
 ST. LOUIS MO. CLEVELAND, OHIO. SPRINGFIELD, MASS.



K-35



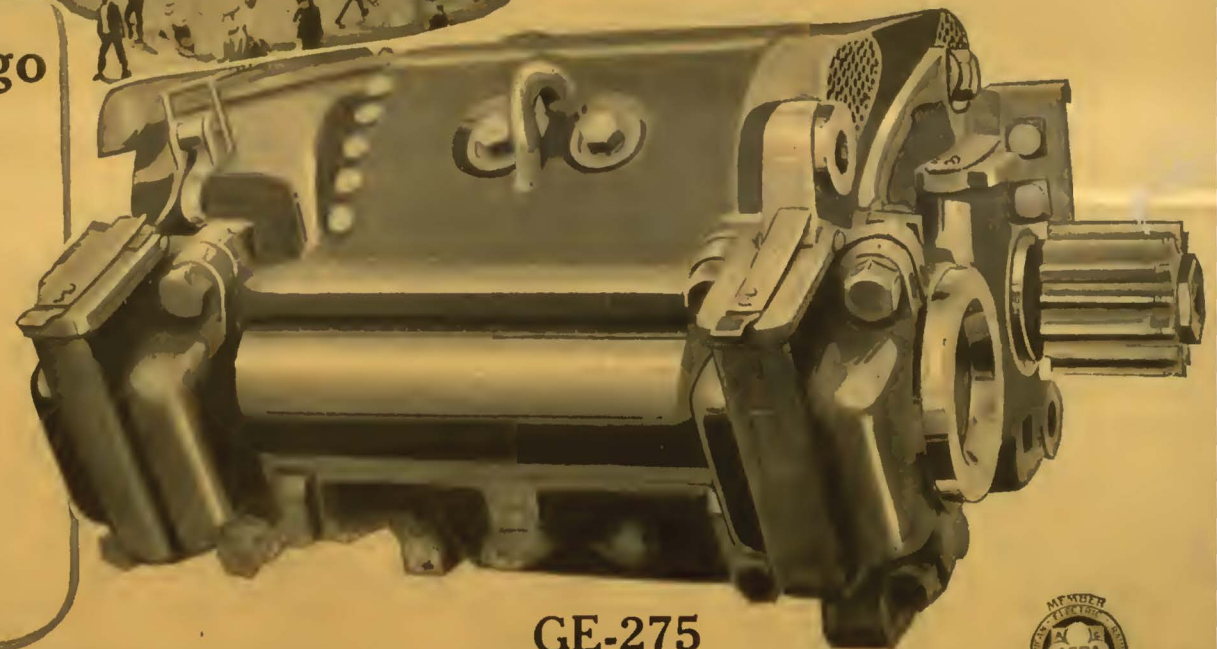
CP-127

400 More Motors for Chicago

Successful operation of the GE-275 Motors on the Chicago Surface Lines has led to a repeat order for 400, making a total of 766 GE-275 Motors for that system.

The first 366 motors, ordered last fall, are for interchangeable use on double-end, wide-platform, two-man cars to handle trailers or on light-weight one-man cars.

These 400 additional GE-275 Motors will be used as four-motor equipments, with K-35 controllers and G-E Line Breakers. The Air Brake Equipment for these 100 cars is also "G-E", with CP-127 (20 cu. ft.) compressors.



GE-275



General Electric Company
Schenectady, N. Y.



GENERAL ELECTRIC