MAINTENANCE AND CONSTRUCTION ISSUE

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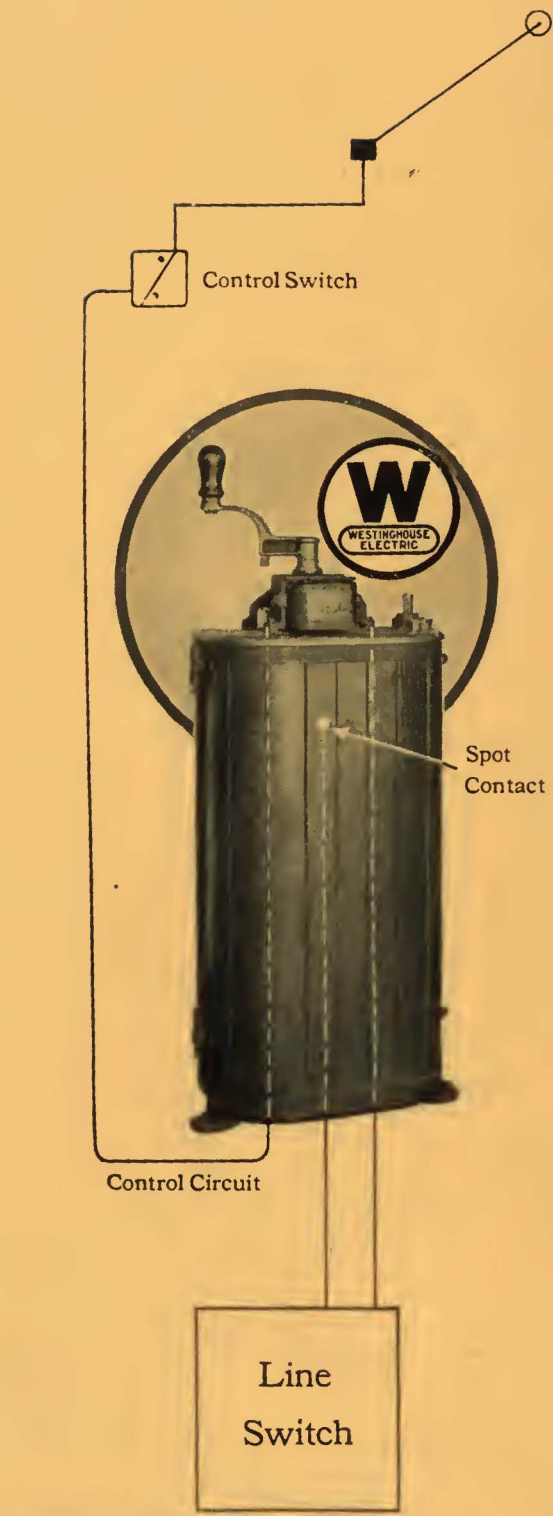
ELECTRIC RAILWAY JOURNAL



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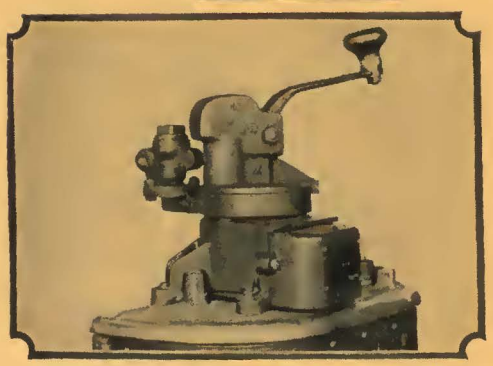

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Vol. 69
No. 8

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FEBRUARY 19, 1927

Straining at the Leash

READER, to appreciate the problems of a publisher, you should drop around at the "dead line," when everyone from copy boy to the press operator is straining at the leash. It is then that you would experience some of the strain and realize that romance enters into the publishing business. Amid the cacophony of rumbling presses and clicking linotype machines, there is always an overpowering sense of responsibility that nerves each editor, in fact everyone who enters into the production of the "book," to see that there are no errors and that last minute news is included in the edition.

When ELECTRIC RAILWAY JOURNAL reaches the "dead line," every man is at his post, conscious of his responsibility, a responsibility accepted as part of the game, but nevertheless one that never fails to inspire those upon whom it rests. This sense of responsibility makes your JOURNAL accurate, informative, and the criterion of all that is best in the electric railway industry. It is this straining at the leash that brings romance and excitement as well as enormous responsibility to the publisher. He accepts it gladly, if conscious that his reward will be the unqualified support of his readers.

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New Type Interurban Cars Attract More Riders

Gary Railways' Patrons are Enthusiastic in appreciation of new Equipment

Interior view, showing dome lighting, plush seats, metal sash, etc. Notice on the exterior view, above, that the window guards raise with the windows.

SEVEN new light-weight one-man cars of the type illustrated were recently placed in service by the Gary Railways, for interurban work between Gary and Hammond, Indiana. These cars replace heavy two-man cars of older type. The line serves several steel mill towns, and the traffic is heavy, particularly during the rush hours, when thousands of mill workers are carried to and from their work.

Previous to being placed on the line the cars were exhibited for several days. During the exhibition and since the inauguration of the new service, visitors and passengers alike have expressed their enthusiastic approval of the new cars.

Plush seats, dome lights, linoleum floors, treadle operated exit, safety features,—in other words, all the characteristics of the *modern* car, are found in these new cars, built by

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Successor to McGuire-Cummings Mfg. Co.

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—develop a retarding force sufficiently powerful for stopping even the heaviest bus quickly to increase safety and permit faster schedules.

—provide automatic equalization to minimize skidding and lengthen life of brake linings.

—relieve the driver of braking fatigue to increase safety and utility.

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Today we demand that every means of transportation at our disposal be rapid, as well as safe.

The automotive industry is producing motor coaches that are commodious, comfortable, "get there quickly," and are SAFE, because—

Westinghouse Air Brakes are now recognized by leading bus builders as the most satisfactory means of safeguarding highway transportation.

"Pioneers and specialists in air brake development and manufacture since 1869."

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

WESTINGHOUSE
AUTOMOTIVE AIR BRAKES

Wilcox High Speed Bus Equipped with 6 Cylinder Waukesha Engine

(A-709-LC)

Waukesha in the Northland

From Minneapolis to Duluth with its many railroad crossings, towns and almost impassable detours these Wilcox, Waukesha Equipped buses have to maintain railway speeds and schedules summer and winter. After more than a year's service in competition with the best buses made in America it is significant that the Northland Transportation Company operating them is putting more and more Waukesha Equipped Buses in their service.

Waukesha Heavy Duty Six Cylinder Bus Engines are different in design and performance from all other engines in this service. They have the "Ricardo Head," which gives greater power and fuel economy and also eliminates "pinging." The dual cylinder heads prevent head trouble. "Truncated Cylinders" give longer life and more uniform lubrication, "Girder Type" crankcase insures great rigidity and combined with a large crankshaft insures vibrationless performance. These are only a few of the features. Write for "Six Cylinder Bulletin," giving more information about them.

(A-712-LC)

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Waukesha **Wisconsin**

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Exclusive Builders of Heavy Duty Automotive Type Engines for Over Twenty Years

39½ per cent

IT IS significant that within the short space of two years, Studebaker busses have won a position of leadership in Ohio, a pioneer motor bus state.

Experienced operators were quick to recognize the outstanding qualities of Studebaker equipment and today of the 1,049 busses of 43 different makes operating in the State of Ohio, 415 are Studebakers.* The next three makes have 129, 99 and 64 respectively. This gives Studebaker 39½ per cent of the total and a decided dominance over all other makes!

Such popularity is based on three major advantages which Studebaker equipment offers the operator. First, the lower initial cost; second, the extraordinary long life; and third, the outstanding economy of operation of Studebaker busses.

*Taken from the Ohio Public Utility Commission's records of Franchise Registrations.

STUDEBAKER

of all Ohio Busses are STUDEBAKERS

Seven Reasons Why Studebaker Busses Predominate

1 ***Power*** According to the ratings of the Society of Automotive Engineers the specially designed Studebaker bus chassis is the most powerful of its size and weight in the world.

2 ***Low Maintenance Cost*** The fact that Studebaker busses stand up under the most severe service minimizes the need of repairs. But the simplicity of Studebaker construction is a big factor of economy, for it results in reduced labor costs, when repairs are necessary. Every part of the chassis is easily accessible. Studebaker cylinder heads are removable.

3 ***Low First Cost*** Large scale production in modern plants by the most efficient methods of manufacture reduce production costs of Studebaker busses to a minimum. Economies thus effected enable Studebaker to offer greater bus values. Complete Studebaker busses, costing five to six thousand dollars, are comparable only with busses selling from ten to twelve thousand dollars.

4 ***Remarkable Mileage*** Every Studebaker chassis has tremendous mileage built into it. Only the finest materials are used. Premiums are paid for special alloy steels. As a consequence every Studebaker unit is capable of delivering at least 100,000 miles of dependable service. This is proved by a recently published list of 256 Studebaker busses having mileage figures ranging from 100,000 to 300,000 miles each and which are still in service.

5 ***Proper Size*** Studebaker busses weigh 50 per cent less than the average bus and are operated for 25 to 50 per cent less than the average truck type bus seating from 25 to 30 passengers. When the average load of 10 passengers is carried the Studebaker bus requires only 5 passengers to pay operating costs while the average 25 passenger bus requires 8 passengers. Thus the Studebaker bus carries 5 profit producing fares (on the average load) as opposed to 2 profit producing fares of the larger capacity bus.

6 ***Lower Depreciation*** Compare the cost of a Studebaker at $6150 and the cost of a large truck type bus at $10,000, each turning an average of 50,000 miles annually, the depreciation figured at a conservative 20 per cent is but $1230 or 2.5 cents a mile for the Studebaker against $2,000 or 4 cents a mile for the larger type bus.

7 ***Economy*** An investigation of operating costs of six different bus chassis in 8 cities showed that it cost seven to nine cents less per mile to operate a Studebaker bus.

Studebaker 20-Passenger
Parlor Car De Luxe
$6150
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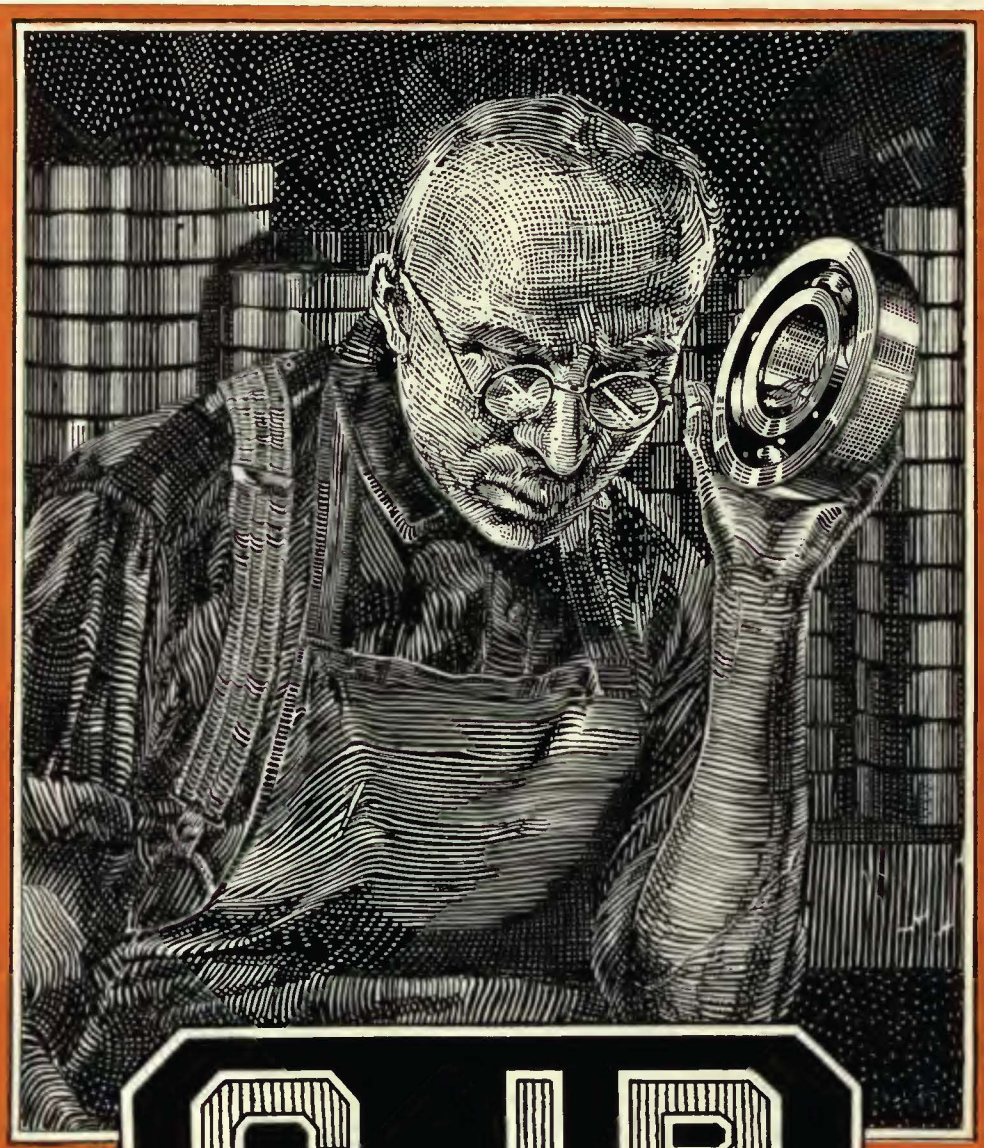
BUSSES

More profit per Passenger Mile



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The only ball bearings in the world made by highly skilled men using the exacting methods of old world precision and the most efficient machines developed by new world genius.

Back of this, lie 16 years experience and the largest active service organization with thirty-five branches. Ahlberg engineers are always ready to co-operate with users of ball bearings regardless of requirments.

This advertisement is number one of a series picturing the thoroughness of Ahlberg Methods.

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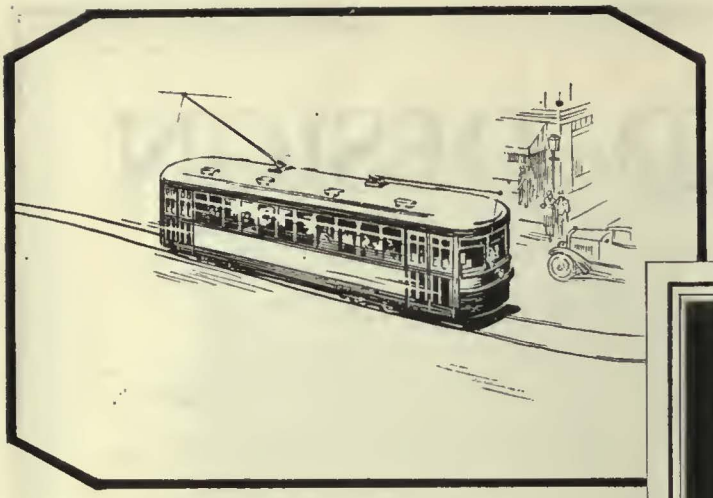

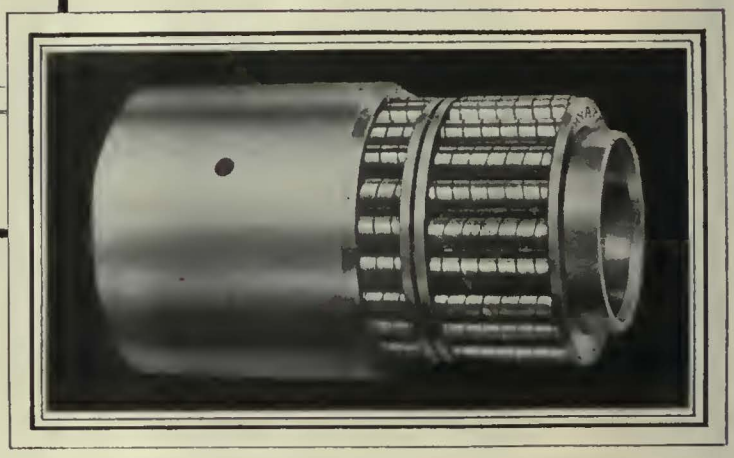

True Anti-Friction Bearings for railway car journals

Hyatt Roller Bearings take the jolt out of railroading.

They promote smooth and rapid acceleration—coasting instead of pulling. Their motion is frictionless.

Rain, snow and dust cannot interfere with their easy operation.

Hyatts consume but a fractional part of the oil which brass bearings require. Their mileage is several times greater in comparable service.

Hyatts are true anti-friction bearings—and are unusually quiet.

A mechanical engineer from the Hyatt Railroad Department will be glad to present some interesting facts on operating economy.

HYATT ROLLER BEARING COMPANY
NEWARK, NEW JERSEY

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QUIET ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

GE Insulating Varnishes help to keep motors in service

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Good insulating varnish is *protection.* It helps to keep cars on the road.

General Electric Insulating Varnishes, developed in its Research Laboratories for its own apparatus, are dependable. These varnishes of the original equipment quality used in G-E Railway Motors are available to you.

IN THIS CATALOG

a complete listing of the following G-E Insulating Materials. Write for it.

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Motor Tubing
Asbestos and Cotton Tapes
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The G-E Merchandise Distributor near you is in a position to render you valuable service. He can supply G-E Insulating Materials from his warehouse. His stocks are complete—his deliveries prompt.

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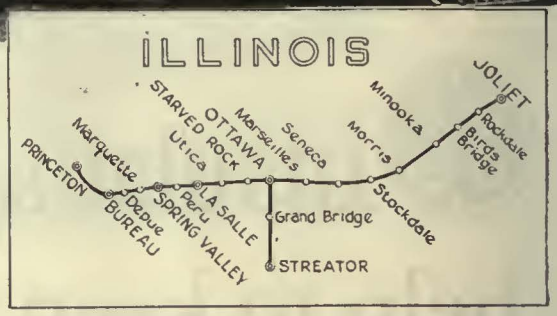
GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

Through specific figures, facts are revealed. Experience of a few years with modern light-weight cars, both city and interurban, has furnished convincing proof that new revenues can be developed and substantial savings effected.



A significant page from recent Illinois Traction history

In 1924 this company replaced its 94,000-lb. interurban cars, operated on the Illinois Valley Division, with new 37,000-lb. one-man cars and decreased its headway from 2 hours to 1 hour. The financial gain realized in 1925 from operating these modern cars, which are all equipped with G-E Motors and Control, is indicated by the following facts:

Although two more city cars were operated on the system than in 1923, there was a reduction of 33% in the shop force.

Even with an increase of 70% in interurban passenger car mileage, operating expenses were less by $39,000.

On account of the more attractive cars and reduction in headway, passenger revenue increased $33,000—the total savings, therefore, being about $72,000 or a gross return of about 39% on the investment.

Of 22,239 trains operated in 1923, 92% were on time; in 1925 the number of trains increased to 32,858, of which 97% were on time.

This achievement in improving service and lowering costs of operation is another instance of the success of modern G-E Car Equipment. For these new Illinois Traction cars, G-E-265 Motors with K-35 Control were selected.

The comparative operating costs per car-mile for accounts affected by the new cars are:

	1923	1925	Saving per C. M.	% reduction
Equipment	3.60	0.95	2.65	73
*Power Purchased	5.80	3.35	2.45	42
Flatform expense	5.17	3.75	1.42	27

*All service

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Published by McGraw-Hill Publishing Company, Inc.

CHARLES GORDON, *Editor*

Volume 69 New York, Saturday, February 19, 1927 *Number* 8

Equipment Men's Conferences Worthy of Active Support

COMPARATIVELY new is a phase of sectional association activity represented by the rapid development during the last few years of territorial conferences among groups of maintenance men. Two groups worthy of mention are the Electric Railway Association of Equipment Men, Southern Properties, and the Central Electric Railway Master Mechanics' Association. A report of the recent Toledo meeting of the C.E.R.A. men is published elsewhere in this issue. The meeting of the Southern equipment men in Memphis was reported in the Feb. 5 issue of the JOURNAL.

Both of these bodies have become actual working conferences of maintenance executives rather than merely sectional association meetings. That the men who take part mean business is apparent to any one who has attended their meetings. Better acquaintance, good fellowship and sectional spirit are desirable and laudable objectives of sectional association activity. But these maintenance men go much further than that. They make a critical comparison of their practices and methods and express their ideas as frankly as in a staff conference on their own properties. Their purpose is to find their own shortcomings, and that is the road to progress. General executives of the properties located in the territories covered by these maintenance groups may well afford to lend full measure of their support and backing.

Greater Interest Is Warranted in Economies of Treated Timber

OPPORTUNITIES to make substantial savings by preservative treatment for ties and timber that are used by electric railways have been much neglected. During the past three or four years there has been a slight increase in the interest shown in this important subject by electric railway mangements, but it has lagged far behind that shown by the steam railroads. General adoption of a policy of obtaining the maximum life of all timber used undoubtedly would save the industry a large sum every year.

Desire to keep the initial expenditure to a minimum is probably the principal reason why electric railways have continued to use large quantities of untreated timber. This is a penny-wise and pound-foolish policy, as in many cases the untreated wood deteriorates rapidly. The criterion of economy is the annual cost rather than the initial. In this connection, the experience of the Boston Elevated Railway, as given in an article elsewhere in this issue, is a convincing argument in favor of preservative treatment. On that system the cost per treated tie per year is only 8.7 cents as compared with 13.3 cents for untreated. Thus treatment has reduced tie cost approximately 35 per cent.

Another important factor not always appraised at its full value is the possibility of using a cheap grade of timber when preservative treatment is applied. In Boston, standard or merchantable grade is now employed for many purposes where previously it was considered necessary to use only hard timber of first quality. Judging by the experience of this company, it appears that the economy claimed for the policy of using untreated timber because of its lower initial cost is largely fictitious, and that real economy in the long run will result from greater use of the preservative treatment process. Moreover, in view of the dwindling supply of timber in this country its conservation by every means has become a moral obligation which should be heeded before increasing costs due to scarcity makes it a financial one.

A Damaged Commutator Invariably Means Expensive Rewinding of the Armature

SO MUCH depends on the perfect operation of a railway motor armature that it is important to keep it in as good operating condition as possible. Even though the armature may appear rugged, the component electrical parts must be insulated from the metal core. This necessarily makes some of these parts relatively delicate. It is a rather simple operation to insulate and support the armature conductors in the core, but to insulate the commutator bars from each other and then insulate the entire assembly from the core and from the shaft makes the problem more difficult.

Nearly every commutator failure that occurs today means a new set of armature coils and a labor charge to strip and rewind the armature, while a coil failure usually does not affect the commutator. Therefore, when purchasing a set of assembled segments to refill a commutator, they should measure up with the highest material and workmanship standards. These requirements are the result of costly investigation over a period of years by both manufacturers and operators.

It is also essential that the commutator be assembled correctly. A certain railway purchased a set of assembled segments to refill a commutator. These met all the requirements of a good specification and the commutator was placed on the armature and the motor returned to service. During the morning rush period of the first day the motor was in operation the motor failed. The trip was completed in order not to tie up traffic, but the commutator bars were strewn along the track. When the car returned to the carhouse and an inspection of the motor was made it was found that the

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

commutator structure had loosened and all of the bars were missing. The armature and field coils were damaged beyond repair. The brush-holders had broken from their supports and lay in the bottom of the motor case.

Due to the damaged condition of the motor it was impossible to determine the cause of the failure. It seemed most probable that there had been improper assembling of the commutator on its spider. Evidently the holding nuts had loosened to such an extent that the bars had come out of the V rings. Proper methods had not been used to tighten the assembly and to insure that the whole structure had been heated sufficiently to secure a permanently tight fit. Probably it had not been inspected cold to be certain that the bars were tight.

Had the commutator been assembled according to the specifications laid down by the original manufacturer, with the use of tools which insure high-grade workmanship, the accident would not have happened. The series of articles on commutators by Jesse M. Zimmerman which has been running in the maintenance issues of ELECTRIC RAILWAY JOURNAL gives in detail the practices of one manufacturer. While the practice of leading railway motor manufacturers may differ slightly in minor details, their general manufacturing principles and standards are comparable. By adopting for maintenance operations the methods set forth in this series of articles the number of armature failures should be reduced materially.

What Is a Pull-In?

PULL-IN records are of great value in determining the condition in which a property's equipment is maintained. But a large part of this value is lost unless such records for one property are comparable with those of another. Discussions of this subject have appeared before in the JOURNAL. There is still, however, a wide variation in the definition of a pull-in as applied by various properties. Because of this, comparisons which should serve as a stimulus toward better maintenance practice are frequently very misleading.

There are several classes of pull-ins. Some are chargeable to the mechanical department, others to the transportation department and still others to causes beyond the control of the company. In this latter class come cars disabled by certain types of accidents. A pull-in record, to be of real value, should include a report of every car that is withdrawn from service before completing its scheduled run. With such a broad interpretation as a beginning, the basis for classification may be fixed by definition, so that pull-ins chargeable to the mechanical department for defects in equipment, and to the transportation department for improper operation, may be determined.

After all, the broad purpose of pull-in records is to stimulate avoidable interruptions to passenger service. Only when the records of various properties are on a comparable basis do they serve to stimulate that effort toward improvement from which progress grows. The mechanical man who makes an honest effort to find out how his performance compares with that of other properties would, of course, welcome any step toward uniformity of definition which would increase the value to him of comparative records. The Association of Equipment Men, Southern Properties, has established a set of rules for determining pull-ins, as was outlined in a letter by A. D. McWhorter, its president, in the Jan. 15 issue of the JOURNAL, page 128. This work should be extended. It appears to be a subject which warrants study by the American Electric Railway Engineering and Traffic & Transportation Associations. Once the proper definitions are laid down and followed by member properties, pull-in records will become of much more value than they are under present conditions.

Opposition to One-Man Cars Is Based on Lack of Knowledge

FROM several quarters attacks have been launched recently against the use of the one-man car. Among these Buffalo, Toronto and Montreal are perhaps the most prominent. In practically all cases, in these and other cities as well, the objections raised have been mainly of a political nature. Organized labor has been a factor, although the national officers of the Amalgamated Association are on record in favor of the one-man car as a progressive step and one which will redound to the advantage of the men themselves.

Those who argue against the one-man car do so without knowledge of the facts. Far from being an experiment, it is one of the most striking successes in the transportation business. There is not a state in the Union nor a province in the Dominion of Canada where one-man cars are not used. They have been found successful on the smallest properties and the largest. In the Borough of Manhattan, New York City, one-man cars are giving satisfactory performance at certain times of the day, as well as all day on Sundays. Across the Hudson River the Public Service Railway of New Jersey uses one-man cars exclusively, operating some 1,200 in regular service, many of them through the heart of Newark, one of the largest American cities.

A stock argument against the one-man car is that it increases the accident hazard. That this is incorrect is shown by the record of practically every property that is a user of this type of equipment. The results obtained by a group of properties under a well-known utility management firm is typical. This group of properties covers a wide territorial range, so that local conditions do not enter to any great extent. In the four years 1922-1925, during which the proportion of one-man car-miles increased from 48.7 per cent of the total to 84.6, the passengers carried per person killed or injured went up from 52,000 in the earlier year to 64,000 in the later. The average cost of the accidents has remained practically stationary, going from $23.63 to $23.86. What increase there was came from greater seriousness of accidents with two-man cars, as the cost for these went up from an average of $23.78 to $28.08, while the cost per accident with one-man cars went down from $23.78 to $23.07 in the same period.

As to schedule speed, now that operators are thoroughly familiar with the method, there is little or no difference between one-man and two-man service. In fact, some companies obtain higher schedule speeds with the one-man car, particularly if small numbers of passengers board at one stop, or if the fare system makes it possible to collect all fares outside the congested district. The advantages of lower operating cost and possibilities of more frequent service are so well known that it is not necessary to reiterate them here.

No one thinks of requiring two men to operate the ordinary type of bus. Yet the driver has to do everything the operator of the one-man street car must do, and in addition he has to steer his vehicle in and out of a maze of traffic.

When action is contemplated inimical to the one-man car, it is well that the legislative or regulatory body become familiar with the facts. They are public property, and it is the duty of the public official not only to acquaint himself with them, but to see that he does nothing that will injure or perhaps stifle one of the public's most essential utilities.

Engineering Supervision Over Maintenance Is a Step in Right Direction

SUCH momentum has been gained by the modernization idea of improving the appearance and comfort of cars that it has now covered the entire country. In most instances the approval of the public is evidenced by the increased revenues. This favorable public attitude can only be perpetuated by maintaining reliable and uninterrupted service. Without such continuity of service all the comfort and all the fine appearance will at once lose their appeal. Reliable service cannot be rendered and road failures decreased unless the shop practices are systematized so that the equipment receives thorough inspections and overhauling on a definite basis, which is given at such intervals that failures are anticipated rather than checked up after they have occurred on the road. Appreciating the importance of this situation, the management of the New Orleans Public Service, Inc., reorganized that company's shop organization and placed the most important work under the direct supervision of a field engineer. The results obtained have been most encouraging. The company's 1926 report shows the remarkable average of 261,084 miles per car pull-in due to equipment failures, and a maintenance cost of $20.39 per 1,000 car-miles. A. J. Naquin, this company's engineer of rolling stock and shops, in a paper presented before the Electric Railway Association of Equipment Men, Southern Properties, which was abstracted in the JOURNAL for Feb. 5, explained the manner adopted for overhauling cars on a 40,000-mile basis. The careful attention given the car equipment accounts in large measure for the results obtained. The plan is well worthy of study. The change in shop organization and standardization of practices along engineering lines is a definite step in the right direction.

Good Maintenance Requires Intelligent Supervision

TAKING too much for granted is a disease easily contracted by those who supervise maintenance work. Many companies make an appropriation for maintenance work either as a definite sum or a per cent of gross revenue and it devolves upon those in charge to spend the appropriation. Some mortgages even specify the per cent of gross revenue that must be spent, leaving the quality of the work performed or its effectiveness undefined.

Obviously expenditures poorly supervised or inefficiently made are economically unsound. Moreover, wasteful methods of maintenance may become evident even to the public. Recently a gang of eight track men were observed slowly walking along one of the tracks of an electric railroad in full view of a morning crowd of commuters. Each man except the foreman was armed with a spiking maul, and as the gang proceeded the spikes that had loosened were driven home again. It does not require a technical education to appreciate the fact that time and money were being wasted by this gang employed in the work generally assigned to one, or two men at the most.

Appearing on the same day in the morning papers was one of a series of articles telling of the progress of a rate case by this same company for an application to increase fares. One of the points brought out at the hearing was that the cost of operation had not declined during the post-war years to the same extent as on other roads. This fact was to some extent substantiated in the minds of those commuters who read and think.

Such an incident, although insignificent and perhaps explainable on good grounds, nevertheless leaves an unfortunate impression that may not be as easily eradicated. Public relations depend on performance, and maintenance is a factor in the establishment of good relations fully as important as any function of the service. The quality of the work will affect the upkeep of the property, but the methods used, especially when exposed to public view, are also important in their psychological effect on the patrons served.

Stop-Loss Bus Operation Merely Begs the Paving Question

JOY is being expressed by many motorists because the Morris County Traction Company is considering the removal of its tracks from the Newark-Morristown highway and the substitution of bus operation to replace the present car service between Newark and Lake Hopatcong. As soon as the tracks have been taken up it is proposed that the various municipalities through which the line runs replace the worn-out pavement in the track area by smooth new concrete paving.

No doubt such a change would be very agreeable to the motorists, as the present paving is in deplorable condition in many places and the railway is too poor to pay for its replacement. If the municipalities are willing to pay for new concrete paving, as they will have to do if this proposal is carried out, it could be laid just as well with the tracks in place. Last year, however, there was great outcry when the state Senator from Morris County introduced a bill to relieve street railways from their paving obligations. The bill was defeated and the Morris County Traction Company, already in receivership, has had to continue patching pavement worn down by hordes of automobiles and trucks never dreamed of when the obligation was imposed.

A larger question is involved, however, than the mere shifting of the paving burden. Whether or not the bus can provide better transportation than the car on this route appears to have received very little attention. Besides the trackage in paved street, there is considerable mileage on private right-of-way, particularly west of Morristown. In summer the Newark-Morristown-Lake Hopatcong highway carries extremely heavy automobile traffic. Buses certainly could not make as good time under these conditions as do the cars on private way. Before embarking on such a substitution, both the railway and the municipalities would do well to consider experience elsewhere, which has shown clearly that the operation of buses as street cars on rubber tires may serve temporarily as a stop-loss measure, but does not always result in the upbuilding of a satisfactory and prosperous transportation system.

Timber Preservation Saves Money on Boston Elevated System

More than 500,000 Ties Installed Since 1916 on Surface, Subway and Elevated Lines Have Been Treated—Cost Per Tie Per Year Is Estimated to Be 35 Per Cent Less than that of Untreated Ties —Timber for Bridges, Stations, Etc., Also Receives Treatment

Southern pine ties used by the Boston Elevated are landed at the company's wharf, where a 12-ton Industrial crane picks them up in bundles of 48 and piles them for storage prior to treatment.

SINCE 1916 all wood ties used on the surface and rapid transit lines of the Boston Elevated Railway have received preservative treatment before installation. Experience of this company indicates that such treatment practically doubles their useful life. After making allowance for the cost of the treatment, it is estimated that the saving per tie per year is about 35 per cent. Moreover, preservative treatment reduces the original cost of construction by permitting the use of a less expensive grade of timber. Economies have been effected also in the paving account due to less frequent tie renewals. Similar treatment of nearly all other timber used by this company in outdoor construction work has been influential in prolonging its life and reducing maintenance cost.

Experience with treated ties on the Boston Elevated began some 25 or 30 years ago. At that time a preparation called "Woodiline" was used in an open tank. Later a preservative known as "Avenarius Carbolineum" was used. While the results achieved by this method and these products were not perfect, they did impress the management with the value of preservative treatment. In November, 1912, the company commenced the use of creosote pressure-treated ties. These were treated by the Bethel full cell process by a commercial creosoting firm. In the early part of August, 1916, operation of the railway's own plant at South Boston was begun. This is equipped to treat timber by the Rueping empty cell, Bethel full cell or open tank processes.

Treated ties are now used in all track, whether paved or in open construction, and also in subways, tunnels and on the elevated structures. No untreated ties have been used since 1916. An average of about 50,000 ties per year have been installed on the surface lines and about 5,000 per year on the rapid transit lines. Altogether more than 500,000 treated ties have been installed, including those laid in 1926, concerning which exact data are not yet available. Figures by years are given in the following table:

TIES INSTALLED ON BOSTON ELEVATED SYSTEM

	Surface Lines	Rapid Transit Lines		Surface Lines	Rapid Transit Lines
1917	54,000	2,878	1923	55,900	4,158
1918	22,500	793	1924	37,284	6,777
1919	81,418	5,079	1925	31,916	7,210
1920	35,324	5,550			
1921	67,782	6,210		449,264	44,557
1922	63,140	5,902	Average	49,918	4,951

Oak and chestnut ties were used on the surface lines in 1912 and their use continued until the opening of the company's treating plant in 1916. Since then South-

An Average of 50,000 Ties Per Year Used by the Boston Elevated Railway Insures Rapid Movement Through the Timber Treating Plant and Prevents Deterioration Due to Long Storage

ern pine ties have been used except for a brief period during the war when native oak and chestnut were used. Ties on the rapid transit lines have always been hard pine since the opening in 1901. The timber comes from Georgia and Florida by water. Prime grade is used for certain curves on the rapid transit lines, merchantable grade on the remainder of the rapid transit lines and standard on the surface lines.

Hewn ties, 6 in. x 8 in. x 7 ft. 9 in., are used on surface lines except under special trackwork. Sawn ties, 6 in. x 8 in. and 8 ft. to 17 ft. long, are used under special work. On tangent track on the elevated structure ties are sawn 6 in. x 8 in. x 8 ft. 6 in. On the elevated and in the subway under special work ties 7 in. x 8 in., 8 in. x 8 in., 8 in. x 9 in., 8 in. x 10 in., 8 in. x 11 in. and 8 in. x 12 in., ranging from 9 ft. to 17 ft. in length, are used. Bevel ties are used on curves on elevated structures. They vary in size from 6 in. x 8 in. to 7½ in. x 8 in. at the small end and 7⅞ in. x 8 in. to 13¾ in. x 8 in. on the large end. In length they range from 8 ft. 6 in. to 9 ft. 6 in.

Ties and timber are shipped from the South by steamer. After arrival in Boston harbor they are lightered to the railway wharf, where they are landed f.o.b. They are inspected at the wharf and are piled into sling loads. In the case of 7-ft. 9-in. or 8-ft. ties this means 48 ties are picked up by the crane in one lift and landed at the point of piling. With an Industrial 12-ton crane no difficulty is experienced in handling timber of any dimension.

Grade No. 1 A.E.R.E.A. creosote oil is used for treatment. The oil is delivered in tank cars at a nearby siding. These cars are shifted by the elevated to the storage tanks, where the necessary connections are made. A sample from each tank car is submitted to the railway's chemist for analysis before the car is unloaded. His O.K. must be received before the oil is accepted. Storage for 55,000 gal. of preservative material is provided.

The treating cylinder is of 7 ft. 6 in. diameter and 51 ft. long. Up to Dec. 31, 1925, a total of 454,269 ties and 8,027,554 ft. board measure of lumber had been treated. The entire plant represents an investment of approximately $60,000. Upkeep amounts to about $650 a month.

Operating personnel consists of one supervisor, two engineers, one clerk, one foreman and from ten to 25 laborers as required. Of the two engineers, one is the regular plant operator and the other acts as assistant to the supervisor, but is available for plant operation if a double shift is required or when the regular operating engineer is absent.

In addition to inspecting and directing the treatment of all lumber received at the South Boston plant, the supervisor is charged also with the inspection of all lumber received at other locations on the railway. Reports are furnished to other departments so that they can approve invoices. Lumber from razed buildings on the railway's property is sent to the treating plant for inspection, grading and storage. This is used again

Method of Piling Timber for Storage at South Boston Creosoting Plant. Untreated Ties Are Shown at Left and Treated Ties at Right

for purposes to which it is suited, thereby effecting substantial economies.

Hewn ties for the surface lines are adzed before treatment. For this purpose a Greenlee adzing machine has been mounted on an old car which can be moved from point to point. This arrangement has been found to be much more convenient than having the machine in a fixed position. A friction feed on the receiving side allows the ties to be carried to the knives and then dropped to a skid on the leaving side, thence to the treating trucks, with a minimum amount of hand labor. Timber and ties used on the elevated structure are framed at the sawmill after treatment. Certain framing has to be done on the job to fit rivet heads, buckle plates, etc., but in all cases framing done after treatment is protected by a brush coat of creosote. The same precaution is taken after boring holes for bolts, lag screws, etc.

Unit Piling System Used

Before treatment ties are piled according to the one by ten plan, with 224 ties in each bay. Four bays with 896 ties comprise one pile. Four more ties are stored on top to make an even 900 in each pile. The piles are 30 in. apart, allowing proper air seasoning. Illustrations on the preceding page show clearly the methods of piling used for untreated and treated ties.

Treated ties are stored in the open, each lift being two by 40 with five lifts in each bay. The length of the bay depends on the storage area available. As the treated ties move rapidly out of storage, no difficulty is experienced in keeping them in first-class condition. Another advantage of this method of storage is that it follows the principle of unit piling for accounting purposes. When loading ties with a locomotive crane it is easy for the crane helper to force a bar between the bays and drop a chain through, making it possible to pick up 40 ties at one hoist. It has been found necessary to provide employees at the treating plant with cheap canvas gloves to protect their hands. Tie tongs were tried, but did not prove satisfactory. Employees installing freshly treated ties are also provided with gloves.

A gang paving block cutter was installed at the South Boston treating plant in October, 1917. The railway now manufactures its own paving blocks of hard pine, 3 in. x 8 in. and 4 in. x 8 in. This machine makes seven blocks at each cut. The only hand work necessary is to feed timber into the machine. Cut blocks drop into a chute and then go to the treating cages. Sawdust is diverted into a separate chute and lands in a bin where it can be reclaimed.

Dating nails are installed in all ties sent direct to the job from the treating plant. Nails are furnished to division offices which supply ties from other storage points. Ties are shipped to the job in steel dump cars holding 300. For small jobs motor dump trucks holding 60 to 70 ties are used.

As the result of its experience the company estimates the life of untreated ties in pavement without concrete base to be about twelve years and in open track from eight to ten years. It is estimated that treated ties laid in pavement will last at least twenty years and in open track at least fifteen years, although often the useful life of the tie is far in excess of these figures.

Cost of ties varies with the market. Sawn ties cost approximately 26 cents more than hewn ties. At the present time, considering wages, cost of material, etc., the total cost of treating a 6-in. x 8-in. x 8-ft. tie amounts to about 50 cents, of which 21 cents is the cost of handling and 29 cents the cost of treatment. The cost of treatment per cubic foot of timber under present conditions amounts to 11 cents. Based on the first cost per tie of $1.75 and a life of twenty years the cost per treated tie per year would be 8.7 cents. For untreated ties at $1.25 each the cost per year is 13.3 cents. Thus preservative treatment reduces tie cost approximately 35 per cent.

A cheaper grade of timber is now being used by the Boston Elevated for ties and on the elevated structure. Previously it was considered necessary to use only hard timber of first quality. Today standard or merchantable grade timber is used. For surface line tracks in pavement or in the open, the same quality is used. A grade cheaper than merchantable of hard wood, such as beech, birch or maple, may be used if obtainable. Actually the company has found it practically impossible to obtain any hard woods of this description.

No offsetting disadvantages connected with the use of treated ties have been experienced by the Boston Elevated. No difficulties have been experienced with the spikes nor has there been any serious cutting of the ties at the base of the rail. In fact, it is thought that this has been less than with untreated ties.

It has been found that the use of preservative treatment of timber for purposes other than ties on the rapid transit lines increases its life due to a reduction in mechanical wear such as checking or splitting. All timber used for bridge stringers, guard rails, footwalks, cable boxes and miscellaneous purposes on the elevated structures, crossarms, fence posts, pickets, station floor stringers, wharf repairs, piling, block paving, etc., is now being treated before installation. The company is thoroughly convinced that this practice extends its life and lowers maintenance cost.

Wheel Fenders Protect Trucks

FOR the purposes of protecting the electrical equipment and keeping its new cars as clean as possible, the Porto Rico Railway, Light & Power Company, San Juan, P. R., is installing fenders on all trucks for its six new cars now being assembled. The frames for these fenders are made up of ⅛-in. x 1-in. angles bent in

Sheet Iron Fenders Placed Over the Car Wheels Keep Mud and Dirt Off Equipment in San Juan, P. R.

semi-circular form and securely bolted to the truck frame. Sheet iron is riveted to the angles, and this has sufficient stiffness to support itself so that no angle is necessary on the inner side of the car wheels.

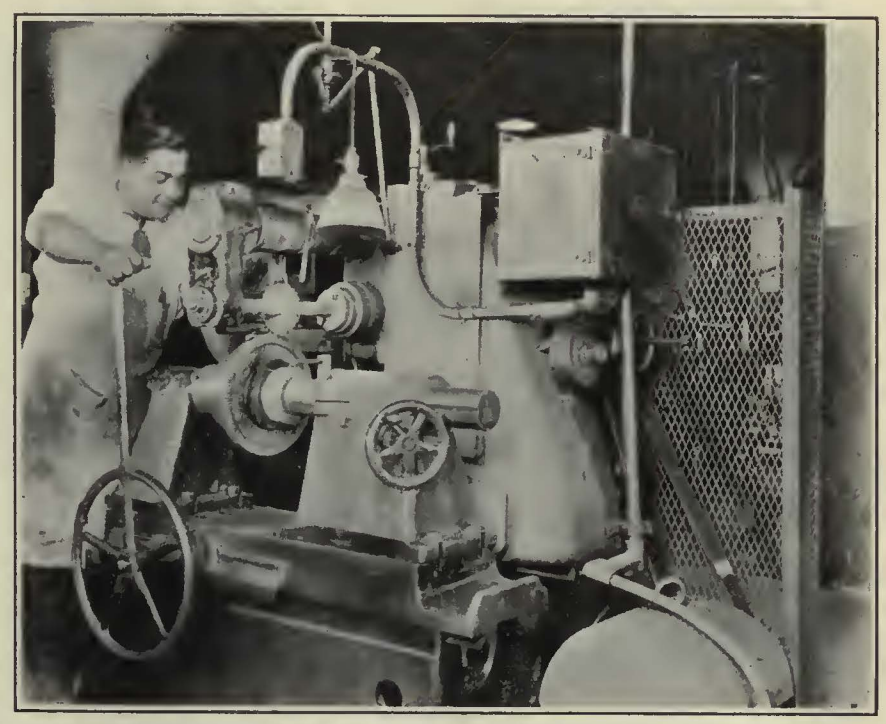
The illustration shows these fenders mounted on one of the trucks. Their use keeps mud and dirt off the equipment and so assists in maintenance of the cars.

Soldering of Railway Motor Commutators*

Satisfactory Methods for Removing the Leads from the Necks of Commutators Preparatory to Rewinding Are Given and Soldering Operations Are Described—Pot Dipping Best When a Large Number of Armatures Are to Be Soldered

By Jesse M. Zimmerman
Renewal Parts Engineering, Westinghouse Electric & Manufacturing Company

BOTTOM leads of practically all armatures wound with wire coils, and a large proportion of these with single-loop strap coils, may come straight to the commutator necks. With this arrangement it is not necessary to use a filler between the top and bottom leads. However, in order to make a double-loop coil of ribbon wire or insulated strap, which can be wound without forming the bottom leads during the winding operation, it is necessary to bring the leads to the commutator neck at an angle of approximately 45 deg. with respect to the top lead, as shown in an accompanying diagram. A triangular filler must then be placed between the top and bottom leads to take up the space. This filler is kept from sliding back in the slot by bending its front end, *D*, to one side. After the leads are soldered the end of the filler is machined off.



Slotting a Westinghouse Type 12-A Commutator Neck

All drifting should be done on the filler in the top of the commutator slot and not directly on the leads. This avoids the nicking of the copper. Swedging of the leads also should be avoided. The bottom lead should lie in the bottom of the slot in the front of the neck only; at the rear of the neck a clearance of $\frac{1}{8}$ in. should be left. This is accomplished by making the rear of the slot at least $\frac{1}{8}$ in. deeper than necessary to contain the armature leads. The rear mica V-ring should be built up with treated cloth tape $\frac{1}{8}$ in. above the bottom of the slot. When the leads are placed in the slot the tape will compress sufficiently to provide a good solid pad for the leads to rest on, thus decreasing the vibration and eliminating the possibility of nicking the bottom lead. Some operators have found it desirable to make a ring of wood to place over the rear V-ring back of the commutator neck to support the leads instead of using treated cloth tape.

In figuring the depth of a commutator slot, two rules are used, one being for the front slot depth and the other for the rear slot depth. The front slot is made the depth of the conductors plus the front depth of the triangular filler between top and bottom leads, if one is used, plus the filler in the top of the slot. The rear slot depth is the depth of the conductors plus the rear depth of the triangular filler between top and bottom leads, plus the filler in the top of the slot, plus $\frac{1}{8}$ in. between the bottom of the slot and the bottom lead.

On some types of armatures it has been found necessary to strengthen the leads where they leave the commutator slot, by placing a phosphor bronze sleeve over them. This sleeve supports the leads back of the commutator, eliminating broken leads. The use of these sleeves is confined to ribbon and small strap coils. The thickness of the phosphor bronze sleeve must be added to the depth of the conductors when figuring the slot depth.

It is best to place a filler in the top of the commutator slot. All drifting should be done on this filler and in the front part of the slot, and not directly on the leads. It can be made from the cut-off ends of the conductor. However, in figuring the slot depth $\frac{1}{8}$ in. should be the maximum amount to be allowed for the top filler.

Sufficient clearance should be left between the conductor and the side of the slot that the leads may be driven home without crowding and to permit ample room for the solder. In figuring the slot width 0.005 in. is usually added to the width of the conductor for wire coils, and from 0.010 in. to 0.015 in. is added to the width of strap conductors. Whenever a phosphor bronze

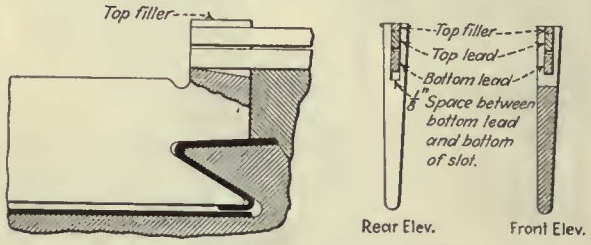
*This is the sixth of a series of articles on commutators appearing in ELECTRIC RAILWAY JOURNAL. The others were "Choosing Materials for Railway Motor Commutator," published Aug. 2, 1926; "Important Considerations in Replacing Commutator Bars," published Oct. 23; "Accurate Machining of the V's of Assembled Commutators Is Essential," published Nov. 20; "Mica V-Rings and Bushings Have Important Functions in Commutators," published Dec. 18, and "Methods and Equipment for Efficient Assembling of Commutators," published Jan. 15, 1927.

sleeve is used over the armature lead the allowance should be added to the width of the sleeve and not to the lead.

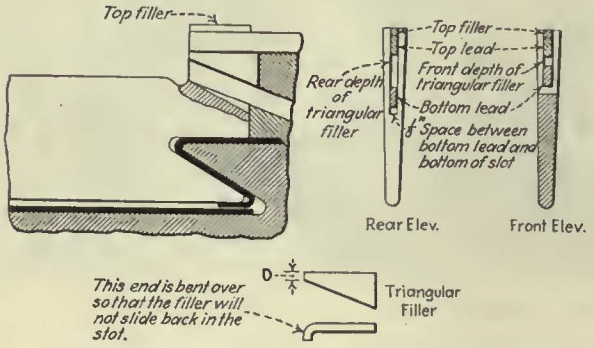
Removing Leads from Commutator Neck

Removing the leads from the soldered commutator neck can be accomplished in four ways, namely, drifting the leads out cold; drifting after softening the solder; breaking the solder with a splitting tool, and remilling the slot. Some repairmen drift the leads from the slot with a gouge without heating the solder. This apparently works out very satisfactorily, though care must be taken so as not to break the side of the neck.

To soften the solder the commutator neck should be heated, preferably with a hot soldering iron. With a torch the commutator neck should not be heated too long at one spot as it will tend to anneal the copper. When the solder has softened the leads can be removed from



Standard Slotting for Commutators



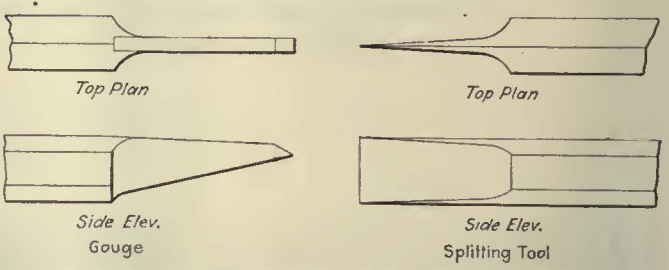
Commutator Slotted for Special Triangular Filler

the slot with a gouge. After the conductors have been removed the soft solder which remains in the slot should be blown out with compressed air. This method can be used to good advantage where the conductors are very small.

The splitting tool used for removing conductors is a chisel which has a wide thin blade. This is driven between the conductor and the side of the slot to break the solder holding it. It must be driven on each side of the conductor, which then can be lifted by the gouge. After the conductors are removed from the first slot the necks will bend over slightly, giving sufficient room to make the operation easy. This method does not work as well as the previous ones in removing small wire. After the leads have been removed the sides of the slot should be cleaned with a thick hacksaw blade or a thin flat file.

If equipment is available to reslot the commutator bars it is convenient to cut off the armature leads behind the neck in a lathe or with a hacksaw and reslot the commutator. This leaves a clean slot in which it is easier to solder the leads. After the commutator neck has been remilled the slots should be coated with a flux of 1½ lb. of resin mixed with a quart of denatured alcohol. This prevents the copper from corroding.

Before discussing the soldering of armature leads it is well to analyze the different types of solder which are available. There are three important phases to consider, namely, cost, ease of working, and ability to hold the metals being soldered. The two first are closely related. The soldering material may be low in first



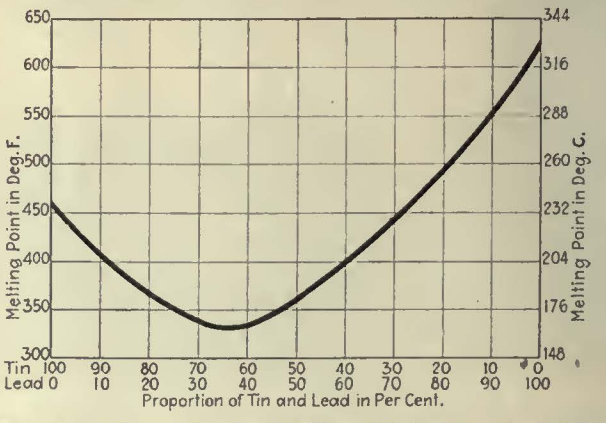
Tools for Removing Armature Leads from Commutator Slots

cost, yet if it does not work easily the excess labor which is required will make the total cost of the soldering very high. Cheap solder always contains a large proportion of lead and is difficult to work. In selecting a solder it is necessary to consider the maximum operating temperature of the commutator, as it must withstand this temperature without softening. An accompanying graph shows the melting points of different mixtures of tin and lead solder.

Solder made from half lead and half tin has a melting point of 181 deg. C. It flows readily and holds the metal firmly as long as the commutator temperature does not become excessive. Besides, it is reasonable in price. Its application is limited mostly to wire-wound armatures.

Pure lead solder has a melting point of 325 deg. C. Although cheaper than half and half solder and having a higher melting point than pure tin it cannot be worked easily. Any solder which has a large proportion of lead is so hard to handle that it is difficult to obtain a good job. Therefore it should not be used.

Where the operating temperatures of the commutator are high pure tin solder should be used. It has a high melting point, 230 deg. C., and when molten it flows easily and rapidly. It tends to spread beyond the surface being soldered, so a skilled workman is needed to



Temperature Curve Showing Melting Point of Tin-Lead Solder

handle it properly. The use of pure tin solder is confined to strap and ribbon coils because the clearances between the conductors and the slot are so small that it is necessary to use a very fluid solder. Armatures wound with wire conductors which are worked at high temperatures should be soldered with 85 per cent tin and 15 per cent lead. Extreme care should be taken

when using pure tin solder on commutators wound with wire coils in order to prevent it from running through the slot, forming a short circuit back of the commutator.

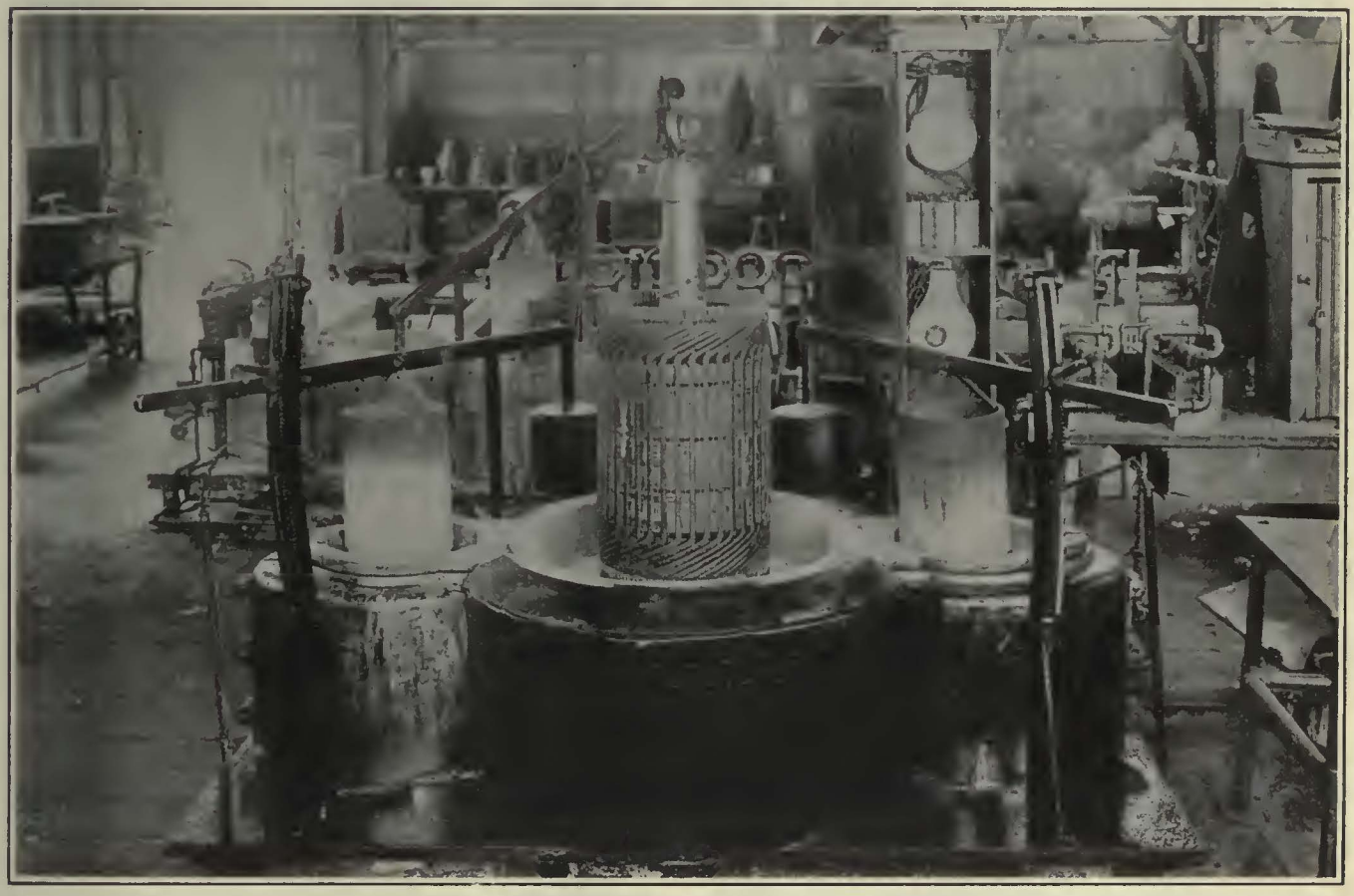
When the commutator is overheated for too long a time while soldering the pure tin will eat its way into the copper parts. It is therefore necessary to watch the temperature and length of time required for the soldering operation when using pure tin.

As soon as the solder begins to soften and throw when the armature is in operation the trouble is usually laid to high commutator temperature. The softening is due to a high temperature of the commutator neck, but not always to high commutator temperature. It is the tendency in some repair shops to take a heavy cut off the front of the commutator neck after the leads have been soldered. This makes the neck narrower, thus cutting down the contact surface. Since in a railway motor each soldered connection in the neck must carry half of the armature current it can readily be seen that if the contact surface is decreased materially the necks will overheat. After the leads have been soldered the machining should remove only the extended leads and as little of the commutator neck as possible.

Flux is a compound which is used to make the solder take hold of the metal. It prevents the formation on the metal surfaces of thin coatings of oxide which hinder the solder from covering the entire surface of the two parts being soldered. It is important to make sure that the flux does not contain acid, as it will destroy the insulation on the armature coil, thus causing a short. An inexpensive flux which will not affect the insulating material can be made by mixing 1½ lb. of resin in a quart of denatured alcohol. It is easier to apply flux in a liquid form.

It is not necessary to tin the slots before soldering an armature, if the slots are painted properly with a liquid flux immediately after slotting and the armature leads are tinned well. If the commutator slots are dirty, they can be cleaned with either a heavy hacksaw or a thin file. A few repairmen feel that it is desirable to tin the slots of commutators using strap coils. An investigation has shown that no real benefit has been obtained if the slots are clean and leads properly tinned.

Soldering in the average repair shop is usually done by hand. However, if a large number of armatures are to be soldered, a soldering pot is the most efficient method. Before undertaking to solder the commutator the leads should be tinned well, the slots should be perfectly clean and a coat of flux applied.



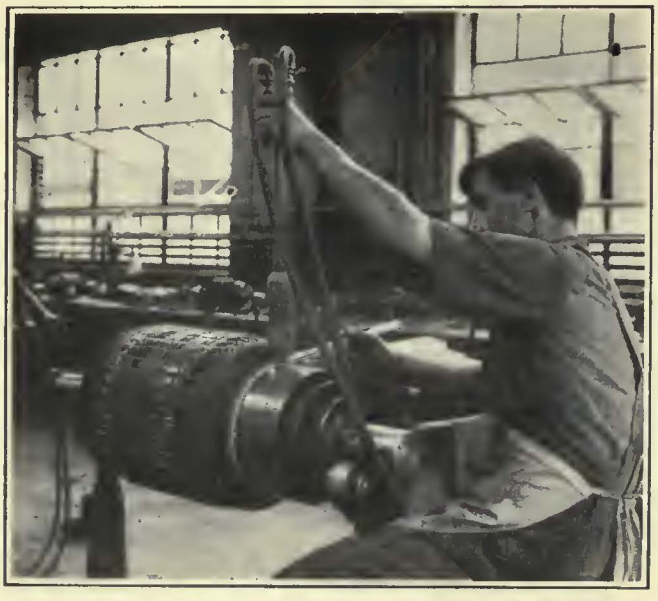
Complete Soldering Pot Showing Thermostatic Control

In the illustration, an armature is shown in a soldering pot. The center compartment has an opening large enough to fit the largest commutator. For smaller commutators, rings are used which will fit over the face. The opening between the commutator face and the hole in the ring is closed by wrapping the commutator face with several turns of asbestos rope. This prevents the solder from flowing out of the compartment along the commutator face. The two side pots contain molten solder which is forced into the center pot around the neck of the commutator by lowering the plungers. This solders all the leads at one time, thereby eliminating the danger of overheating the commutator neck. The level of the solder is brought up to the same height as the rear of the commutator neck. With this method the solder cannot work back of the commutator neck

Dipping Armature to Solder Leads

and thus cause a short circuit. After the commutator neck has been immersed for a short time the solder is drained from the center compartment by lifting the plunger. The use of a pot simplifies soldering wire-wound armatures with the 85 per cent tin and 15 per cent lead solder.

In order to prevent short circuits back of the commutator neck, it is necessary to raise the pinion end of the armature high enough that the rear of the slot will be slightly above the front of the slot. This will cause the excess solder to flow to the front of the slot. The soldering can be done either at the top of the commutator or at the side. It is found that by soldering on the side, short circuits back of the commutator are not so likely to occur. By eliminating the possibility of these shorts the repairman will not be afraid to heat the neck so that the solder will cover the entire surface.



Solderlug an Armature at the Top with a Self-Heated Iron

Soldering a Commutator at the Side. The Soldering Iron Is Supported by a Special Rest

Hand soldering is usually done with a copper tool heated in a gas flame. Self-heating gas or electric "irons" are often used but are not as popular as those heated in a gas flame. The irons usually weigh from 2 to 3 lb. Heavy irons will hold the heat longer, which is desirable. However, when heavy irons are used for side soldering there should be a support for the iron to rest upon. This will relieve the workman of the strain of holding the iron during the soldering operation.

Tinning of the iron is very important. When soldering is done on the top of the commutator the whole point of the iron should be well tinned. If the soldering is to be done on the side of the armature with pure tin solder the part of the iron which strikes the copper bar should be clean and tinned perfectly. The lower side of the iron should not be tinned because the molten solder will flow along the bottom of the iron and drop off instead of flowing into the slot.

When soldering large commutators it has been found convenient to apply a gas flame on the iron during the soldering because the leads and core of the large armature will radiate heat from the iron very rapidly. The commutator face should be wrapped with asbestos cloth. The nozzle of the torch is pointed to the front of the commutator and adjusted so that the flame will strike the flat side of the iron.

Before hand soldering, large commutators should be preheated. This is done most conveniently by heating the whole armature in an oven. If an oven is not available the commutator can be heated by rotating the armature while exposing the commutator face to the gas flame. Some armature winders when soldering commutators have a small gas flame strike the commutator face in front of the commutator neck just ahead of the soldering iron. This is bad practice because it is very difficult to adjust the flame so that it will not overheat the commutator face in spots, annealing the copper and causing the commutator face to wear unevenly. The same result can be obtained by making a small electric pad or heater which can be placed against the commutator face to preheat the bars before they are soldered.

One of 40 New One-Man Cars Built for the Milwaukee Electric Railway & Light Company In the Short Time of 3½ Months. Reduced Width of the Rear Door Gives the Car an Appearance of Added Length

New Cars Selected in Preference to Rebuilding

The Milwaukee Electric Railway & Light Company Has Just Bought 40 New One-Man Cars, Believing that the Operating Economies Possible Will Pay Better than the Rehabilitation of Old Equipment that Later Would Have to Be Discarded

NOTEWORTHY in street railway annals is the recent purchase, building, delivery and assignment to duty on the lines of the Milwaukee Electric Railway & Light Company of 40 one-man cars. This was completed eleven months prior to the date set by the Railroad Commission in an order directing the company to install additional equipment. It is also an illustration of successful co-operation on the part of the car builder in an emergency so that improved city service could be rendered within the shortest possible time. Although the cars were ordered only on Sept. 4, all were in operation by Dec. 30. This is said to set a record in providing street cars in quantity lots.

The first cars arrived on Nov. 22, eight days ahead of the promised delivery date, and the remainder arrived from a few days to more than a week ahead of time. While the building of such a large number of cars requires under ordinary circumstances from six to eight months, in this case the company demanded quick action so that the patrons could have immediate use of the new equipment. The company hopes to effect economies in operation by furnishing the new equipment now instead of providing temporarily rehabilitated equipment that later would have to be discarded in favor of new cars.

A Feature of the Cars Is the Inclosure of the Piping and Wiring

In general appearance and construction the 900 type car, as the new series is known, is much the same as its predecessor, the 800 type one-man car, which was originally designed by the company's engineers. No effort has been spared to enhance the interior and exterior appearance. With a headway that is at least 20 per cent more frequent than the previous one, a

substantial increase in street car traffic is looked for. Construction of these new cars was carried out in accordance with plans provided the St. Louis Car Company by the railway company's engineering staff. These included several important changes in design and equipment from previous types. Interior improvements which have a parallel application in automobile construction are more numerous than the exterior changes. This is in accordance with the view that the rider is far more interested in the inside accommodations than in a finely finished exterior which may have been provided at the expense of an attractive and inviting interior.

Unlike the preceding model the new cars are arranged for front entrance only. Elimination of the doors at each end for operation by a conductor has a tendency to make the car appear longer as well as to add to the seating capacity. Only a small exit door, operated by a treadle, remains at the rear, and it has been moved farther back. The change in platform design provides seats for four more passengers and permits the installation of an extra window at each end where there formerly was a door. The new cars have a seating capacity of 55.

A pleasing feature of the new car which attracts the eye of the rider immediately on boarding is the clean-cut appearance. This is largely the result of the introduction of a new control cabinet arrangement. The entire control equipment is incased in brown enameled sheet metal, concealing the compressed air pipes and other devices ordinarily visible on the platform. Besides improving the appearance, this arrangement allows the platform to be cleaned thoroughly, which was impossible with many exposed pipes. Now only two pipes and the foot valve are exposed. This is done to make a recess or opening in the center of the cabinet so that the operator can bend his knees when in a sitting position.

An improvement in the control which was developed as an added precaution against accidents provides an automatic interlocking of the air brakes with the treadle door so that should a passenger stand on the treadle ready to alight and the operator release the air, the brakes would still remain set until the passenger alighted, after which the treadle would unlock the valve.

Another important interior improvement which has attracted much favorable comment is a radical change in the lighting equipment. Instead of the old type 23-watt lamps mounted in sockets on a molding above the seats, six large attractive center fixtures of the semi-direct type are equipped with two 61-watt non-glare lamps each. These units are hung from the center

The Interior Is Attractively Finished in Light Cherry Trim, Set Off by Polished Aluminum Fittings

of the ceiling, throwing a much brighter light, but without discomfort to the eyes. This arrangement also increases the clean-cut appearance of the interior. The lighting fixtures were developed by the Milwaukee company. Consequently all overhead lighting equipment was shipped to the builder for installation. Other changes in lighting include the use of two lamps on each platform instead of the customary three. Increased platform illumination is provided, however, by using 61-watt lamps instead of 23-watt.

Aluminum is used for grab handles on the seats and for vertical stanchions, taking the place of brass or white enameled metal. The seat covering is Kemi-suede placed over rattan. Like other interior parts of the car the dark gray seat coverings can be cleaned with soap and water. When worn out they can be replaced quickly with new covering.

A new type signal button has been installed. This is an improvement over the old type because of less difficulty experienced in locating trouble with contacts installed inside the posts. With the entire button mechanism outside the posts little difficulty is had in examining and repairing them.

An electric heater is placed below each seat. The temperature is automatically regulated by a thermostat. Curtains are the National Lock Washer type covered with double-faced Pantasote. Two rear-view mirrors are on each platform, one directly above the operator's head and the other in the front left-hand corner. During daylight hours the operator can watch the treadle door

GENERAL SPECIFICATIONS OF MILWAUKEE ONE-MAN CARS

Weight, total ..... 33,200 lb.	Conduits and junction boxes..... Steel	Motors..... Four GE-264-A, inside hung
Bolster centers, length..... 20 ft. 9 in.	Control ..... K-35 JJ	Paint.... Gliidden railway enamel, 20 cars; R. F. Johnston railway enamel, 20 cars
Length over all..... 45 ft. 0 in.	Curtain fixtures.... National Lock Washers, spring plug	Safety devices..... Safety Car Devices Co.
Truck wheelbase ..... 5 ft. 4 in.	Curtain material... Double faced Pantasote	Sanders..... St. Louis air operated
Width over all..... 8 ft. 7½ in.	Destination signs..... St. Louis	Sash fixtures ..... Edwards wedge lock
Height, rail to trolley base..... 11 ft. 4 in.	Door-operating mechanism.. National Pneumatic treadle rear exit and T. M., E. R. & L. Co. standard	Seats ..... St. Louis
Body..... Steel, wood roof	Energy saving device..... Economy meter	Seating material.. Kemi-suede over rattan
Interior trim ..... Cherry	Fare boxes..... T. M. E. R. & L. Co.	Slack adjuster... Non-automatic turnbuckle
Headlining ..... Agasote	Wheelguards.. T. M. E. R. & L. Co. standard	Springs..... Elliptic bolster and coil for equalizers
Roof ..... Arch	Gears and pinions..... Grade M, 30 sets Grade B non-resonant, 10 sets	Step treads ..... Kass
Air brakes..... Safety Car Devices Co.	Heater equipment..... Railway Utility	Trolley catchers ..... Ideal
Armature bearings ..... Plain	Headlights.... O. B. Golden Ray Reflector	Trolley base ..... U. S. 13-E
Axles..... Heat treated carbon steel	Journal bearings ..... Plain	Trolley wheels ..... 6-in. diameter
Bumpers ..... Channel	Journal boxes ..... St. Louis	Trucks ..... St. Louis E1, B64
Car signal system..... High voltage	Lightning arresters ..... M-D	Ventilators ..... Peerless
Car trimmings ..... Bronze		Wheels ..... Steel, 26-in.
Center and side bearings.... Oil lubricated center, plain side		
Compressors DH16		

with either mirror. At night when the back curtain is brought into use the center mirror is obscured and observation of the rear is accomplished by means of the extra side mirror. All switches are centralized and inclosed in two cabinets, one on each platform. These are finished in a light cherry stain which lends attractiveness to the interior.

A new type of truck has been introduced which possesses better spring suspension and easier riding qualities. For propulsion four GE-264-A motors are used, together with St. Louis E-1 B-64 cast steel trucks with equalizing springs and auxiliary light-load bolster springs.

The Milwaukee company painted these cars in a special color scheme so that they can be distinguished readily from others on the system by waiting passengers. With the entrance at the front this is quite desirable. The new cars are finished in deep orange on the side panels up to the belt rail and on the letterboard. Sash rests and window posts are ivory and the bands of color are carried across the doors and around the ends of the car to give a streamline effect. The interior is also pleasingly bright, being cheerfully finished with light cherry wood trim that is set off by the polished aluminum fittings.

Screened Refuse Car

CONSIDERABLE trouble having been experienced by the York Railways, York, Pa., from the blowing about of light refuse material during its transportation from the shop to its disposal point, E. L. Greene, master mechanic, designed and constructed a refuse car to obviate this objectionable feature. This car is a single-truck trailer, with heavy yellow-pine underframing, braced and reinforced by cross and vertical oak timbers, all being securely bolted together. It is of semi-closed construction, the closed portion extending above the floor about 3 ft. and the remainder being screened by a wire screen having about ½ in. mesh.

Refuse Car Has Hinged Section of Solid and Screened Parts

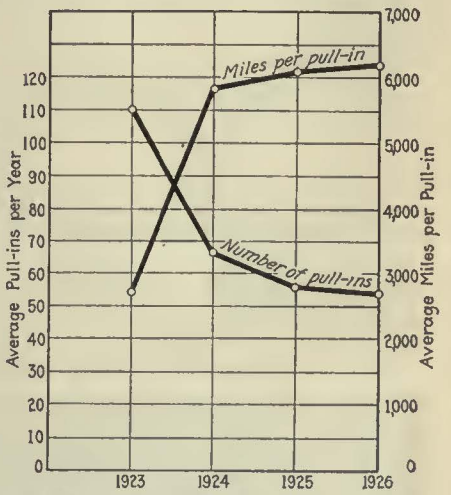
The solid and screened portions of the sides of the car are divided into sections and heavily hinged to permit the opening of the entire side, thus facilitating loading and unloading. Heretofore refuse material was deposited in an open bin in the vicinity of the shop, then loaded and transported on open cars or trucks to the refuse dump. With a reasonably strong wind blowing or the car running at a fair rate of speed considerable of the light refuse was blown to the street.

Now all refuse is deposited directly in the car, thus saving double handling and eliminating the disagreeable feature of light particles being blown to the surrounding highways during transportation.

Maintenance Cost Reduced at Harrisburg

Introduction of Rigid Inspection System, Making Minor Repairs on the Road, Not Filling Vacated Positions Has Improved Operation and Effected a Substantial Saving

EARLY in 1924 the management of the Harrisburg Railways, Harrisburg, Pa., initiated an intensive analytical study of the methods and practices followed in the maintenance of the company's car equipments for the purpose of determining wherein maintenance costs and car defects could be decreased. All departments and sections of departments were investigated carefully as regards the work being performed, the method of accomplishment and speed of production. This resulted in several changes being made in the centralization of production and shop practices and which had an extremely beneficial effect in the reduction of maintenance costs. The four outstanding changes consisted of:



Graphs Showing Decrease in Pull-ins and Increase in Mileage per Pull-in of the Harrisburg Railways. (The Last Three Months of 1926 Are Estimated)

1. Introduction of a more rigid inspection system and means of placing responsibility.

2. Making all minor equipment failure repairs at Market Square.

3. Discarding oil rear lamps and substitution of electric.

4. Leaving labor vacancies unfilled where possible.

It had been the practice for the inspection organization to make inspections and repairs and return the

HARRISBURG RAILWAYS CO.

CAR No..... Date.....

WORK ORDER

DISTRIBUTION	REMARKS
Trucks	
Bodies	
Wheels and Axles	
Motors	
Gears	
Trolleys	
Switches	
Wiring	
Controllers	
Heaters	
Bussers	
Sand Boxes	

Inspected by.....

Finished

Temporary

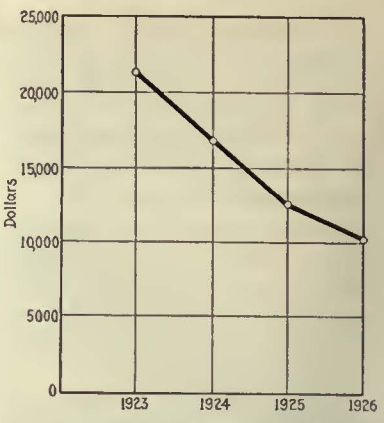
Date.....Repaired by:

.....

Adoption of this Inspection Tag by Harrisburg Railways Has Resulted in a Better Analysis of Maintenance Costs

car to service without completely recording the findings of the inspection or the nature of the repairs. As a result when a road failure of the equipment developed it was very difficult to obtain sufficient history of the defective piece of apparatus to place the responsibility accurately. To obviate this condition an inspection tag was designed covering all inspection operations which is attached to the car upon its arrival in the shop for inspection. The inspectors are required to note on this card the condition of the various parts of the equipment together with the nature of the repairs made. This tag, bearing the signature of the inspector is filed in the master mechanic's office and provides a permanent record of the inspection, repairs and responsibility for every car going through the inspection process. This tag has been the means of creating a feeling of responsibility among the inspectors and has resulted in more efficient and satisfactory work being performed, with a marked reduction in road failures.

The physical layout of the system with regard to the main traffic arteries is such that if the transportation crews were required to return defective cars to the carhouses serious service interruptions would occur. It had therefore been the practice to utilize two carhouse men for the replacement of a defective car with a good operating one. This replacement generally took place at Market Square, which is the terminal for all lines. As a result of this method the services of these two men for shop production purposes were lost during the greater part of the working day.



Electrical Maintenance Costs Have Decreased Each Year Since the Adoption of the New Method. (The Last Three Months of 1926 Are Estimated)

A careful check of the road failures showed that 95 per cent of them were of a very minor nature and could have been repaired on the road, saving the shifting expense. Therefore a capable man was placed in Market Square, whose duties were to make all repairs possible without interrupting service, and the services of the shifting crew were dispensed with. This change has been the means of reducing greatly the pull-ins and labor expense for maintenance, as well as obtaining appreciation from the operating men and the public.

SUMMARY OF AVERAGE PULL-INS PER YEAR, AVERAGE MILEAGE PER PULL-IN AND ELECTRICAL MAINTENANCE LABOR COST ,HARRISBURG RAILWAYS

Year	Pull-ins Average per Year	Average Mileage per Pull-in	Electrical Maintenance Labor Cost per Year
1923	110	2,700	$21,322.62
1924	66	5,773	16,805.86
1925	56	6,044	12,518.18
1926	54	6,220	11,204.48

(Nine months actual)
(Three months estimated)

Basic schedule..... 50 cars
Peak schedule..... 90 cars

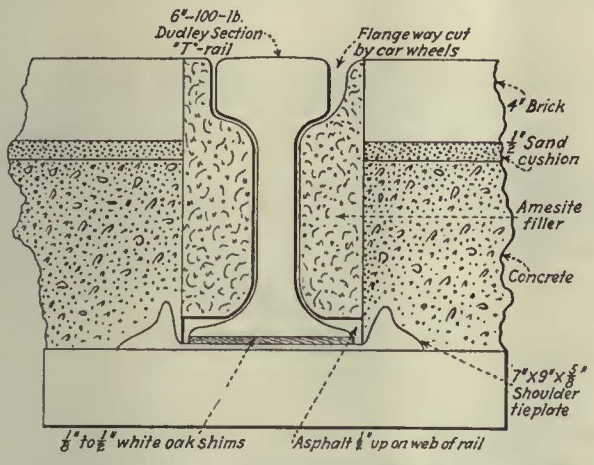
Rear end protection by means of oil lamps was found to be very expensive from a maintenance point of view, since it required the continuous services of two men to gather, distribute and trim these lamps. A careful balance of the cost of a new electric rear end lamp installation and its maintenance against that of the oil light system showed that the cost of the new installation could soon be paid for by the saving effected in maintenance. As a result all cars were equipped with electric rear lamps. As the work progressed the oil lamp maintenance gang was decreased until the maximum of saving in maintenance was procured.

Where possible, vacancies caused by dismissal or resignation have not been filled. A part of the wages saved is utilized in salary increases for the remaining men and the balance is credited against maintenance saving. These increases have been received by the men with great appreciation and have acted as a stimulus for greater effort. As a result the production has not been reduced due to the loss of man power.

Adoption of numerous changes in methods and procedure throughout the shop, especially those enumerated above, has been a means of reducing the electrical maintenance labor costs 47 per cent and increasing the average mileage per pull-in 230 per cent.

Correcting Rail Alignment and Repaving

EARLY in 1913 new rails were laid by the Erie Railways, Erie, Pa., on State Street between Sixth and Fourteenth Streets. A standard 6-in. steel rail weighing 100 lb. was laid on wood ties with steel shoulder tie plates and screw spikes, all being imbedded in solid concrete. This rigid construction, together with the heavy traffic, finally caused rail joint flexion which radiated the entire length of the rail. This



Sketch Showing Method for Shimming Rails, Installing Paving and Applying Filler

resulted in wear on spikes and tie plates and a general loosening of the rails.

This condition was discovered in the spring of 1926. It was found that the rails were very loose in some places and would require immediate attention. A careful examination and calibration of the rail and the pavement away from the rail showed both to be in such good condition that a new construction job was not warranted. Various schemes were considered for the realignment and tightening of these rails. A method was finally adopted which after eight months service has been found satisfactory.

The pavement was opened adjacent to the rails and excavation made to the top of the tie. After the rail was brought up to grade the gap between rail and shoulder plate was filled with white oak shims, varying in thickness from ⅛ in. to ½ in., and the rails spiked. A wooden form was set up on the edge of the rail base of such a height as to permit laying 4-in. brick to grade on a ½-in. sand cushion and this form was filled with concrete. Removal of the form left the base of the rail exposed. When the concrete was set thoroughly, hot asphalt was poured around the base of the rail and up ½ in. on the web. On top of the concrete 4-in. brick on a ½-in. sand cushion was laid 3 in. back from the rail on the gage side and 2 in. back from the rail on the outside. The space between was tamped tightly with Amesite flush with the top of the rail, the flangeway being cut by the car wheels. The surface was then rolled and hot pitch asphalt poured over the entire surface to fill any existing voids. At the expiration of about a week or ten days, an examination was made. Where settlement had occurred hot asphalt was again poured into the depressions and on top of this was tamped and rolled a Tarvia mixture with considerable small aggregate and sand content.

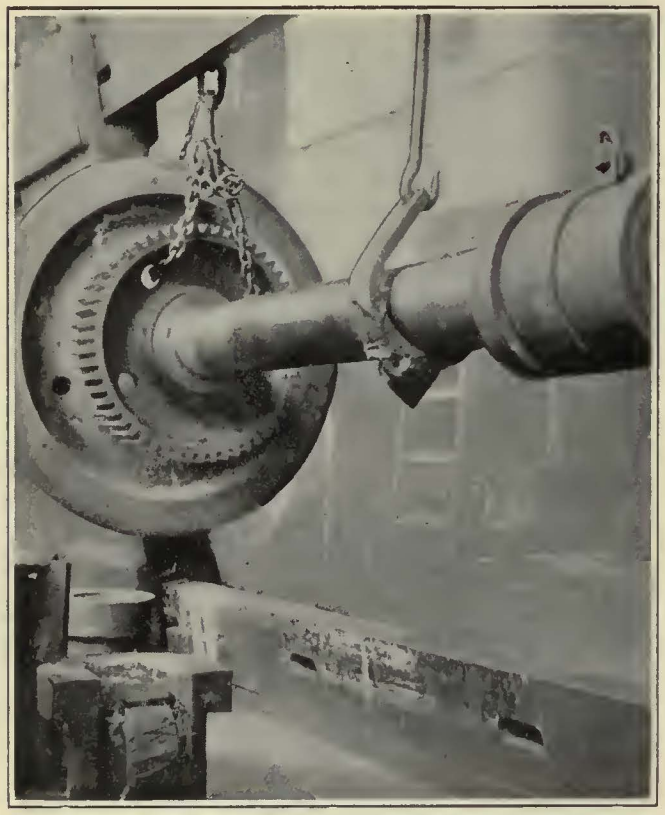
While this method of realignment of rails and adjacent paving is purely experimental great hopes are expressed that it will prove a success, and if so it will be of material assistance to the maintenance man where rails are too good to scrap and the pavement has several more years of life.

Wheels Removed and Pressed On Economically

PRESSING on and removing of wheels, together with the keeping of accurate wheel and axle records, is being given very careful attention in the shop of the Wilkes-Barre & Hazleton Railway, Hazleton, Pa. Where it is necessary to remove a worn-out wheel it has been found good practice to burn the wheel radially to within ¼ in. of the axle by means of an acetylene torch. By driving a wedge into the slot at the tread or by applying a slight pressure the seal is broken and the wheel is removed easily. This method has been found very economical due to the rapidity with which it can be carried out.

In pressing on wheels the danger of shaft distortion, so generally encountered by the usual pressing methods, has been overcome by the use of a specially designed thrust cylinder and mandrel. The cylinder is made of steel about 13½ in. long and 9½ in. outside diameter bored to fit snugly over the wheel fit, with the end pressing

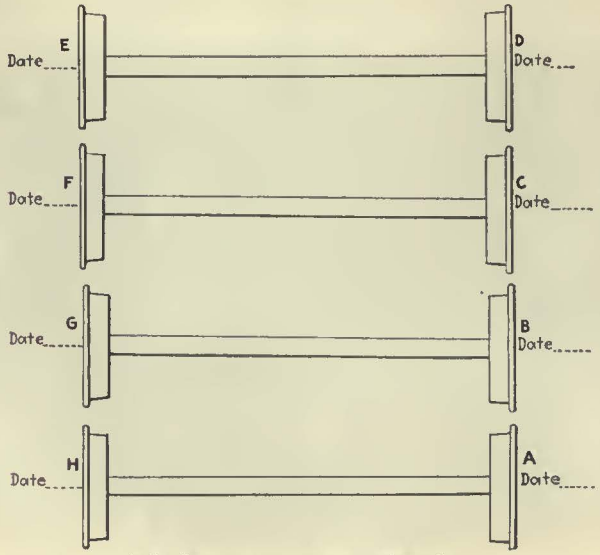
General Appearance of Rails and Pavement on State Street, Erie, Pa., Where Experimental Paving Method Has Been Installed



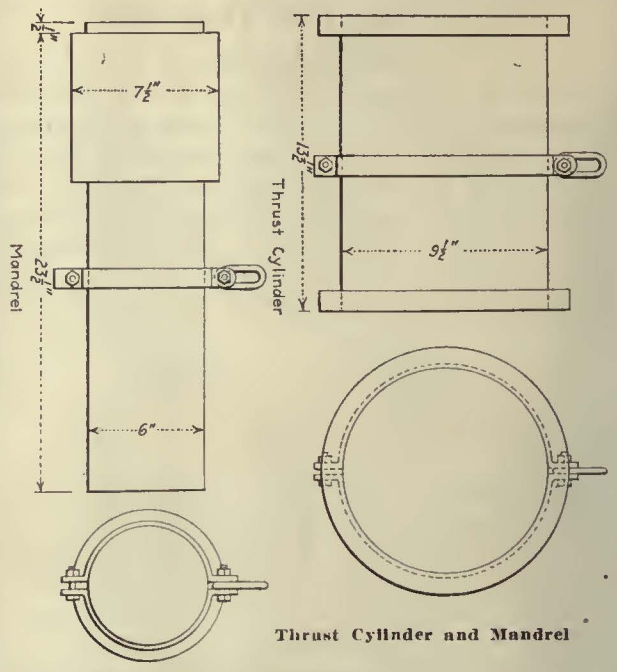
Wheel Being Pressed on with Thrust Cylinder and Mandrel

perfectly against the wheel seat. The mandrel is of steel about 24 in. long, 6 in. diameter at the small end and 7½ in. diameter at the large end. A ½-in. x 6-in. projection extends from the large end fitting the bore of the cylinder. This projection does not touch the end of the axle.

To press on a wheel the thrust cylinder is placed on the wheel fit with its face pressing against the wheel seat. The mandrel is next put on with the projection entered in the cylinder bore and the other end against the press ram. With this equipment the entire pressure is exerted against the wheel seat, thus eliminating the danger of shaft distortion due to shaft end pressure. This apparatus has proved very satisfactory and since its adoption not a single case of a distorted shaft has occurred.



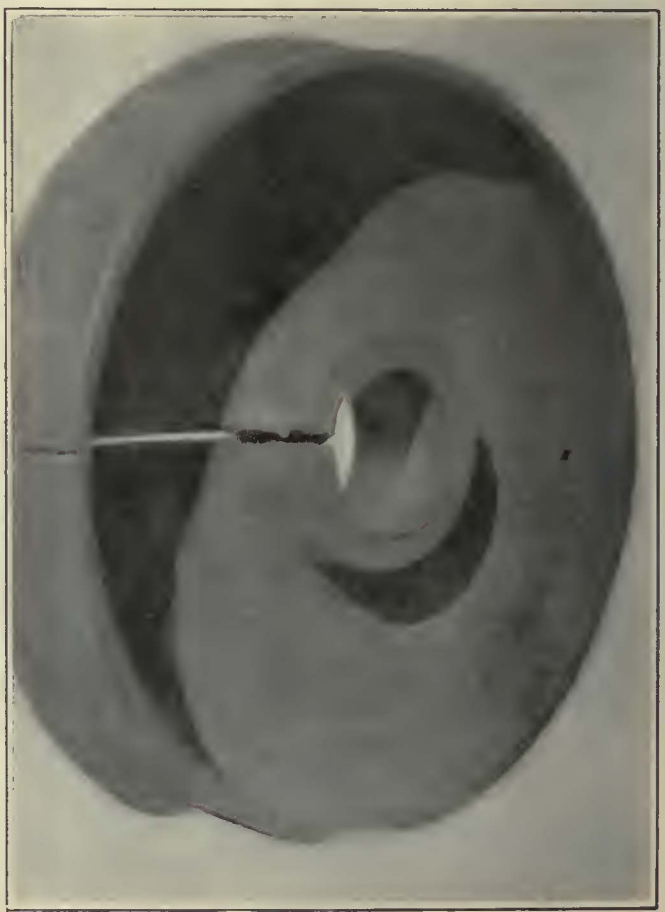
Wheel and Axle Record Stamping



Thrust Cylinder and Mandrel

The press used is of 400 tons capacity with a 25-ton release. All 36-in. wheels are bored 7 in. and are pressed on at a pressure of 75 tons. The pressure used for each wheel is kept on a recording gage chart and filed systematically for ready reference.

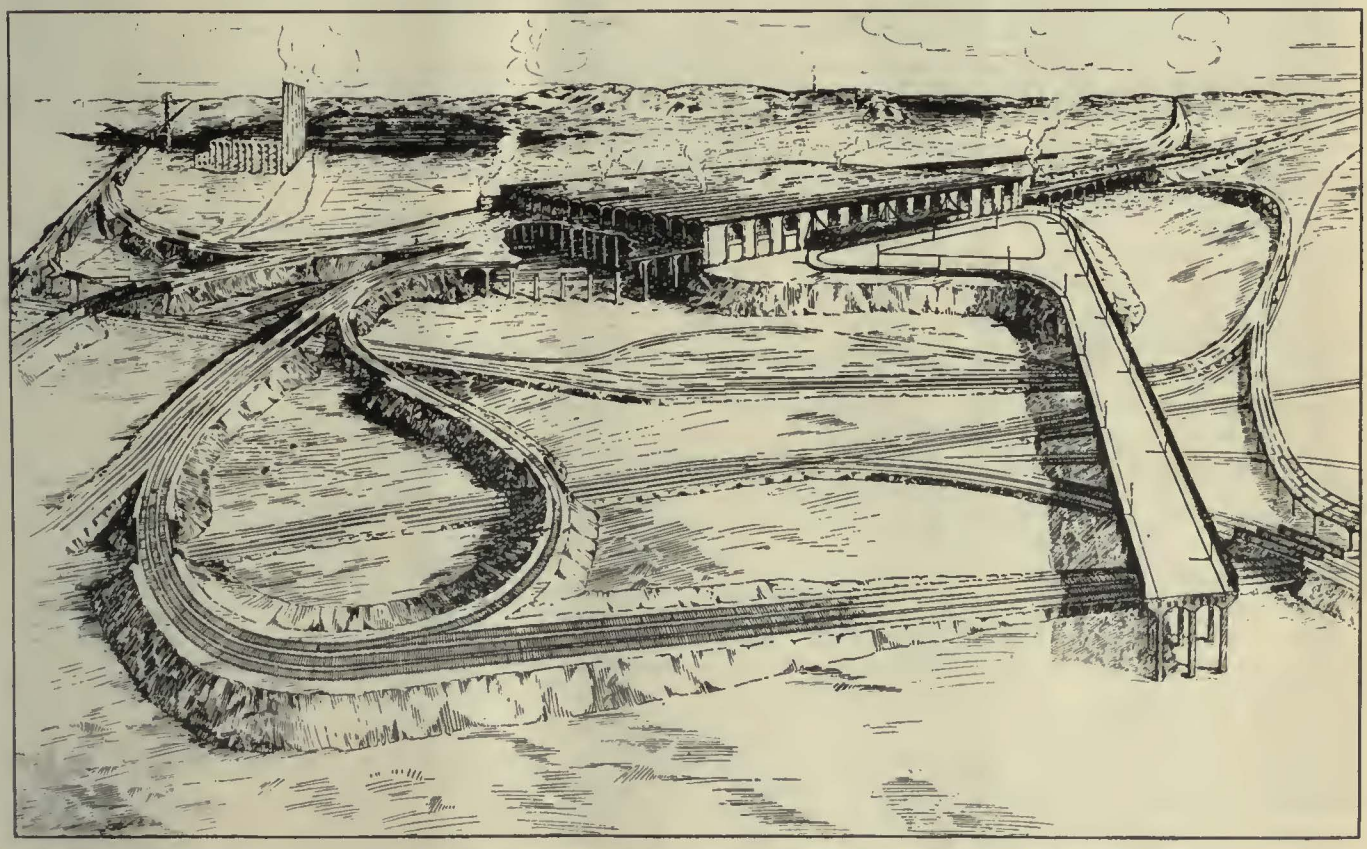
Each wheel of a car, together with the end of each axle, is lettered consecutively from A to H, along with the date it was pressed on. This record is suitably filed so that complete information on any wheel or axle is obtainable when desired.



36-In. Wheel Removed from Axle by Burning with Acetylene

New Plans for North Jersey Transit

Studies Made by North Jersey Transit Commission Embrace a Loop Line Between Manhattan Borough, New York, and the Steam Railroads Serving New Jersey Communities—Alternate Plans Provide for Various Contingencies—Many Differences from Proposals of Former Commission



Perspective of Proposed Meadows Transfer Station Near the Present Croxton Yard of the Erie Railroad

MARKED efforts toward elimination of former physical objections and definite recommendations for the speedy realization of the interstate rapid transit loop are features of the new report of the North Jersey Rapid Transit Commission, which was presented to Governor A. Harry Moore on Feb. 14. This report, prepared under the direction of Chairman Daniel A. Garber, follows an earlier report presented in 1926, and which gave somewhat similar recommendations although not in such complete form.

In order to obtain definiteness and clarity the report is presented in three major sections: Status of the physical plan, prepared by Glenn C. Reeves, assistant chief engineer, and Daniel L. Turner, consulting engineer; studies in means of financing, prepared by Philip H. Cornick, specialist in taxes and assessments, and opinion of counsel relative to district organization, prepared by Spaulding Frazer, counsel.

While the basic plan is the same as that reviewed in ELECTRIC RAILWAY JOURNAL for Feb. 6, 1926, page 239,* the commission, during the five months at its disposal, has by exhaustive studies broadened the entire scope of the project and developed several new features of outstanding importance. In addition, it has apparently established an *entente cordiale* not only with the managements of the steam roads entering New York but with the transit officials of New York City.

Briefly the new features are: (1) A transfer station at Journal Square, Jersey City. (2) Physical connections with the New York City Board of Transportation's Eighth Avenue subway and various changes in the 1926 plans for physical connections with the downtown subways. (3) A transfer station at New Durham, N. J. (4) Definite plans for extending the B.-M.T. Fourteenth Street-Eastern subway to Meadows Transfer Station. (5) Definite plans for extending the Interborough Rapid Transit 41st Street subway to connect with the New Durham Transfer Station. (6) An

ONE-WAY COMMUTER TRAFFIC ON NEW JERSEY STEAM RAILROADS FOR A TYPICAL DAY

	Excluding Passengers	H. & M. Per Cent	Including Passengers	H. & M. Per Cent
B. & O.	550	0.36	550	0.18
Central Railroad of New Jersey	28,106	18.59	28,106	9.12
Delaware, Lackwanna & Western	34,296	22.68	34,296	11.13
Erie	50,337	33.29	50,337	16.33
Hudson & Manhattan	.....	.....	156,986	50.94
Lehigh	980	0.65	980	0.32
New York, Ontario & Western	338	0.22	338	0.11
Pennsylvania	24,248	16.04	24,248	7.87
West Shore	12,351	8.17	12,351	4.00
Total	151,206	100.00	308,192	100.00

*See also ELECTRIC RAILWAY JOURNAL, Feb. 7, 1925, page 222; Jan. 30, 1926, page 210; March 13, 1926, pages 444, 447 and 449; April 10, 1926, page 639.

independent subway through Manhattan in conjunction with the authorities of Westchester County, New York.

These new plans are predicated on a detailed study of passenger traffic into New York City on the various routes from New Jersey points. The accompanying table summarizes the information which was secured from an elaborate traffic count.

Of the nine steam railroads involved, four, the Central Railroad of New Jersey; the Delaware, Lackawanna & Western; the Erie, and the West Shore, now handling 83 per cent of the commuting population, will need to make a complete reorganization of their terminal operations, and three will have to move from their waterfront terminals to the other side of Palisades Hill.

The commission has laid the situation before the managements of the roads affected and has obtained the co-operation of practically all of them. The West Shore is recommending a rearrangement of its terminal facilities in accordance with the commission's plans; the Erie, whose traffic load is 33 per cent of the total and exceeds by 46.8 per cent that of any other system, has made helpful suggestions and still has the plan under advisement. In this stand the Erie has been joined by the Lackawanna and the Central Railroad of New Jersey, whose traffic loads are 23 and 19 per cent respectively. The Hudson & Manhattan (which receives 31 per cent of its total passengers from steam railroads) has agreed to the extension of its lines to the proposed Meadows Transfer Station. The Pennsylvania Railroad, which enters New York directly and hence is not particularly concerned in the steam commuter problem, has raised no particular objection to the plan. The Lehigh Valley is noncommittal.

On the basis of a request from the engineering staff of the Port of New York Authority, the advisability was considered of revising plans for the proposed 178th Street and Fort Lee Bridge so as to permit of at least four rapid transit lines passing over this structure.

JOURNAL SQUARE STATION

Returning to the outstanding modifications of and additions to the 1926 plan, the Journal Square Station, Jersey City, has been given considerable study because it is the locus of most of the bus and trolley passenger traffic on the west bank of the Hudson River. On a typical day the buses alone deliver 52,000 one-way passengers, most of whom use the Hudson & Manhattan tubes to New York City, so that any plan for traffic relief at this location affects both the Pennsylvania and H. & M. Railroads. "This plan," the report states, "proposes a rapid transit station to be located on the rock ledge which now forms the northeasterly side of the railroad cut in which the present H. & M. Journal Square Station is located. The station is to extend between the Hudson County Boulevard Bridge and a point some 250 ft. beyond the Summit Avenue Bridge. The rapid transit electric station platforms below are reached by ramps and stairs from a mezzanine over the electric tracks, which in turn is reached from the street level by additional ramps, one connecting with the Boulevard Bridge, another from Bascot and Magnolia Avenue, and another connection with the Public Service trolley plaza and the Hudson & Manhattan platforms. Entrances are also provided from Summit Avenue to this mezzanine. . . . Other studies for various routing through the Journal Square section which would not make use of the right-of-way of the Pennsylvania Railroad through the northern arch of the Boulevard Bridge also have been made."

Taking into account the colossal problem of financing the Interstate loop as a single unit and based upon suggestions of John H. Delaney, chairman of the Board of Transportation of New York City, the commission made nine different studies to determine the most advantageous routing for the North Jersey transit subway in order to make connections not only to the east side and west side Interborough lines but also to the independent system of the Board of Transportation. These plans include a Manhattan terminal building such as the present Hudson Terminal, utilization of the empty reverse movement capacity now existing on the local subway tracks during the morning and evening rush hours, and a general scheme that will not only collect the greatest number of commuters conveniently, but at the same time form a part of the final loop.

Of the nine studies, three of the most desirable are illustrated in this article. These are referred to as Schemes *F*, *G* and *I*. In all of these the North Jersey Transit Commission's subway line would enter Manhattan at the Battery. In Scheme *F* the line would bifurcate to make connections with local lines of the east side and west side Interborough subways, the former connection being south of Brooklyn Bridge with deep level stations under the east side line. This contemplates provisions for development of the Board of Transportation's subway plans.

Basic Plan of 1926

1. Construction of a new North Jersey rapid transit system.

2. Hudson & Manhattan Railroad extensions in New Jersey.

3. Interborough extensions of its Manhattan lines to New Jersey.

4. Brooklyn-Manhattan Transit system extensions from Manhattan to New Jersey.

5. Extension of North Jersey rapid transit system, listed as part one of this program, to serve a larger area.

6. Electrification of existing steam railroads.

The North Jersey rapid transit system, part one of the program, would consist of the following five lines:

1. Interstate loop line, running north and south between the Hackensack River and Bergen Hill in New Jersey, passing under the Hudson River via a tunnel at the Battery, up through Manhattan to 57th Street and back through another tunnel to New Durham. Its length would be 17.3 miles. A so-called Meadows Transfer station would be located near the intersection of the Erie and Delaware, Lackawanna & Western Railroads.

2. A line from Paterson through Montclair and Newark, following the Interstate loop route through Manhattan to New Durham and thence to Rutherford and Hackensack. The length of this route would be 41.9 miles.

3. A line from Ridgewood via Paterson, Passaic, Rutherford, New Durham, the Interstate loop route in New York City, to Newark and Elizabeth. Route mileage would be 39.8.

4. An intrastate route from Elizabeth through Newark and Rutherford to Hackensack, 18.8 miles in length.

5. Another intrastate line from New Durham to Newark, 13 miles in length.

P. H. Cornick D. L. Turner D. A. Garber S. Frazer G. C. Reeves

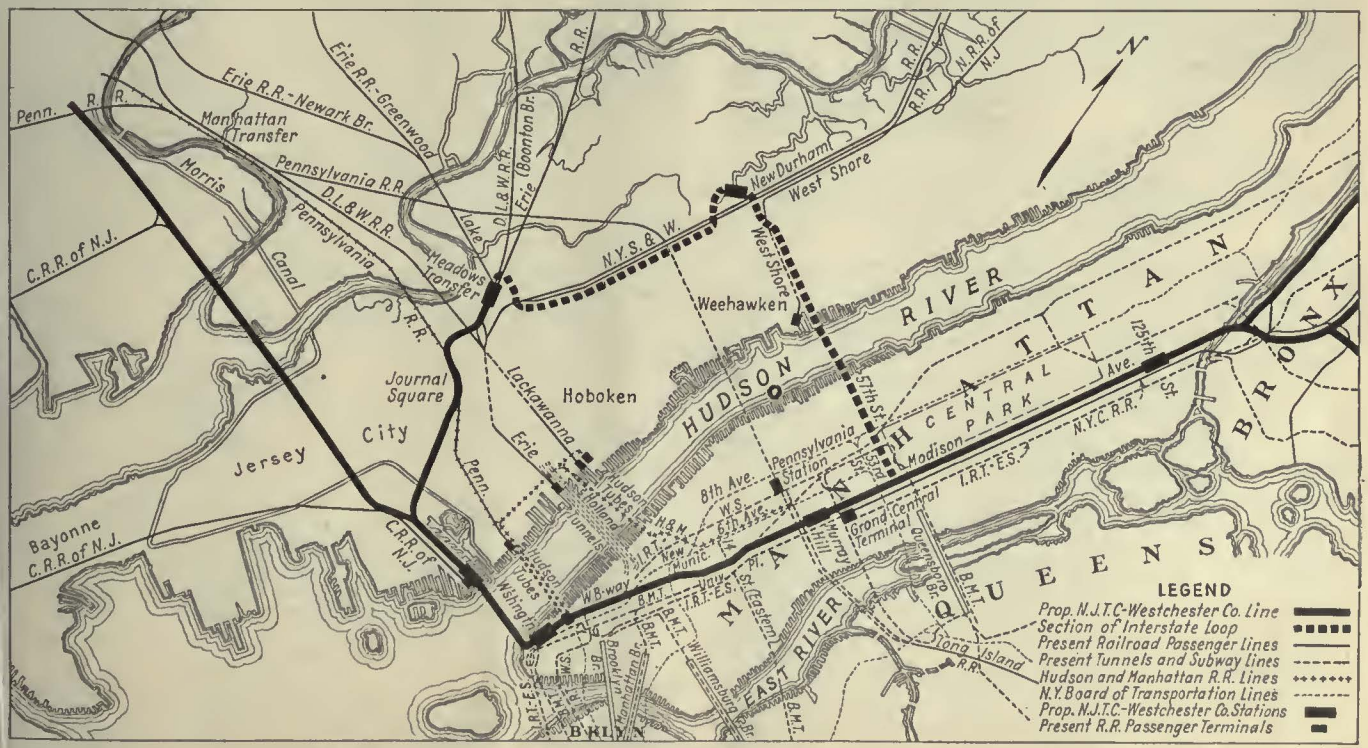
Men Responsible for 1927 North Jersey Transit Plans

Scheme *G*, on the other hand, proposes connections to both Interborough subways and also with the Board of Transportation's independent line in Church Street. The plan of the connection is shown in the map. Scheme *I* also proposes a connection to each of these three subways, but would include a cross-connecting track at Barclay Street. It also contemplates running the new line under Washington Street for the southern portion of the route, making connection with the east side subway at a point north of Worth Street.

According to the report, "all of the studies for one entrance into Manhattan have been made with the thought in mind that at some future time it would be necessary to have an independent commuter subway through Manhattan to connect with New Jersey. These schemes, *F*, *G* and *I*, are to be considered as a first step measure, and when the time does arrive for the independent commuter subway this first step construction would be used as a part of that independent line."

At New Durham, N. J., on the meadows opposite 57th Street, New York, the commission proposes a rapid transit station whereby the steam railroad passengers from the West Shore Railroad, the New York, Susquehanna & Western and the Northern Railroad of New Jersey will have opportunity to transfer to rapid transit electric trains for distribution in New York City or other parts of New Jersey when the comprehensive plan is accomplished. Four studies have been made for this station, any one of which would mean the removal of steam railroad passengers and local ferry passengers from the waterfront terminals. "This very important step," continues the report, "is one that should be made, and the West Shore Railroad is in sympathy with such a move."

Of the four plans presented, Scheme *D* provides for a complete separation of the Erie and West Shore Railroad tracks and platforms by a passageway or driveway leading to the ticket offices and other facilities. Directly over this passageway and parallel to the axis of the steam station platform are the electric tracks and platforms. To reach these platforms passenger bridges leading to a distributing concourse over the



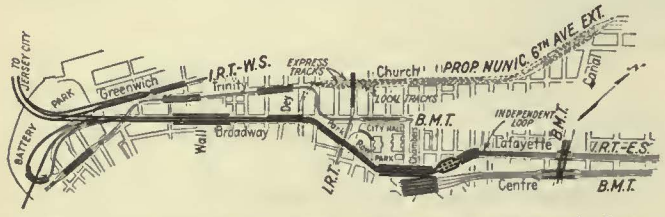
Route Planned for New Jersey-Westchester County (New York) Subway. One of the First Relief Measures Suggested by the Commission

driveway and directly under the electric platforms are provided over the steam tracks.

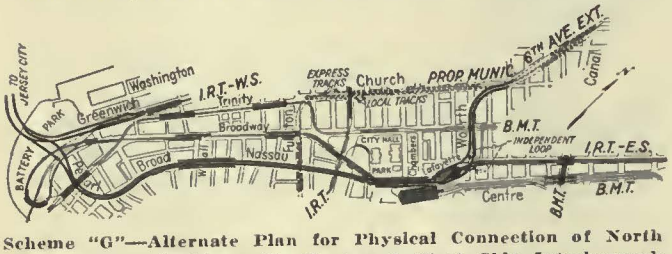
In order that this transfer station might be of service to the commuters, the minimum rapid transit construction required would be either the 57th Street trunk of the Interstate loop or the 41st Street extension of the Interborough subway. At this point recommendation is made that should the 57th Street tunnels be constructed before the Interstate loop, they should be made of sufficient size to accommodate standard railroad equipment.

B.-M.T. Fourteenth Street Extension

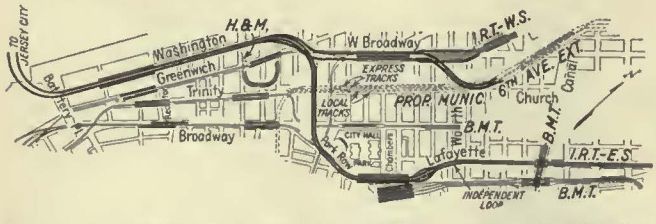
In regard to this extension the commission now makes these definite proposals as a means not only of effecting the most direct connection with the B.-M.T.



Scheme "F"—Proposed Physical Connection of the North Jersey Transit Line with the West Side Interborough Subway South of Rector Street and with the Local Tracks of the East Side Interborough Subway South of Brooklyn Bridge Station



Scheme "G"—Alternate Plan for Physical Connection of North Jersey Transit Line with East and West Side Interborough Subways and Subway of the Board of Transportation Now Being Built in Church Street



Scheme "I"—Which Proposes Physical Connections with the West Side and East Side Interborough Subways and Also with the Independent Subway of the Board of Transportation

subway for traffic of the Lackawanna and Erie, but of serving passengers from Hoboken and the heights section of Jersey City. The most advantageous route extends from Fourteenth Street and Sixth Avenue westward under the Hudson, emerging to the surface about Clinton Street, Hoboken, to pass into the side of Palisades Hill at Congress Street, where the route turns southward in subway into Palisade Avenue. Continuing under Palisade Avenue, the line turns into Franklin Street and thence into Manhattan Avenue, where, after the Hudson County Boulevard has been reached, it emerges in the western slope of the Palisades to continue on trestle to Meadows Transfer Station. This line will be stub-ended and the rapid transit electric trains will be returned over the same rails to New York City.

"This is a very logical extension," the report states, "and should be made at the earliest opportunity. Conference has revealed that such an extension would be acceptable to the New York Rapid Transit Corporation." In addition it is pointed out that it might prove desirable to extend this line to New Durham Transfer as well and then return to New York via the 57th Street tunnels to connect with the stub-ended tracks of the B.-M.T. at 59th Street and Seventh Avenue, thus forming the upper trunk of the Interstate loop.

Interborough 41st Street Extension

All plans for the New Durham Transfer Station provide for the extension of the 41st Street Interborough subway line as part of the rapid transit system almost in a direct line under the river through Palisades hill to the New Durham transfer station, with a subway station on Franklin Street between Boulevard and Bergenline Avenues, Union City, N. J., which would serve a large portion of those local ferry commuters now depending upon the Weehawken ferries for transportation to New York City.

Westchester-New Jersey Commuter Subway

On this project the commission makes some very definite observations based upon the uncertainty of the present subway policy of New York City, which it believes might prevent the construction of connections to the subways. In such an event the commission urges a co-ordination of effort with the authorities of Westchester County, New York, for the construction of an independent subway from some point in that county through the entire length of Mahattan, under the Hudson River to the Central Railroad of New Jersey terminal at Communipaw. Thence one section would continue along the Newark branch of that road to its present Broad Street station in Newark, while the other section would extend to Meadows Transfer through the Journal Square section of Jersey City. On this point the report continues:

> This would furnish Newark with a rapid transit service in addition to that rendered by the Pennsylvania Railroad (Hudson & Manhattan) and at the same time would afford the suburban passengers of the Erie and the Lackawanna Meadows Transfer access to a rapid transit line for distribution in New York City. Such a line would be economical of operation in that the loaded trains from Westchester County would distribute their passenger load through Manhattan; then these same trains would continue to Newark and Meadows Transfer and return with another load of Manhattan-bound passengers. This is a slight modification of a part of the comprehensive plan as presented in the 1926 report. The main points of difference, however, are only temporary in that the southern trunk of the proposed North Jersey Transit System would terminate at Newark until the comprehensive plan can be fully developed instead of continuing to Paterson or Elizabeth, and the Manhattan trunk would be continued to Westchester County until the 57th Street line or northern trunk of the Interstate loop could be constructed.
>
> In the event that the complete Interstate loop commuter subway cannot be developed and financed as a unit, then the first section of that loop constructed should be an express and local service line from and including Meadows Transfer station to a physical connection with the downtown Manhattan subways.
>
> Should the subway policy of New York prevent this physical connection to downtown Manhattan subways, then the first step of construction should be (in conjunction with the Westchester County of New York State) the Westchester-Meadows Transfer-Newark commuter subway.

Plan of Finance

The section of the report dealing with finance, comprising some eight chapters, is a powerful argument as to the fallacy of financing such a project by a private corporation. Admitting that there are probably one or

two railroad companies in the North Jersey transit district which have reserves adequate for the establishment of their own commuter terminals in New York City, the report dismisses these as local and, continuing, comments:

"So far as any comprehensive plan for rapid transit is concerned, however, no public body and no conceivable combination of private agencies is in position to provide accumulated capital sufficient for its consummation."

The commission also frowns on anticipated revenues as a means of financing the project and makes it clear that the only revenues that could be made available for construction costs would be those derived from taxes as special assessments. The report continues:

The only remaining alternative is that of basing the financial plan, in part at least, in anticipating future revenues—in other words, the issuance of bonds to be supported out of operating revenues, taxes, special assessments, or a combination of all three. If the bonds are to be supported solely by fares and additional revenues from advertising, your engineers have estimated that the cost for total expenses would require a fare of 16.56 cents per passenger on a basis of 125,000,000 passengers per annum and 11.28 cents on a basis of 250,000,000.

The nearest comparable service rendered in the district is that supplied by the Hudson & Manhattan lines whose fare is 5 cents for intrastate passengers and 6 or 10 cents for interstate passengers, depending on their destination in New York. It is open to question, therefore, whether it would be feasible, wise or desirable to rely solely on anticipated future operating revenues as a means of supporting construction costs. If that be granted, revenues derived through the taxing power would be needed at least to supplement operating revenues.

A concrete example will serve to illustrate the relative advantages and disadvantages from the standpoint of the taxpayer of using this supplementary source as a basis for a bond issue, or of making a direct levy for construction funds as they are needed. The preliminary estimates made by the engineers of the cost of constructing the interstate loop (exclusive of land costs) totaled $154,000,000. Assuming a seven-year construction period and equal yearly expenditures throughout that term the annual requirements would amount to $22,000,000.

In order to provide this from current tax revenues a levy amounting to $5.44 on every $1,000 in the net valuation taxable for 1926 in the North Jersey Transit district would be necessary. The weighted average tax rate imposed on the same base in 1926 for all purposes was $39.63 per $1,000. Assuming that all other governmental expenditures were to remain constant and that there were to be no change in assessed valuations, this additional burden would require an aggregate average tax rate of $45.07 per $1,000 for the seven-year period.

If, on the other hand, seven successive bond issues for $22,000,000 each were to be made during the construction period, each issue running for 35 years and bearing interest at 4½ per cent per annum, and if sinking funds were assumed to earn at the rate of 3½ per cent yearly, then the increase in tax rate would amount to only 31 cents per $1,000 of assessed values of the first year. It would increase 31 cents per year during the remaining six years of the construction period and would then remain constant at $2.19 per year for 28 years.

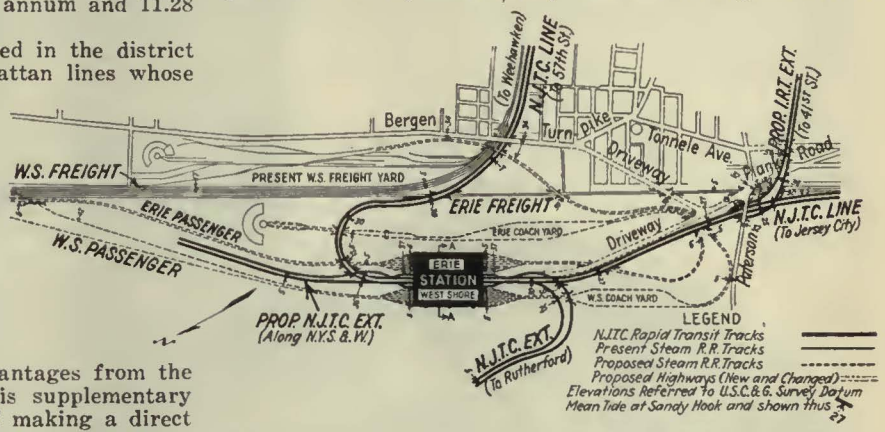
If current revenues from special assessments were to be relied on, the increased burden would, of course, remain the same, but the base against which it was levied would be considerably narrower. It is evident, therefore, that no plan for financing construction costs direct from current revenues, and without resort to bond issue, can be carried out for a work of the magnitude of the proposed Interstate loop without bringing about an unduly severe increase in the current burdens which already fall on taxable or assessable property.

Following the foregoing analysis, the commission makes the following conclusions relative to choice of means of financing that would seem to be warranted:

1. *That the proposed North Jersey Transit System be publicly financed and publicly owned.* It is true that the only rapid transit system now operating in the North Jersey transit district was provided by private capital. It is probable, furthermore, that certain of the railway companies which handle large numbers of commuters in this district have the capital and credit necessary to provide rapid transit connections with New York City for their passengers. Nevertheless, all such operations, desirable though they may be, can provide only local and temporary relief; and there is slight probability that any one company, or any group of companies, can provide the necessary capital for a transit system of the type which the North Jersey Transit Commission believes to be essential to the continued and symmetrical growth of the territory comprised within the district.

2. *That the bonds to be issued for construction costs be supported by supplementary pledges of full faith and credit based on the taxing power.* Regardless of the types of revenues which are to be pledged to the support and retirement of bonds, the supplementary pledge of full faith and credit is essential to obtaining the lowest interest rates.

3. *That the maximum term of all bonds issued for transit developments, regardless of the specific part of the work for which they are to be issued, be fixed at 35 years.* The completion of a rapid transit system in this region will inevitably bring new population, and an attendant increase in problems, for whose solution further bond issues will be needed. The imposition of long-deferred burdens which will fall on future generations, who will have abundant current burdens of their own, is therefore to be avoided.



Scheme "D"—Proposed Transfer Station at New Durham, N. J., for Commuters on Several Branch Lines of the Erie Railroad and for the West Shore Railroad. This Plan Has Been Indorsed by the Latter Road

Special Taxing Powers Asked

In the main the legal section of the report is a plea that the commission be empowered with authority to levy taxes within the territory affected:

A study of the portion of this report dealing with the physical and financial aspects of the transit situation shows that no type of agency now in existence, except that of state authority financed by general state tax or by state bond issue, similar to the existing Highway Commission, can bring to the problem powers adequate for its solution.

And yet the problem, despite its magnitude and the large territory involved, is essentially a district problem, in which other portions of the state have naturally either no interest at all, or, if we bear in mind the rapidly growing Camden metropolitan section at best so slight an interest as to make the proposal of state-wide authority supported by the contribution of the whole state, whether in the form of direct tax or of bonds, one which must seem obnoxious to the voters of those parts and therefore, quite naturally and properly, one which, except under unusual conditions, would scarcely receive the support of the senators and assemblymen from those counties. . . . Many commissions have been granted assessing powers, and this has been upheld not only in state courts but in the broadcast terms by the federal Supreme Court as in no way violating the due process and equal protection clauses of the federal Constitution.

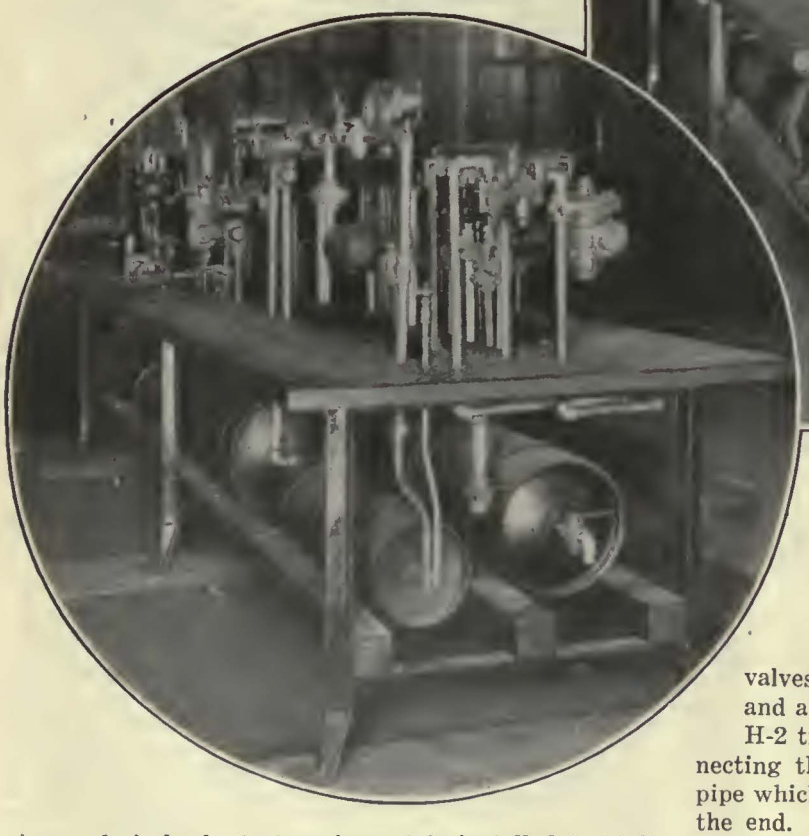
Air Equipment Tested in Place on Cars

Thorough Testing of Triple Valves, Motorman's Valves, Brake Cylinders, Feed Valves and Other Parts by Means of a New Test Rack Has Eliminated Many Troubles on the Cars of the Indiana Service Corporation

BY ARTHUR W. REDDERSEN
Superintendent of Motive Power Indiana Service Corporation, Fort Wayne, Ind.

EACH piece of air apparatus used on either city or interurban cars of the Indiana Service Corporation is given a thorough test by means of an air brake test rack, recently completed and installed as a part of the equipment of the Spy Run shops at Fort Wayne. The air supply for operating the rack is furnished by a 225-ft. shop compressor, located in the basement. Air lines from this run to the rack and also to the various shop pits for careful testing of the equipment in place on the cars. Where desirable, equipment may also be removed and taken to the rack for testing.

The top of the bench on which the various pieces of air brake test equipment is installed is 14 ft. long, 46 in. wide and 36 in. above the floor. In the center is a framework built up of 2¼-in. x ⅜-in. angles. It is 11 ft. 4 in. long, 18 in. high and 14 in. wide. This is bolted to the top of the bench and braced at each end so as to leave 16 in. of bench space all the way around, providing a convenient place for tools when testing and making adjustments. All pipe brackets are mounted on the framework, with the necessary cut-out cocks located in the pipe lines between the brackets and top of the bench.

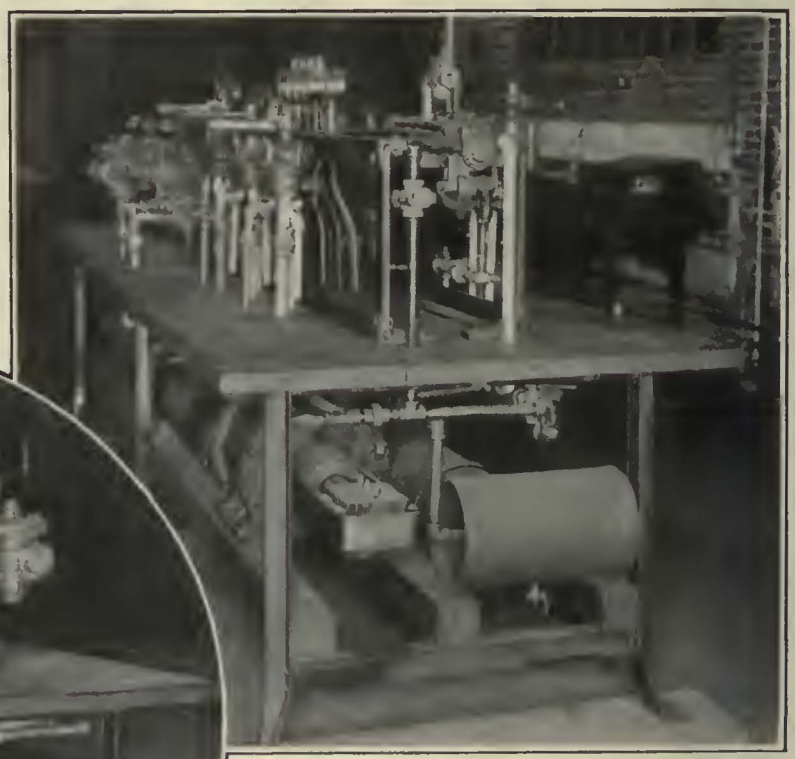


Space on Top of the Bench Around the Test Rack Provides a Convenient Place for Tools When Making Adjustments

A brake-pipe line is run in the basement of the shop to the tracks where box cars and all non-compressor car repair work is done, so that after the brake rigging has been overhauled and the triple valves and brake cylinders cleaned and lubricated a test is given for piston travel before the car is again returned to service.

A brake cylinder located under the bench is operated when any triple or brake valve is being tested, unless this cylinder is cut out by closing the double cut-out cock above the bench. A yoke is attached to the non-pressure head of the brake cylinder so that by dropping in blocks of various thicknesses any given piston travel may be obtained and the result indicated on the brake cylinder gage.

Automatic engineer valves and triple valves are tested on one side of the rack. Feed valves, governors, safety valves, gong ringers, door engines, low-pressure city brake valves and emergency valves are connected in with the straight air brakes and are tested on the opposite side of the rack. An H-2 triple valve application test is provided by connecting the brake pipe to atmosphere through a ⅜-in. pipe which runs above the bench with a cut-out cock on the end. The cut-out cock is plugged at one opening. The plug is drilled with a hole of the proper size so that the brake pipe pressure is reduced from 70 lb. to 50 lb. in ten seconds when the cut-out cock is open. Two duplex and six single-pointer test gages are used on the rack, each mounted so as to be in the operator's direct range of vision while tests are made.



The Brake Cylinder Installed Underneath the Bench Is Provided with Blocks so that Different Length Piston Travel Can Be Obtained.

Following are some of the troubles that have been overcome through the building of the rack:

Previous to the installation and use of the present

careful testing methods frequently a triple valve would be removed from a car on account of a defective slide valve. Either the inspector would fail to mark the cause of removal or the tag would become destroyed before the triple valve arrived at the repairman's bench. The repairman, not being able to detect the defective slide valve, would clean the valve and mark it O.K. An inspector would again put the triple valve on a car, only to find that the slide valve was defective. This often necessitated going to the shop for another triple valve and caused delay to the train as well as unnecessary expense in getting proper equipment to make the car pass the test.

Since the installation of the test rack, triple valves are given a test after cleaning. Those found to have defective slide valves are sent to the factory for a general overhauling. After being cleaned all feed valves are given a rack test and a code test, as recommended by the Westinghouse Air Brake Company. If they do not pass this test, they are also sent to the factory for general overhauling.

The rack has been arranged so that it can be used for instruction, as well as for testing purposes. Motormen being instructed on car equipment can thus be shown what actually happens in addition to obtaining explanations of the various operations. These include particularly the time required to charge the auxiliary reservoirs after a train has been made up and the importance of waiting until all auxiliary reservoirs are charged before attempting to make a terminal brake test. Motormen are also shown that when making a brake application it is useless to reduce the brake pipe pressure below the point of equalization. The importance of stopping the brake pipe reduction when the point of equalization has been reached is explained. This instruction has proved very beneficial.

The Readers' Forum

Extensive Rehabilitation Programme Planned by South Carolina Power Company

CHARLESTON, S. C., Jan. 22, 1927.

To the Editor:

An extensive program of improvement and modernization has been mapped out for the railway department of the South Carolina Power Company. This includes track renewals, the substitution of improved rolling stock for worn-out or obsolete equipment, and an advertising campaign to "sell rides" in connection with the improvements.

It has been recommended that all cars in regular service be equipped with comfortable, upholstered seats, and with floor covering. All cars will be painted in our new standard color, a bright orange, and instead of being lettered will carry a distinctive insignia emblematic of the company.

It is our opinion that by furnishing the public economical, safe and dependable service, and keeping that picture prominently before their eyes, we can increase our gross revenue to such an extent that with the attendant economies in operation, we can finally pull a mighty sick patient out of the hospital.

H. BIGELOW,
Superintendent of Railway.

Careful Inspection Program Gives Good Results

PHILADELPHIA RAPID TRANSIT COMPANY
PHILADELPHIA, PA., Jan. 20, 1927.

To the Editor:

Before the present one-man, two-man, front-entrance, center-exit cars were adopted as standard on the Philadelphia Rapid Transit Company lines a very thorough study was made of the operating requirements in this city. The variety of transportation requirements led us to believe that a car of the maximum flexibility was necessary for our purpose, and we feel that our present type is the best which has yet been developed to fulfill our needs. Our fare collection system was also developed from a standpoint of giving the maximum of adaptability to all our service requirements. It is possible to operate one of our standard cars over any of our surface lines and in the surface car subway on Market Street. We will probably continue to standardize on this car design until some later development appears which will prove even more desirable for use in our co-ordinated transportation system.

It is true that we have not placed a great deal of emphasis upon interior fittings which approximate the luxurious. Deep spring seats with leather upholstery have doubtless proved very satisfactory in many applications, but we have thus far found it expedient to retain the wooden seats, both lengthwise and crosswise. Great care is manifested at all times, however, to keep the cars thoroughly clean and attractive, both inside and out. We have adopted a very positive schedule for car cleaning and inspection, and as a result we have succeeded in reducing our electrical and mechanical failures from a total of 15,035 in 1921 to 2,102 in 1926.

To obtain this gratifying result the following schedule for car cleaning and inspection has been adopted:

Daily—The interiors of the cars are washed thoroughly with a solution consisting of one part disinfectant to fifteen parts of water.

Weekly—The interiors of the cars are cleaned thoroughly and the exteriors are given a complete washing.

500 Car-Miles—At the end of this period, the so-called "A" inspection is given to the cars. This consists of a careful mechanical inspection of fundamental brake equipment, control equipment and current collection equipment.

2,500 Car-Miles—After this interval the car is given both an "A" and "B" inspection. The "A" inspection was described above. The "B" inspection consists in giving the cars a thorough lubrication of the controls, motors, compressors, etc.

7,500 Car-Miles—At this time the cars receive a complete electrical and mechanical inspection which covers all operating parts of the cars.

60,000 Car-Miles—When this limit is reached every car is completely overhauled and sent through the paint shop.

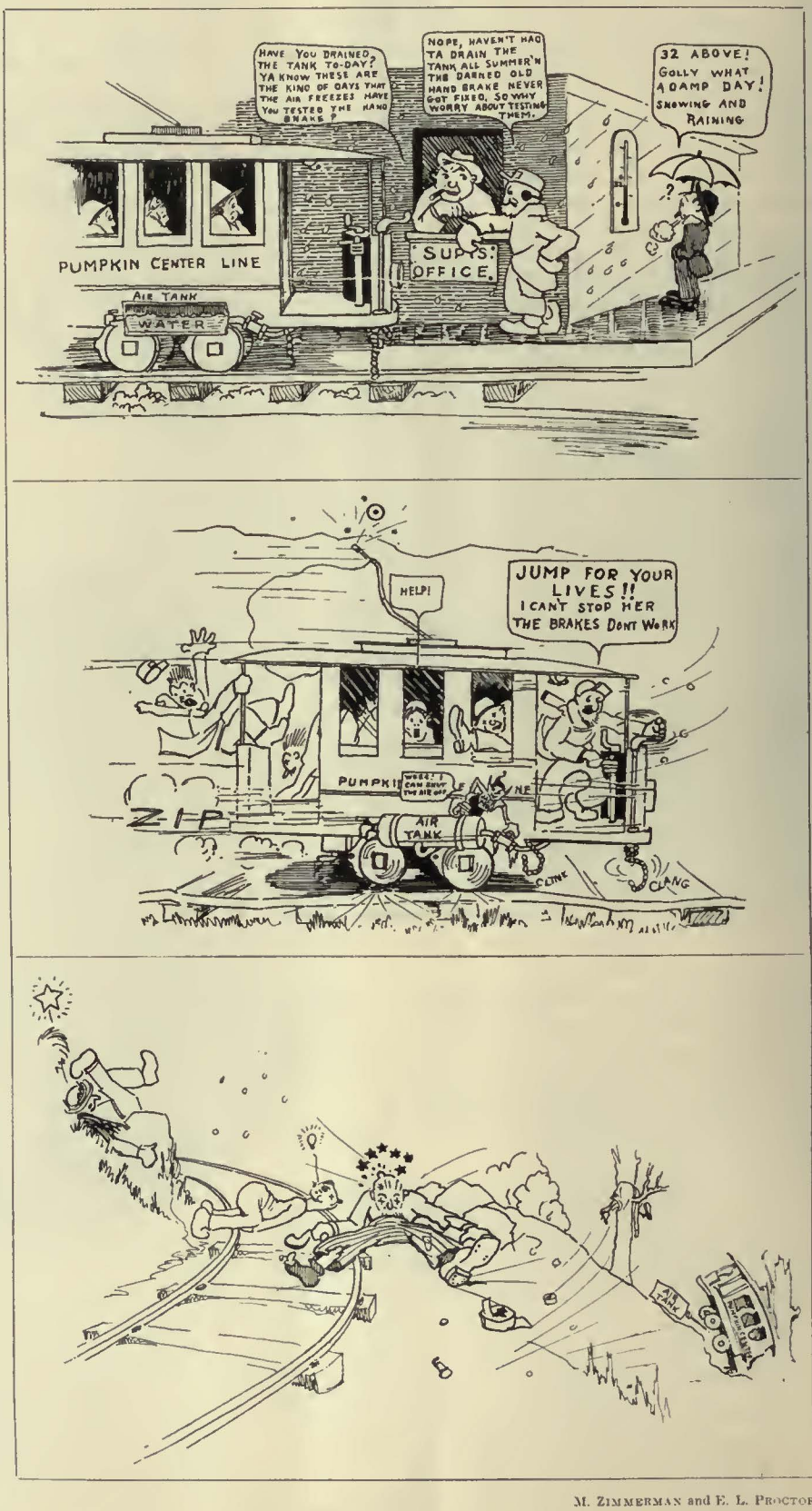
Not only has this system succeeded in reducing the street failures to a remarkable extent but it has also had a very favorable reaction from the public. Frequent comments are heard on the cleanliness and well-painted appearance of the surface cars, and we find that our conductors and motormen react very favorably to public appreciation shown for presentable rolling stock. The cost of cleaning and painting cars is after all but a small price to pay for the gratifying returns in public good will and in improved morale which is bound to follow, and this does not take account of the material savings in maintenance expenditures which result from reduced street failures.

G. H. STIER,
Superintendent Rolling Stock and Buildings.

Adventures of

Old Man Trouble on the Hicksville Railway

The Electric Car Is Not an Aquatic Animal



Air reservoirs should be drained often in cold weather and hand brakes should be tested on every trip. Dry reservoirs and piping constitute the surest way of avoiding freeze-ups.

ELECTRIC RAILWAY JOURNAL will be glad to furnish press proofs of this page free of charge for posting on bulletin boards and will supply electrotypes of this series at cost for use in company publications.

M. ZIMMERMAN and E. L. PROCTOR

Maintenance Notes

Weekly Washing Keeps Cars Attractive

By A. F. Rexroth
Master Mechanic Harrisburg Railways, Harrisburg, Pa.

BELIEVING that clean cars are one of the greatest inducements to ride, the Harrisburg Railways, Harrisburg, Pa., devotes particular attention to car washing. Cars are scrubbed and washed with soap every seven to ten days and a more general and thorough scouring and cleaning are given once a year. In the general cleaning Wyandotte detergent is used.

This is a scouring preparation

The Light Part of the Panel has Just Been Cleaned. The Remaining Part of the Car Is in Its Original Condition

somewhat like pumice. From 8 lb. to 10 lb. of this preparation is used to about 8 gal. of hot water. This quantity will clean and scour a 48-ft. car inside and out. An accompanying illustration shows a car as it is being scoured by this process. A marked contrast is shown in the car portion which has been washed and that which has not as yet received the treatment.

The keeping of cars clean and attractive has been facilitated somewhat by the use of the enamel system of car painting that was adopted some time ago to replace the paint and varnish system. Cars now receive two coats of enamel, which is the equivalent of a three-color paint job.

Be Wise, Systematize,
Open your eyes, Modernize
And thus Economize.

"Join the K.K.K.'s"
"Keep Kars Klean"

This enamel is placed over the old paint and a good job is obtained. After a car has been newly enameled a record is placed immediately under the water table showing the date and kind of job done. Thus the designation "E-1-15-27" would show that an enamel job was done on the car on Jan. 15, 1927.

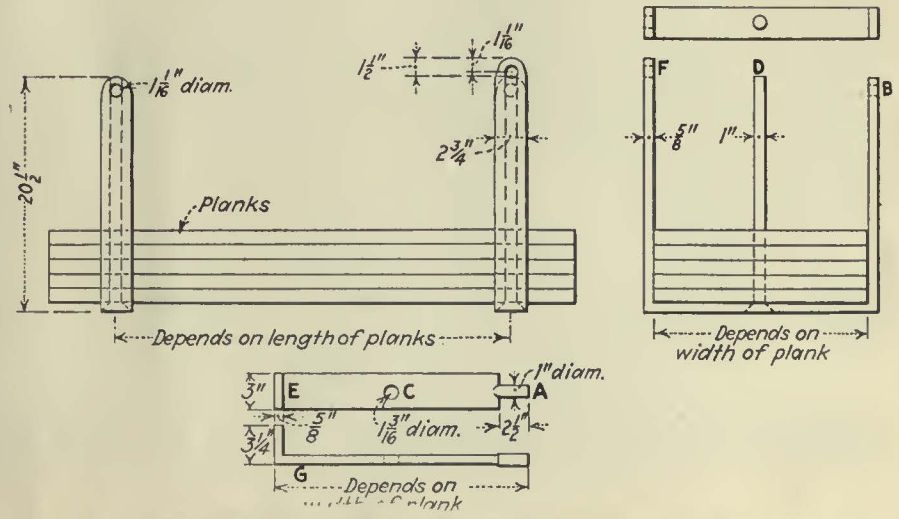
The second time that a car is brought in for refinishing by the enamel system it is given but one coat of enamel and is then restriped and relettered. By this method cars are kept in attractive condition without great expense.

Receptacle for Scaffold Plank Storage

IT IS a common occurrence for the paint shop organizations to be annoyed and their work retarded when men of other departments remove scaffolding planks from the paint shop and utilize them for other purposes. This was particularly true in the shop of the Washington, Baltimore & Annapolis Electric Railroad, Academy Junction, Md. To overcome this objectionable condition and assure the painters that the planks would always be at hand when required, George Watts, foreman painter, designed and built a receptacle for the storage of the scaffolding planks which has not only permitted uniform and neat storage but provided a means for locking them securely to prevent removal.

There are two $\frac{5}{8}$-in. x $2\frac{3}{4}$-in. bar-steel U-shaped frames, each with a piece of 1-in. round bar riveted at the center of the bottom. A $\frac{5}{8}$-in. x 3-in. flat steel strap slips in suitable holes in the uprights and provides a means of padlocking. Each plank has a $1\frac{1}{8}$-in. hole bored in the center about 12 in. from either end. The planks are impaled in the upright posts. After the clamp is placed in position and locked it is impossible to remove any of these planks unless the padlock or other parts are destroyed. Planks not in use during the day are kept locked and the key is retained by the foreman of the paint shop. At the close of the day all planks are returned to their receptacles and locked.

This method has resulted in eliminating paint shop delays. The planks are always at hand when required. Accidents caused by breakage have been reduced since the planks are not being used for purposes for which they were not designed.



Appearance of Scaffold Storage Used in the W., B. & A. Shop
Rod *A* slips into hole *B*, rod *D* passes through hole *C*. Surface *G* rests on top plank. Holes *E* and *F* are in line and are fastened with a padlock.

Saw Belt Driven by Air Compressor Motor

INDIVIDUAL electric drive for a circular swing saw has been provided in the shop of the Lackawanna & Wyoming Valley Railroad, Scranton, Pa., through the utilization of an air compressor motor. This motor is suspended from the side wall directly above the saw by means of strong, rigid brackets and is

Circular Swing Saw Belt Driven by an Air Compressor

belted through a countershaft. All of the shop requirements for this class of work are easily handled by this unit.

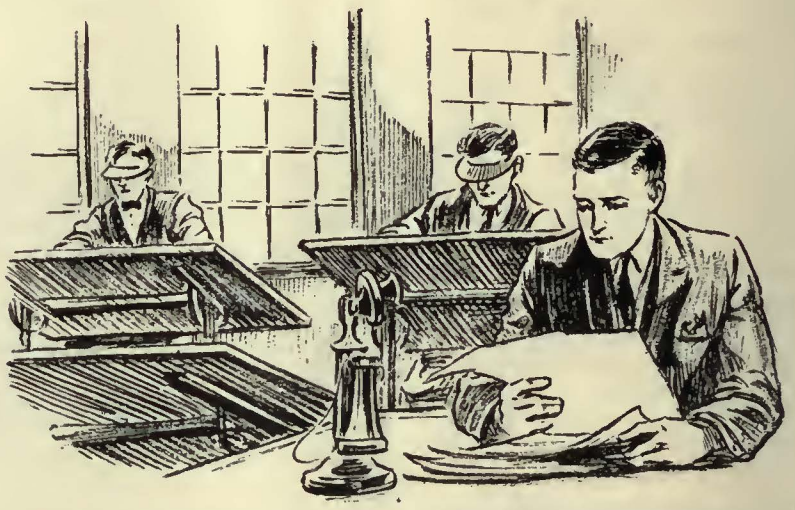
Utilize the PEP in the uPkEeP of your equipment.

Pull-in Classifications Corrected

IN THE table published on page 250 of the issue of Feb. 5 giving a comparative statement of car pull-ins for the year 1926 as reported by the Electric Railway Association of Equipment Men, Southern Properties, the headings "Not chargeable to carhouse" and "Chargeable to carhouse" were reversed. The lower table should have carried the first heading and the upper table the second heading.

Dick Prescott Considers Shop Policy

And Reaches a Conclusion



DICK PRESCOTT, assistant shop superintendent of the Consolidated Railway & Light Company, spent considerable time studying the design of the springs used by the company for replacements on various types of trucks. Following his investigation of the use of wood blocks to compensate for sagged springs he found that the practice of ordering replacement springs by sample had led to considerable variation in the materials obtained, with consequent unsatisfactory performance in service.

Study of the subject led him to a careful check of the operating loads on various types of equipment in service, and finally to the preparation of a series of drawings and specifications covering the types of springs needed for replacement purposes on each series of equipment.

"Here," concluded Dick, "is the kind of work that should be done by the engineering forces in a maintenance organization."

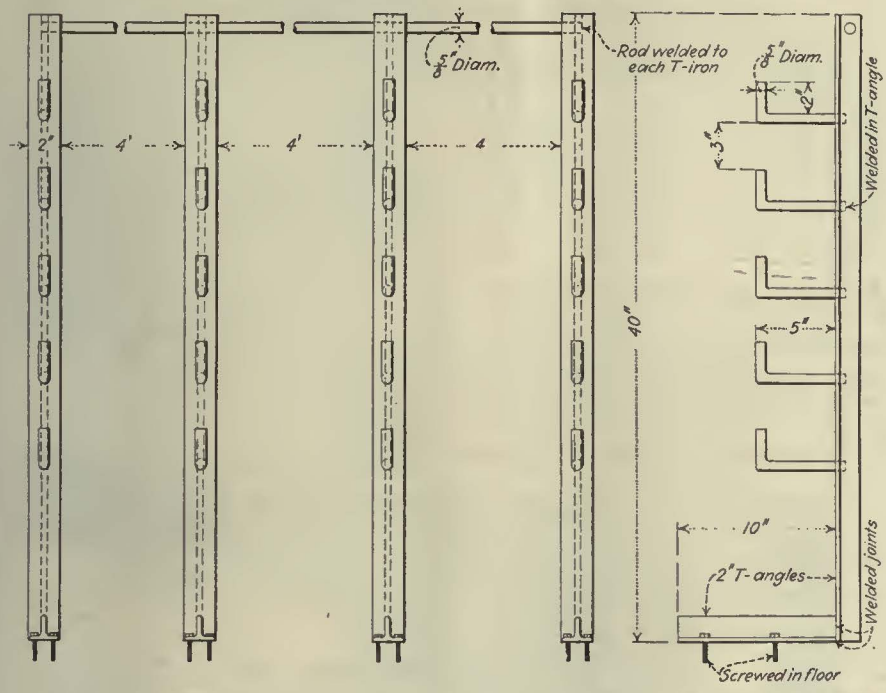
This particular subject was one to which Dick Prescott had devoted considerable thought. He had found in the Consolidated shop a general tendency to manufacture many parts, which he believed could better be obtained from regular manufacturers. True, there were machines and men available, and the manufacture of parts tended to give the shop a better load factor. So there had always existed a question as to just what constituted a sound shop policy in regard to the manufacture of parts. With the development of an engineering office in the shop there was an even greater tendency than formerly toward manufacturing activity.

Dick had established a clearly defined policy in his own mind. "The question of delivery is one of the important factors in drawing the line between manufacture and purchase," he concluded. "Here again the stores and purchasing departments are important elements. We have a tendency to order replacements in ridiculously small quantities, and unquestionably this habit affects both the matter of delivery and cost. Careful checking of inventories and renewal parts consumption per year; closer co-operation between the shop, storeroom and purchasing department, and adoption of a general policy of buying all parts possible, even when there is a slight price shade in favor of home manufacture, would improve our situation."

His study also led to the conviction that it was hard to obtain the actual cost of manufactured parts and that the factors of quality and uniformity were sometimes stretched in favor of the shop's own output. But despite all this, he felt that there was an even more important reason for avoiding home-made manufacture as much as possible. "A railway shop," he concluded, "is primarily a maintenance organization. Its resources should be devoted to the improvement of maintenance practices and not to the manufacture of items that can be purchased from reliable manufacturers. An organization which devotes itself to the manufacture of a wide variety of parts does not give the attention which is needed to improving maintenance procedure and methods. This affects particularly the men in supervisory or technical positions. When the shop becomes a manufacturing organization, it attracts the major attention of the men in key positions, from the head of the department down. For that reason, attention which should be devoted to the primary problems of maintenance is diverted elsewhere, and the principal function of the mechanical department is left very much to drift, while the problems of manufacture absorb attention."

Dick was so impressed with the soundness of these views that he undertook the preparation of a report on this subject to the company's operating staff for Tom Mullaney's signature.

Rack for Storage of Light Bar Steel



Rack Installed in Norfolk Machine Shop of the Virginia Electric & Power Company for Storage of Light Bar Steel

BELIEVING that the appearance of a machine shop floor reflected the character of the work being performed, Master Mechanic T. W. Madison of the Virginia Electric & Power Company, Norfolk, Va., designed and erected a compact rack in the machine shop for the storage of assorted light bar steel. Prior to the erection of this rack, this material was scattered around the floor of the machine shop, creating a very untidy appearance.

This rack is constructed of four L-shaped T sections spaced 4 ft. 2 in. centers and bolted to the floor. These T's are reinforced at the top by a ⅝-in. round steel bar 12 ft. 9 in. long passing through and welded to the web, about 1½ in. from the top. A piece of T-bar 10 in. long welded to the end of another 40 in. long forms the L-shaped support. Five L-shaped ⅝-in. diameter rods, 5¾ in. long, spaced 5⅝ in. centers, form the members for the support of the stored material. These supports are inserted in holes drilled in the web of the T's and welded.

This rack occupies very little floor space. It has been found very effective for the storage of this material and has assisted in maintaining a better shop floor appearance.

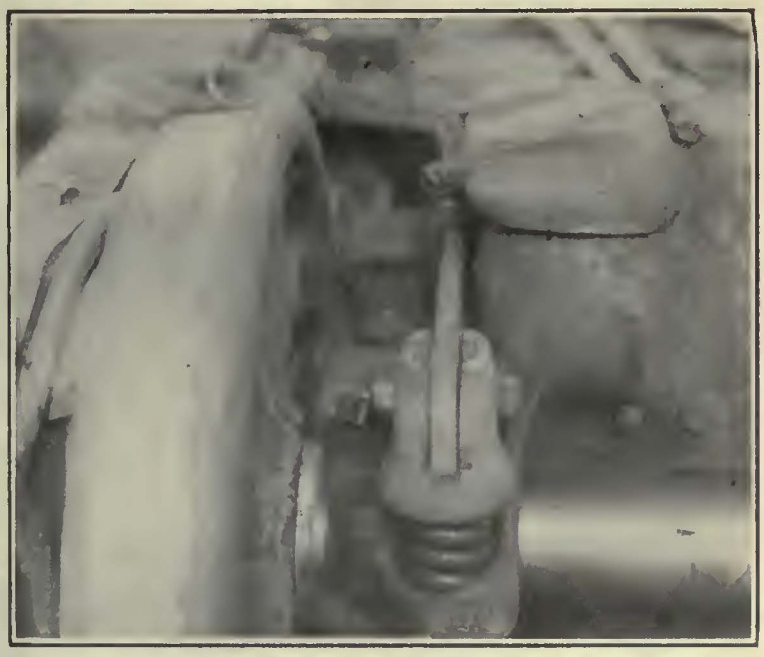
Axle-Bearing Flange Fitted to Truck

BECAUSE narrow-gage trucks are used on the Los Angeles Railway cars, there is no axle collar against which the axle bearing can be fitted. As a result it is necessary to fit the axle bearing flange to the gear on one side and wheel on the other, allowing the proper clearance.

In the truck shop, the motor is swung into its place, the pinion aligned with the gear, and then the gear end axle-bearing flange is trimmed to allow approximately 3/32-in. clearance between it and the gear. The other axle-bearing flange is trimmed to allow 3/32-in. clearance between it and the wheel at the commutator end of the motor. The size of each bearing flange is determined by calipering the space between the motor shell and the wheel or gear, as the case may be.

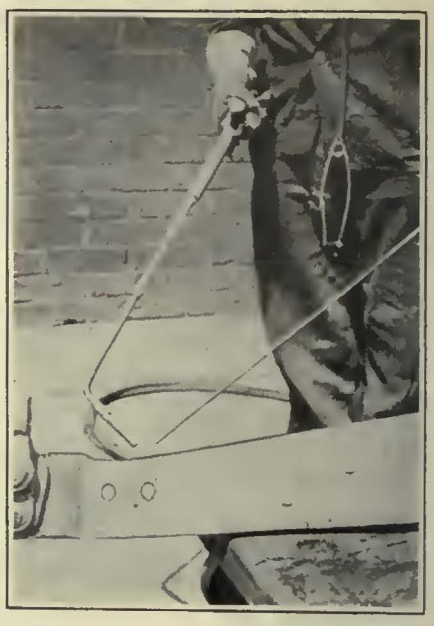
A machine to cut the flange of the bearing has been constructed and

A Machine Mounted on a Post in Los Angeles Railway Truck Shop Trims Off the Flange Face of Axle Bearing to Give It the Proper Clearance in the Narrow-Gage Truck



Close Quarters in Narrow-Gage Trucks Eliminates the Possibility of an Axle Collar. The Axle-Bearing Flange Fits Against the Gear at the Gear End of the Motor and Against the Wheel at the Commutator End. A Clearance of Approximately 1/32 In. Is Allowed

is mounted on a workbench in the truck shop. It consists of a clamping device for holding the two halves of the bearing and a U-shaped frame which has a spindle carrying the cutting tool at the end of an arm. The spindle is turned by hand through a single reduction spur gearing. One of the illustrations shows the construction of this machine. The cross feed is automatic, the tool arm being moved out of the spindle head by a feed screw, actuated by a five-pointed star pick-up, which on each revolution of the spindle strikes a lug, advancing it one point. A bin below the machine catches the waste metal, which is later reclaimed and put back into the babbitt pouring pot.

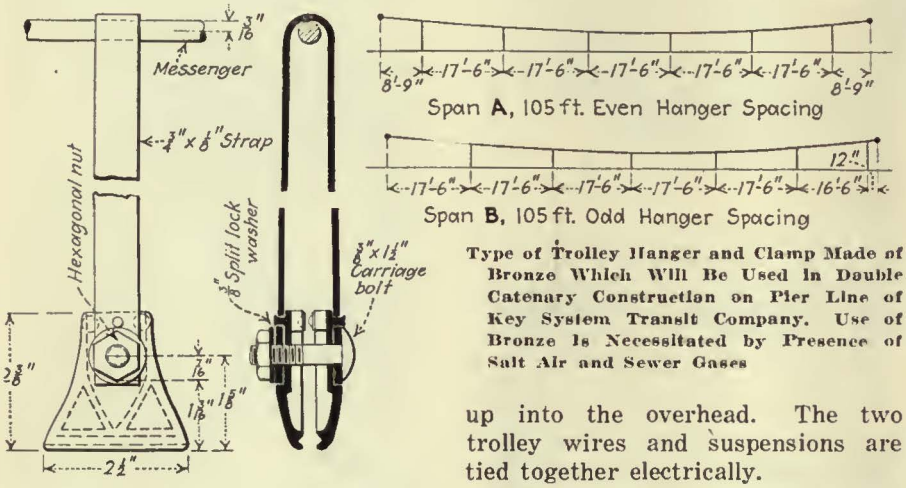


Brake Beams that Are Worn Where the Pull Rods Are Attached Are Built Up by Oxyacetylene Gas Welding

Double Catenary Insures Service

DOUBLE catenary suspension with a double trolley arranged as independent supply for pantograph operation is being installed by the Key System Transit Company, Oakland, Cal., on the 3½-mile double-track pier route between the mole, where the ferryboats connect with the cars, and the mainland at Oakland. This installation is entirely of copper and bronze. It replaces several types of overhead suspension used on this route, which is the bottleneck of the entire Key Route System. Failure of the overhead on this section of right-of-way means paralyzing the entire system. Therefore, it was decided to make the overhead construction of the best possible type and in duplicate so that mechanical failure of one line would not interfere with service.

The new trolley suspension is of the catenary type with a ⅜-in. composition bronze messenger supporting by bronze straps a No. 0000 Phono-electric trolley wire. The straps are of ¾ x ⅛-in. special bronze, fastened by bronze carriage bolts, lock washer and hexagonal nut to a trolley clamp which is designed for either wheel or pantograph operation. The two trolley wires of this construction are spaced approximately 6 in. apart, with the hanger spacing staggered to give odd and even spacing in the same span. The roller of the pantograph makes contact with both trolley wires, and as a result the mechanical failure of one does not permit the roller to fly up into the overhead. The two trolley wires and suspensions are tied together electrically.



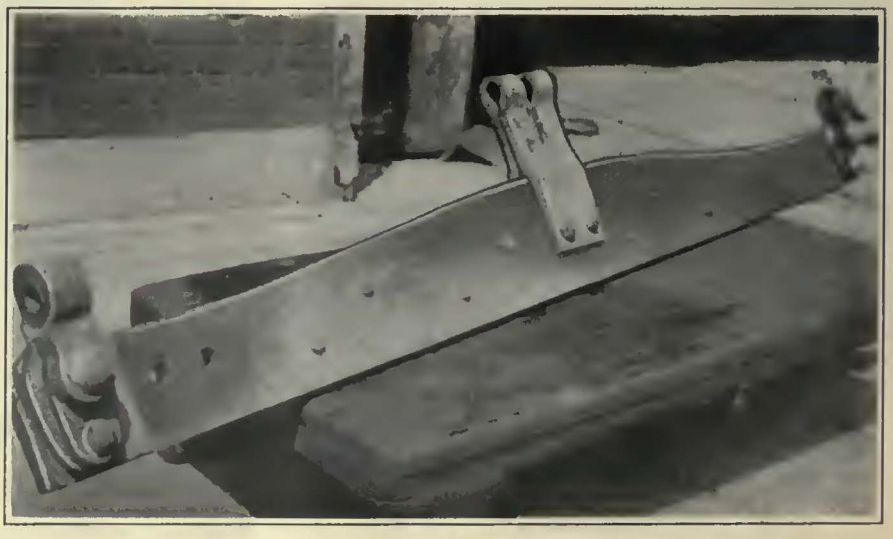
Type of Trolley Hanger and Clamp Made of Bronze Which Will Be Used in Double Catenary Construction on Pier Line of Key System Transit Company. Use of Bronze Is Necessitated by Presence of Salt Air and Sewer Gases

This type of construction, using bronze, is made necessary by the climatic conditions. Salt air and the sewer gas encountered, particularly on the flats, cause excessive corrosion of any metal other than bronze or copper. The old overhead line, with galvanized messenger and hangers, has only seen service for a few years, but now is considered unsafe for operation.

Welding Brake Beams to Make Good as New

BRAKE beams on all types of cars become worn at points where the pull rods are attached. The practice of the Grand Rapids Railway, Grand Rapids, Mich., is to build up the worn surfaces, fill in the holes and when redrilled the beams are as good as new.

Some of these are found to be worn to a depth of ⅜ in. The welding work is done with an oxy-acetylene outfit and a welder can build up and fill in the holes of a brake beam in half an hour. Accompanying illustrations show where the wear takes place and a beam which has been repaired. This method of repair has proved effective in reducing noise.



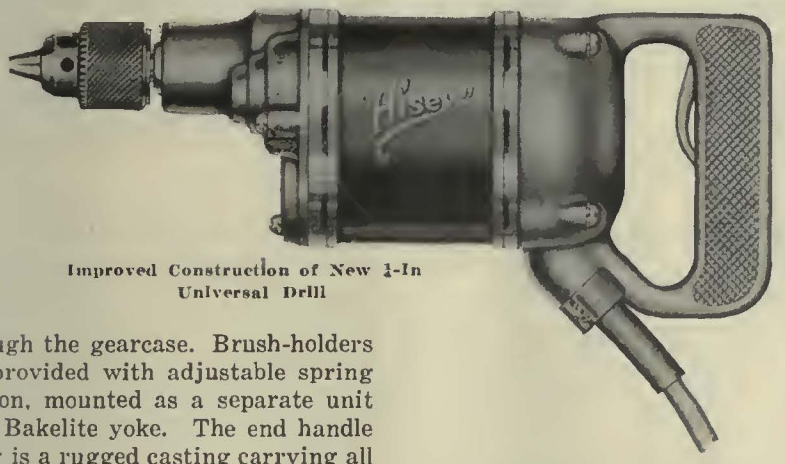
Brake Beam Repaired by Welding Ready for Installation on Car

New Equipment Available

Small Size Electric Drill

BALL bearings and a removable gear on the armature shaft are features of an electric drill of ¼-in. capacity placed on the market by the Hisey-Wolf Machine Company, Cincinnati, Ohio. The gearing is made of high grade steel, electrically heat treated. The compound gear shaft is supported with bearings at each end.

The chuck spindle is hardened and ground and automatically lubricated through the gearcase. Brush-holders are provided with adjustable spring tension, mounted as a separate unit on a Bakelite yoke. The end handle cover is a rugged casting carrying all pressure applied and is independent of the motor and its bearings. This arrangement relieves them of all strain and also affords convenient access to the carbon brushes for adjustment or renewal.



Improved Construction of New ¼-In Universal Drill

Repairs made in time save pull-ins from the line.

Improved Unit Switch Construction

BY THE application of the type 480 mechanism to the 272 switch unit, which was made possible by the development of new arc chutes, operators are given the advantages of more modern construction in unit switches manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

The design of the type 480 mechanism is such that the contacts close with a rolling motion which eliminates wiping action. This mechanism uses a contact spring worked at a low fiber stress. The switch arm gives the mechanism better protection from arc gases and cast copper arc horns with a large cross-section of metal provide better dissipation of the heat of the arc. The use of the type 480 mechanism results in less frictional wear on the contacts, less burning of the contacts, arc horns and arc chutes and the practical elimination of finger spring breakage.

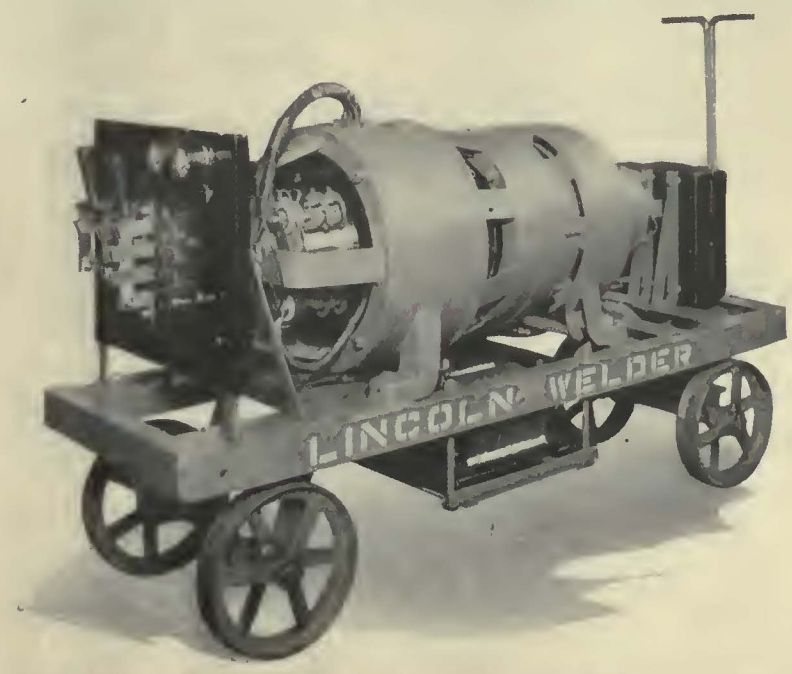
The new arc chutes are built up of asbestos lumber with sides and blocks made from a special arc-resisting molded material. The arc blocks are shaped so that they reduce the possibility of arc gases entering the switch mechanism. The complete arc chute is fastened in the switch box by one wing bolt, which permits removal with minimum effort.

In replacing old switch units, it is recommended that those in an entire group be replaced at the same time, preferably when the equipment is overhauled. Old switch units should be dismantled and serviceable parts placed in stock to be used to maintain the type 272 switch units which have not been modernized. As the stock of the old parts becomes low, additional equipment should be changed over. This permits modernization with the least confusion and lowest cost to the operator.

Welded Steel Shapes Used in Welding Framework

SUBSTITUTION of welded structural steel to replace gray iron castings for the 300-amp. "Stable-Arc" welder has just been announced by the Lincoln Electric Company, Cleveland, Ohio. The motor and generator end rings, brackets and connecting rings are all made of structural angles rolled up into the proper shapes and welded together. The feet of the motor-generator set are made of drop forgings. The truck wheels are of T-sections rolled on a special machine. The hub of the wheel is made of steel tubing. Control panels are usually made of slate or special non-metallic compounds, but the panel of the new machine is made of sheet steel welded together and welded to the supports.

The underlying idea in the adoption of this construction for the new welder is to meet the severe conditions which portable welding equipment must withstand. It is claimed that use of the steel construction, which will bend rather than break, reduces the liability of failure.



New Welding Equipment Employs Structural Steel in Place of Iron Castings

Association News & Discussions

Central Master Mechanics Meet in Toledo

Busy One-Day Session Devoted to Discussion of Brakes, Perfection of Standard Freight Car Specifications and Other Matters Which Would Facilitate Interchange of Equipment

PROGRESS in the work of bringing about greater uniformity of practice among interurban roads in the C.E.R.A. territory was made at a meeting of the Central Electric Railway Master Mechanics' Association held in Toledo, Ohio, on Feb. 2, immediately preceding the meeting of the parent association. Various phases of the work being done by this body to facilitate the interchange of freight equipment among the interurban lines in the central association territory were taken up for progress reports, discussion and further development. Car builders' representatives were present to discuss with the entire group questions in connection with the design and construction of the standard interurban box car, which was one of the early important accomplishments resulting from the work carried on since the organization of this association.

Crowded into the short space of a single day's session was a combination program consisting of papers by manufacturers' experts on subjects of direct interest to the equipment men, a conference and discussion on the work of standing committees and the customary inspection trip through the shops of the home company, in this case the Community Traction Company of Toledo. Air brake design and maintenance practices were covered in a paper on this subject by W. C. Horner of the Westinghouse Air Brake Company. This formed the basis for considerable discussion of brake inspection and maintenance methods. At the request of the association, this paper will be printed in complete form in an early issue of ELECTRIC RAILWAY JOURNAL so that it may be made available to all mechanical men interested in the subject.

AIR-MAGNETIC BRAKES DISCUSSED

Another subject which aroused a great deal of interest and discussion was that of air-magnetic brakes, which was presented by C. V. Ives of the General Electric Company. He covered particularly the form of brake developed co-operatively by the Buffalo & Erie Railway, the General Electric Company and the Cincinnati Car Company. In this design the magnetic brake is energized directly from the trolley instead of by regeneration of the motors. Magnetic brake equipments heretofore used, he explained, fall into three classes: (1) The solenoid brake, in which the armature of a solenoid transmits pressure to brake shoes on the wheels; (2) the disk brake, in which a disk keyed to the axle is retarded by a stationary disk, magnetically attracted to it; (3) the track brake, in which an electro-magnetically actuated shoe acts on the rail and is at the same time mechanically connected to wheel shoes through a system of levers.

In practically all former installations, both in this country and abroad, current for energizing the magnets has been taken from the car motors acting as generators. This method of deriving the power, according to Mr. Ives, afforded the outstanding advantage of the magnetic brake; i.e., the retarding force is automatically decreased as the speed of the car is reduced, thereby compensating for the increase in the coefficient of friction as the car speed declines. This characteristic tends toward uniform retardation without requiring any special skill on the part of the operator. On the other hand, the speaker held that the additional apparatus required and the additional size of motor needed represented inherent disadvantages of most former designs. Resistance banks were needed to limit the current to the brakes during the braking controller operations. Furthermore, when the car reached a stop and the motor armatures stopped rotating it was necessary to utilize the hand brakes to keep the car from moving.

With any form of wheel brakes, the rate of retardation is limited by the adhesion between the wheels and the rail. For that reason, Mr. Ives explained, the combination air-magnetic design is a development of value in making possible much quicker and shorter stops in emergency than are possible with air brakes alone. He cited the results of tests made on the Buffalo & Erie property and published in ELECTRIC RAILWAY JOURNAL for July 17, 1926, page 96, and Aug. 21, 1926, page 290.

USES TROLLEY CURRENT

Due to the use of direct trolley current instead of regeneration from the motors, the control of the air-magnetic design has been worked out in a very simple manner. The design is such that the magnetic track brake is automatically brought into play whenever an emergency application of the air brake is made. It may also be used for service stops (at the will of the operator) in case of a slippery rail, provided he has first made either a partial or full application of the air brake. The automatic feature is obtained by connecting a relay valve to the automatic sanding line of the standard safety car devices. This is used as a means of actuating the relay valve, which in turn admits air from the main reservoir to small vertical cylinders that push the magnet shoes down on the rail. At the same time reservoir air is admitted to a pneumatic contactor which connects the coils of the magnet shoes, through a fixed resistance, to the line. The service application feature is obtained by connecting the manual sanding pipe from the M-28 brake valve to the relay valve through a cut-off valve, the latter being open only when the straight air application pipe is under pressure. In the pipe between the brake valve and the cut-off valve a timing element, consisting of a small reservoir and vent plug, is installed so that the magnetic brake is held on for a predetermined time and is then released independently of the air brake. In any condition of operation, the magnetic brake is released with the release of the air brake.

Mr. Ives also spoke of the continued satisfactory performance of the brakes of this type which have been installed on the Buffalo & Erie property and also on the cars of the Kentucky Traction & Terminal Company. Reports on these properties indicate that maintenance costs up to date have been quite low. He said also that operators of cars equipped with the new brakes are given a sense of security in knowing that a quick stop can be made in an emergency, and that they can accurately judge service stops even under bad rail conditions.

COMING MEETINGS OF *Electric Railway and Allied Associations*

March 4—American Electric Railway Association, Metropolitan Section, Engineering Societies Building, New York City, 8 p.m.

March 8-10—Oklahoma Utilities Association, ninth annual convention, Huckins Hotel, Oklahoma City, Okla.

March 17-18—Illinois Electric Railways Association, seventh annual joint convention, Hotel Abraham Lincoln, Springfield, Ill.

April 26-29—Southwestern Public Service Association, convention, New Orleans, La.

May 31—June 1-2—Canadian Electric Railway Association, annual convention, Winnipeg, Man.

July 27-29—Association of Equipment Men, Southern Properties, 12th semi-annual meeting, Atlanta, Ga.

Oct. 3-7—American Electric Railway Association, annual convention and exhibit, Public Auditorium, Cleveland, Ohio.

Most of the proceedings during the business session consisted of reports of standing committees and discussions regarding their recommendations. Questions raised by car builders in connection with the specifications for the C.E.R.A. standard box cars were the subject of careful analysis. Other recommendations of the standards committee, of which T. H. Nicholl is chairman, occupied a considerable period of consideration and discussion. Recommendations were made by this committee regarding standards which it felt should become American Electric Railway Association Standards to be included in the Engineering Manual of that association. The committee also presented for discussion the design of a master inspector's gage and recommended that arrangements be made so that a number sufficient to provide at least one gage for each member property could be ordered from a reputable tool manufacturer in order that all rejections of cars passing over foreign lines would be in accordance with a standard gage. This was felt to be more than worth while as a means of avoiding controversy because of differences in the gages made up individually by the various properties.

New officers elected for the ensuing year were as follows: President, G. R. Green, general superintendent Chicago, South Bend & Northern Indiana Railway; vice-president, F. J. Foote, superintendent of motive power and equipment Indiana, Columbus & Eastern Traction Company. Charles Sigler, master mechanic Winona Service Company, was elected a new member of the executive committee. An invitation of the Westinghouse Air Brake Company to hold the next meeting of the association in Pittsburgh, so as to permit an inspection of the air brake plant at Wilmerding to be made, was accepted, and it was decided to make this a two-day meeting, the exact date to be set later.

The business session adjourned in the afternoon for an inspection of the shops of the Community Traction Company. During the noon-day recess all of the visiting master mechanics were entertained at luncheon by the local company. General Manager J. F. Johnson, Commercial Manager J. A. Greig and Master Mechanic W. A. Smith acted as hosts.

Higher Standards of Maintenance Will Improve Performance and Reduce Costs*

Modern Shop Machinery, Higher Grade Workmanship and Closer Tolerances Are Needed—Better and More Reliable Performance and Lower Ultimate Costs Will Result

BY H. S. WILLIAMS
Assistant Superintendent of Equipment
Department of Street Railways, Detroit

ELECTRIC railway operations at present show the most alert and progressive spirit that has been manifest in a decade. The mechanical departments are feeling this and are devoting renewed study to maintenance problems. But actual improvement takes more than a decision by the equipment department to adopt higher standards; it requires that the idea be sold to the management and it is the underlying thought in the preparation of this paper to assist in this latter very necessary detail. The question that first arises before the manager is cost, and following that is its corollary —will the results justify the cost. If these two questions can be answered properly the result will or should be the acceptance of the plan. Higher maintenance standards mean slightly higher initial cost, but if intelligently applied will result in ultimate economies that will wipe out the first cost, produce continued savings and help give a more salable service to the public.

Let us examine for a moment the functions of maintenance. The first requirement is to provide for cleaning and sanitation, lubrication and adjustment of wearing parts. The second function is concerned with the detection of defective parts and their renewal before they cause difficulty, which aims at keeping the equipment in as nearly 100 per cent physical condition as is feasible. This requires foresight and regular inspection designed to anticipate possible trouble. In other words, let us call this preventive maintenance. Third, and of almost equal importance, is the study of the equipment and methods with a view to making improvements that will be economically beneficial and that will also increase the sales value of the ride.

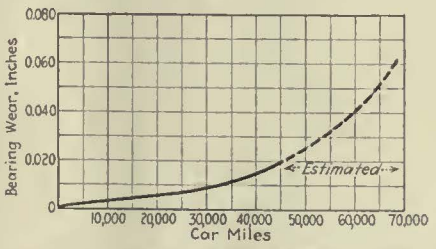


Fig. 1—Progressive Bearing Wear. Average of Tests of Sixteen Railway Motor Axle Bearings

It is not my purpose to dwell long upon the first element, though it may not be amiss to call attention to the unquestioned sales value of clean cars. People will not ride in dirty cars if there is any other means of transportation available. It is regrettable that it cannot be shown how many riders will be attracted to a car on account of its cleanliness or how many will be driven away because of its untidy condition. In a time like the present not only our own interest but the good of the communities which we serve demands that we win over the private automobile driver. But how is that possible if the seat, say of rattan, is bordered with a brownish discoloration and is only presentable where the passengers' clothing has cleaned off a part of the car seat; if the floor is littered with papers, transfer stubs, coin wrappers and dust drifts in every corner and out-of-the-way place; if the windows are streaked and dirty? It just cannot be done and the sooner we stop trying to cut the expense of car cleaning to the bone, the sooner we will help overcome the falling riding habit.

PREVENTIVE MAINTENANCE REDUCES PULL-INS

As to preventive maintenance, we must lay especial stress on this item. Probably no one questions the economy of the principle. What is needed is more extensive use of means now within reach. A systematic, thorough, periodic overhaul program is or should be the goal of every equipment man. Failing in this, the next alternative seems to be the application of a periodic testing of car wiring, motors and all electrical equipment with high voltage in order that weak spots may be broken down at a chosen and opportune time. This results in lowered maintenance cost and improved service through reduced pull-ins. As a specific example of the effect of this practice upon pull-ins is cited the case of a road which adopted this practice in 1924 after an intensive campaign to reduce pull-ins. In this case the reductions are almost entirely attributable to the detection and repair of potential electrical failures before they caused road failures. The results are shown in the following tabulation:

COMPARISON OF PULL-INS FROM POWER CIRCUIT FAILURES AND BREAKDOWNS ON HIGH-TENSION TEST

Year	Pull-Ins per Thousand Car-Miles Due to Power Circuit Failures	Cost of Account 33 per Car-Mile	Cars Broken Down by High-Tension Test
1923	0.0647	0.0059	....
1924	0.0478	0.0044	216
1925	0.0257	0.0043	514
1926	0.0312	0.0042	1,101

It is to be noted in this tabulation that there is a slight increase in pull-ins in 1926, which is explained by an abnormal storm and flood. The increasing number of cars broken down by the high-tension test is explained by added facilities for making these tests and a more strict following out of the procedure. It will be seen, however, that the added breakdowns shown in the last column did not produce a corresponding increase in the cost of maintenance of electrical equipment.

BEARING ABUSE INCREASES COST

Perhaps one of the most abused elements of a street car is the motor axle bearing and there is no one item to which higher maintenance standards

*Abstract of paper presented before Central Electric Railway Association at Toledo, Ohio, Feb. 4, 1927.

can be applied to better advantage. This is true because the condition of this bearing controls not only its own life but that of the motor gears. This being a sleeve type bearing, it is apparent that if it be maintained at a close fit, the only wear to which it will be subjected is frictional. So if the housing is properly designed to exclude dirt and if sufficient lubrication is provided, maximum life of the bearing will be obtained. However, if the original fit be loose enough to allow radial movement, if ever so slight, the bearing is then subjected to impact blows which are far more destructive than the frictional wear and consequently the rate of wear instead of progressing in even stages will increase at an accelerated rate. To illustrate, it is only necessary to compare this hammering action to the main or connecting rod bearings of the automobile engine. Every one is familiar with the action of these bearings and the fact that when well-fitted their life is relatively long. But let them become worn to the stage where hammer is apparent and you know how rapidly the wear accelerates to the destruction point. In order to make a definite application of this principle to the axle bearing and show exactly what happens in actual service on electric cars a series of tests has been run and accurate measurements have been made showing progressive bearing wear.

Sixteen bearings of the solid bronze type were used in the test. The analysis of this bearing metal is: Copper, 79; tin, 8; lead, 8; zinc, 5. The bearings were new and were carefully fitted in their housings. All of them were tightly clamped in position and three sets of measurements of inside diameters were taken by inside micrometers. These measurements were made at either end and the center, so that liability to error was reduced as far as possible. To secure a range of motor sizes, the bearings were divided among 35, 50, and 70-hp. motors. At intervals, the motors were removed from the cars, the bearings clamped back in position and the inside diameters measured. This test has been under way for fifteen months, and while it has not been finished, sufficient data are available to show the tendency of wear and to predict its future trend with reasonable assurance. So far as could be determined, this is the first study that has been made of progressive bearing wear of motor bearings. A detailed record of all the data obtained to date would needlessly confuse this discussion, so the averages have been computed and are shown graphically in an accompanying illustration. Attention is called to the fact that the results from the various test bearings are remarkably consistent. This gives confidence that the results shown in the graph reproduced on the preceding page can be depended on.

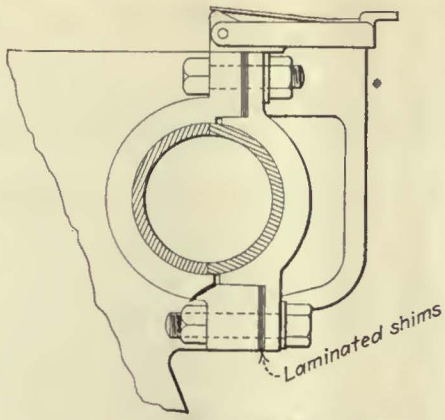


Fig. 2—Type of Railway Motor Bearing Tested

The important deduction from this test is the value of bearing mileage during the time that the bearing clearances are small, or, stated in another and more specific way, a bearing wear of 0.001 in. in the early stages of bearing life will give approximately ten times as much mileage as 0.001 in. of wear near the end of its life. This furnishes proof that loose bearings are not economical and that to secure maximum life the original bearing fit must be as tight as practicable.

Assuming agreement with the principle that loose bearings are not economical, what shall be done to maintenance standards to bring about greater life and economy? First, the outside surface of the bearing should be given more attention. The bearing should receive careful machining, to the end that when clamped in position the strains of the axle cap shall be uniformly distributed and that there shall be no distortion. Also the clamping should produce the strong vise-like action that will hold the bearing tightly in the shell and will eliminate dependence upon keys or dowels to keep the bearing from turning. Dowels were originally designed as locating means only, although the practice has gradually grown into existence of expecting them to hold the bearing from turning. In fitting of axle bearings the practice should closely approximate the fitting of connecting rod bearings of an automobile engine. The cap should have a clearance at its bolting lugs and this space should be filled with laminated shims. The intent of this may be understood better by reference to the accompanying illustration which shows the recommended method of fitting.

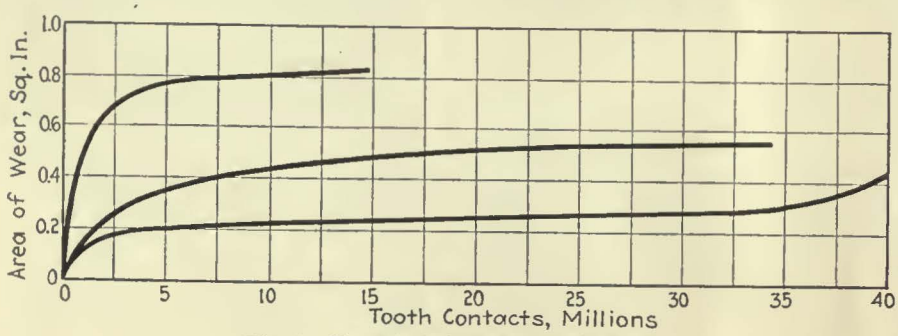


Fig. 3—Characteristic Gear Tooth Wear

Smaller Clearances Desirable

As to the wearing surface of the bearing, it is believed that clearances may be made smaller with profit. To do this the bearings must not only be individually fitted to the axles, but it is contended that the finish fit must be a line-reaming operation. If you will check the alignment of surfaces of newly prepared bearings when clamped in position but without the axle in place the necessity of this will be readily apparent in most cases. A line-reaming operation is not necessarily a difficult nor complicated thing if properly approached. It is estimated that it will add not more than $1.75 to the cost of one motor overhaul while the value of added life should run to many times this cost.

Present standards call for an axle-bearing clearance of 0.015 in. to 0.017 in. Every thousandth that can be saved in original fitting means approximately 5,000 miles added to its life. With careful machining the clearances may be reduced to 0.010, or 0.007 in. less than present practice. This, it is predicted, will add 35,000 miles to the bearing life, which will certainly justify the added cost of higher standards of machining previously mentioned. The next step that logically follows is to apply the line-reaming operation to armature bearings, though the results from this will not show results proportionate to those obtained from axle bearings.

Bearing Wear Affects Gear Life

As stated previously, bearing wear has an important effect upon the life of gearing. Loose bearings will superimpose the element of hammer blow upon the normal frictional wear in exactly the same manner as pointed out in the case of axle bearings. A third element of wear is injected into the case when bearing wear is such as to permit a spreading of gear centers, although this is the least important factor. This is contrary to the commonly accepted view, but it is a fact that if the tooth form is correct and the mounting of the gearing is solid, that is, that the bearings are not worn, the effect of spread centers has little effect on the efficiency of the involute gear. Of course if the teeth are badly worn, another set of conditions is introduced and the normal wear will be excessive.

Spreading centers of correct gears changes the pressure angle. This results in increased tooth and bearing pressures and concentration of wear over a smaller area of the tooth. To show the exact effect of this, the change of pressure has been calculated for the spur gearing of a modern 35-hp. motor with a 20-deg. pressure angle. If the bearings on this motor allow the gear centers to spread ¼ in. this changes the pressure angle but 2.2 per cent. This means that tooth pressure and bearing pressure due to gears is increased only 2.2 per cent. This naturally results in increased wear, but the increase is not sufficient to cause alarm if bearings are tight. Such, however, is not the case in practice because the thing that

causes spread centers is worn bearings. As in the case of the bearings themselves, this looseness allows vibration and consequent hammer blow on the gear teeth with a resultant wear far in excess of normal frictional wear. The exact loss of life due to the hammer blow is difficult of determination. It could be evaluated only after a long series of practical tests. However, it is predicted that the probable wear characteristic will resemble the form of curve shown in Fig. 1.

Now let us examine the other side of the picture and see what would happen to the gear life if the bearings are kept tight. Recently an exhaustive investigation of gear life was made by the University of Illinois. This included careful records of progressive wear. From the data secured in these tests computations have been made to show the characteristic wear of gears. Of course the tests referred to were not made upon railway gears, but the tooth form was the same and pressure angles used were 14½ deg. and 20 deg. Fig. 3 shows the results for several combinations. From this it will be seen that wear occurs rapidly at first but slowly toward the end of its life. Just previous to the finish of the test, the wear curve shows an abrupt rise. The value of these data is to show the tendency of gear tooth wear under good conditions or what the characteristic wear will be if bearings are kept tight. If bearings are loose then the wear curve will not flatten off as indicated in the accompanying diagram, but will continue its abrupt rise and probably following the characteristic of the curve shown in the illustration.

Tight Bearings Mean Less Noise

Having shown that it is highly economical to keep bearings tight, let us look at another view of the question. We are all endeavoring to reduce noise in car operation. Loose bearings and worn gears are one of the greatest sources of noise, so high maintenance standards in these cases will do more to eliminate noise than any other single line of action. It may be argued that as long as we have to depend upon spur gearing or a low angle helical gear we will have noise. If present methods of gear cutting were the only ones in sight, this might be admitted, but fortunately such is not the case. Gearing is inherently quiet. It is inaccuracy of cutting that makes noise. It is predicted that within two or three years we shall be able to secure gears whose inaccuracy will be measured in ten thousandths of an inch instead of thousandths. With the advent of such gearing, we shall be able to obtain results in quietness hitherto deemed impossible. So it behooves us to bring up our standards of bearing maintenance to such an extent as to take full advantage of this perfected gearing when it arrives.

It is manifestly impossible to take up all of the details of car maintenance to which higher standards may be profitably applied. However, the line of reasoning developed in the cases which have been discussed applies to practically all wearing parts. It must not be thought that the advantages to be gained by the introduction of higher standards of maintenance can be obtained without cost. Far from it. First, it will undoubtedly call for an investment in machinery. If present machines are not in first-class condition and capable of doing accurate work they will have to be replaced. Special tools will have to be provided. Second, and more difficult, the mechanics will have to be trained to accommodate themselves to the new requirements. The ultimate savings which are bound to accrue will not be apparent until considerable time has elapsed. In other words, if a car is now overhauled on a basis of eighteen months and by improved methods this period can be extended to 24 months the savings will not be manifest until the eighteenth month. Consequently the adoption of such a plan requires foresight, confidence and courage. It is unthinkable that we should be content with present practices, because that would be to assume that perfection has been reached.

Modern Production Methods May Be Applied to Maintenance Work*

Introduction of Labor-Saving Machines and Time-Saving Methods Are Possible in Many Maintenance Operations—Workman Morale Must Be Built Up to Secure Results

By W. T. Rossell
General Manager Pittsburgh Railways

TRUE economy is what we are seeking. Better maintenance or less cost, or both, means cash, which can be used in any way we see fit. There is a close analogy between all forms of work. Whether we are maintaining cars or track or overhead lines, the underlying principles are the same.

If we look back ten years, improvement in methods is obvious. The same will be true ten years hence. We can hasten this change, but first we must admit honestly to ourselves that our present methods are not the best. We pride ourselves on the accumulation of knowledge the value of which sometimes passes as we acquire it. Experience may become an actual burden as it is always based on the past, whereas we must live and work in the future. It is not desired to belittle knowledge and experience, but to keep them to their proper functions. They are tools, nothing more. A machine or unit of equipment, crystallizing knowledge and experience as it does, becomes a liability as soon as further improvements are developed. So it is with the mind if we fail to seek new ways.

Some one has said that mental attitude is more important than mental capacity. Courage to act according to our convictions and courage to asume full responsibility for our actions is needed. Much of our progress is necessarily through trial and error. Analyze the maintenance problem—there are five definite parts: Supervisory force, workmen, machinery, materials, design. In addition there is a flexible force which pervades the whole. It is method or organization and it determines and controls.

Management Fixes the Viewpoint

The supervisory force includes all who do not do the actual work. It is obvious that the mental capacity of these men from top to bottom is but average and is beyond control. Their mental attitude, however, can be controlled. Justice, opportunity, security, ambition, interest, vanity, all play their parts. Each man has but to recollect his past to understand. Here is the part of management. The subject is too wide to attempt a complete exposition. Favoritism, nepotism and harshness must go. Each must feel that he is judged solely on merit. We must "know no difference of race or creed." There must be a similarity of opportunity in different departments and groups. This is obtained through the plant of organization and the method of promotion. Wherever we find a position without opportunity, there we find a discontented man. See to it that the curve or per cent of opportunity is favorable to all. The individual must feel that if he performs well his position is secure. Due consideration must be given to the humanities, the ambition, the interest, the vanity of the individual. In a word the morale must be high. Here again is the part of management. Now, with a high morale, we must somehow keep all of these men discontented. One of the masters has called it divine discontent.

Through discontent comes progress. They must be discontented with methods and results. They must feel that each process can and must be improved, that each improvement is but a step toward a distant goal. This feeling must reach each one and the utmost freedom of thought and discussion must prevail. Any man's ideas are worthy of respect.

Each man in the supervisory force must be given a definite part and his title should so state. There should be no "assistants." An assistant is usually either a messenger boy or a member of the department office who does all the work, depending on the nature of his chief. Initiative and courage and self-assurance should be developed by judging results and not separate acts. Fear of criticism by superiors is a creeping paralysis which stifles all progress. Petty interference will do the same. We must recognize and overcome the tendency, which all have, to become satisfied, to get in a rut, to cease struggling, to let well enough alone.

In the case of workmen we may

*Abstract of paper presented before Central Electric Railway Association, Toledo, Ohio, Feb. 4, 1927.

expect only the average. But the morale may be raised to the heights. All that has been said of the supervisory force is equally true of the workman. See that he understands what is being done and why. Encourage and praise him if he is doing well and talk frankly to him if he is not. Above all, see that he has a proper amount of work to do and that his work is geared to that of others. This gearing of one man's work to that of others brings a proper pride and feeling of responsibility that will cure much indifference and idling. If work slows down, it is quickly shown who is at fault and how.

Labor-Saving Machinery Eliminates Drudgery

Upon the introduction of labor-saving machinery depends much of our hope. The elimination of drudgery and the raising of the productivity of the individual will come about more through the use of machinery than in any other way. Both selfish interest and common interest call for the use of more and more machinery.

For proper maintenance results, materials should be of proper quality of course, and the utmost care should be taken to assure this. Even more important, however, the flow of materials to the work should be regular and ample. For mass production this is essential. An investigation of the methods of leaders in manufacturing will convince any one of this. A shortage even of unimportant items may prove very costly.

In general, we inherit design and must make the best of it. It is usually very faulty as it is of the past. We may cure minor and glaring faults slowly, but in general we cannot greatly change the equipment on our hands. However, we can and should call the attention of manufacturers to faults. In general, it is the duty of manufacturers and not that of operators to improve design.

Organization Increases Production

It is through method or organization that we may attain what is known as mass production. Its application to maintenance differs from its application to manufacture only because the former is partially repetitive and the latter is entirely repetitive. This gap is bridged by three steps: First, the unit to which the repairs are made is separated from the whole and then dealt with as a complete unit; second, pools of assembled units, partially assembled units and separate parts are maintained and located between each work step and the next; third, the repair is made rather complete, that is, parts are replaced which still have some life.

This last rule covers both small and large units and may be called the overhaul method. All of these processes, however, still lack some of the efficiency which may be attained in manufacturing where exactly the same thing is done over and over.

Now, we have many examples of what to do. A spy tells me that the Ford plant is well worth investigating.

Broadly, we are endeavoring to obtain satisfactory results with as little work as possible. The mechanical equation of work is — force × distance = work. It is obvious that the only way to decrease work is to decrease force or distance or both. Consideration will show us that cost of force varies greatly and that the equation may be restated. Cost of unit of force over unit of distance × force × distance = cost of work.

The cost of a unit of force over a unit of distance at once suggests cranes, tractors, grinders, and other machinery of all sorts. It also introduces the economic problems which go with the use of machinery, such as its utmost use, depreciation, etc. It is usually cheaper to apply a greater force once than to apply a lesser force many times. So we get mass handling of material. Specialization is also suggested as different grades of labor differ in cost. There are ways of reducing the amount of force through more efficient machines and better lubrication. Improved methods of using levers, wrenches and other tools by workmen will also reduce this factor.

The reduction of distance leads the way to centralization, specialization and routing of work, materials and tools. When a workman lifts or sets up a tool, performs one operation and then goes to something else, the lost motion becomes obvious. Examples are all about us, and if we have builded our organization well and will keep its aims high, we cannot fail in our purpose of applying modern production methods to maintain work.

Illinois Association to Meet March 17-18

ILLINOIS Electric Railway men will meet jointly with the state gas and electric associations at the eighteenth annual convention to be held on March 17 and 18, at the Hotel Abraham Lincoln, Springfield, Ill. According to an announcement by Secretary E. V. Prather, the Central and Western Passenger Associations have granted reduced fares—1½ fare for the round trip —over all steam roads in the state, and this same reduction has been made by the Illinois Traction System. He also suggests that hotel reservations be made direct with the hotel.

Papers to be presented before the electric railway association are as follows:

"Traffic Regulation and Relation to Street Car Operation," by E. J. McIlraith, staff engineer Chicago Surface Lines.

"Track Maintenance," by Jonathan Wolfe, assistant supervisor of track and roadways Chicago Surface Lines.

"Handling L.C.L. Freight by Truck vs. Railroads."

"Advantages to the Public of One-Man Car Operation in City Service," by R. F. Palmblade, manager Peoria Railway.

"Car Construction," by M. J. Oswald, sales representative St. Louis Car Company.

"Bus Maintenance," by H. P. MacDonald, superintendent of automotive equipment East St. Louis & Suburban Railway.

There will also be two morning joint sessions on public relations, finance, terminable permits and public utility information.

Automotive Engineers Discuss the Bus

THE place of the motor bus in urban transportation was the subject of a meeting held by the Metropolitan Section, Society of Automotive Engineers, in New York on the evening of Feb. 17.

Speaking with a background of more than five years experience in bus operation, R. N. Graham, manager of railways Pennsylvania-Ohio Edison Company, presented a carefully prepared analysis of the part the motor bus may be expected to play in the transportation scheme of the country. Mr. Graham spoke not as a railway man, but as a transportation man interested in finding the place of each form of vehicle which is available for transportation purposes. An abstract of his talk will be published in next week's issue of the JOURNAL.

Both automotive and electric railway men took part in the discussion. Adrian Hughes, Jr., manager Baltimore Coach Company, said that progressive transportation men today have no prejudice against the automotive vehicle. If there was such prejudice when the bus first made its appearance, the speaker explained, it was the natural result of the unfair conditions under which a great many original competitive bus lines were started. He held to the view that the application of buses as a part of the transportation systems of modern cities should be dictated by the economics of each situation. He said that the study of the matter of how best to use the motor bus, and the analysis of the factors which determine the proper vehicle to use under each given set of conditions, is considered by progressive transportation men to be one of the major problems of the industry.

Gas-electric drive for buses, effect of power brakes on tire wear and one-man operation of double-deck vehicles were phases of the subject discussed by other speakers.

American Association News

T. & T. Executive

PROGRESS reports of committee chairmen occupied the greater portion of the time at the meeting of the executive committee of the T. & T. Association held in Toledo, Ohio, on Feb. 4. R. N. Graham, chairman of the committee on bus operation, indicated substantial progress of the work which has been undertaken. S. E. Emmons reported on the work of the service betterment committee, in which much new work is being undertaken. In the absence of Chairman C. H. Evenson, Samuel Riddle reported on the work of the traffic and safety committee, which is being conducted jointly with the

claims association. This committee recently reviewed the conditions of the Anthony N. Brady Award and agreed with Chairman Thomas Fitzgerald of the American Association committee on a revised set of conditions to be offered to the American Association and the American Museum of Safety. A subcommittee was appointed to co-operate with the electric railway section of the National Safety Council in preparing a revised classification of accidents.

President Sullivan appointed two new committees. The one on convention program consists of W. H. Boyce, chairman; Paul Wilson and A. R. Myers. In addition to preparing the program for the T. & T. Association, this committee was also instructed to get in touch with President Proctor of the Claims Association regarding arrangements for a joint session for the presentation of the report of the joint committee on traffic and safety.

A committee on subjects for next year's work was also appointed, consisting of Edward Dana, chairman; Samuel Riddle and G. B. Anderson. This committee is to consider the results of this year's work and make recommendations for the work of the committees for next year, also taking into consideration whether committees on entirely new subjects should be appointed and some of the present subjects dropped.

It is planned to have the next meeting early in July after the reports of the standing committees have been presented. The date and location will be announced later.

President Sullivan appointed a committee on resolutions on the death of E. M. Walker, late president of the Schenectady Railway. This committee, consisting of Paul Wilson, Edward Dana and Samuel Riddle, was instructed to draft suitable resolutions and submit them for presentation at the convention and inclusion in the Proceedings. A letter of appreciation from Mrs. Walker for the floral tribute sent by members of the committee was read.

Those present were President J. V. Sullivan, Edward Dana, W. H. Boyce, Samuel Riddle, A. R. Myers of the executive committee; Committee Chairmen S. E. Emmons, R. N. Graham, and J. W. Welsh and G. C. Hecker.

Depreciation

POSTPONEMENT of the Interstate Commerce Commission hearing scheduled for Feb. 28 on depreciation, Docket No. 19157, until May 23, 1927, was obtained by Lucius S. Storrs, managing director of the American Electric Railway Association. This change was announced to the sub-committee on depreciation of the national relations committee at a meeting held in New York, Feb. 17, 1927.

Electric railways which report to the Interstate Commerce Commission will be interested in the course events are taking with respect to the impending order of the Interstate Commerce Commission in the matter of entering an order prescribing a system of depreciation accounting for electric railways substantially the same as that entered recently with respect to depreciation charges of steam railroads. Before considering the proposed order it was the idea of the commission to hold a hearing on Feb. 28 at Washington, D. C., before Examiner Bunton, at which those concerned were to have an opportunity to testify.

It was decided that the committee would present the case of the electric railways showing that the situation of the industry was essentially different from either the steam railroads or the telephone systems. Only a few of the electric interurbans and still fewer city systems come under the Interstate Commerce Commission jurisdiction. The assumption is, however, that many state commissions may follow the example of the Interstate Commerce Commission if the national commission should promulgate this change in the depreciation system. The committee recognized the isolated character of electric railways. This and the widely different conditions of finance, earnings, and competition with automobiles was considered of such importance that no standard rule of depreciation could be made effective with justice to all.

The committee outlined a program to collect data and prepare a comprehensive study of the industry. Obtainment of outside counsel to help present the case scheduled for May 23 was agreed upon.

Those of the committee present were: J. H. Hanna, chairman; Thomas Conway, Jr., F. W. Doolittle, W. F. Ham and C. R. Mahan representing C. E. Thompson. In addition Charles L. Henry, Lucius S. Storrs, J. W. Welsh and other members of the association staff attended.

Education

IMPORTANT plans were approved for further development of foreman training and study of the training of platform men at a meeting of the American Association committee on education, held at Toledo immediately after the annual convention of the C.E.R.A. This meeting followed correspondence among the committee members as to the best procedure for the current season and it proved successful in bringing out constructive suggestions.

In attendance at the meeting were these committee members: Edward Dana, chairman; H. H. Adams, W. H. Boyce, F. H. Miller, H. H. Norris and A. J. Sarré. M. B. Lambert was represented by A. B. Gibson and J. A. Dewhurst by Charles Gordon. Guests present by invitation included J. W. Colton, Prof. D. D. Ewing, E. P. Waller and Adolph Schlesinger, all of whom have shown keen interest in the work of the committee.

Discussion on the foreman-conference movement showed a lively interest on the part of railway managers and the need for some definite plan for training foreman-conference leaders. The series of conferences preceding the demonstration at Cleveland was believed to be a step in this direction. The subject is so large, however, that it was referred to a sub-committee, as follows: Mr. Dewhurst, chairman, and Messrs. Lambert, Boyce and Sarré. This committee will consider all possible methods of training, including the holding of a series of training conferences at the Cleveland convention this year. If such a series is planned it is understood that the sessions will occupy only a half day each.

The training of transportation employees was taken up in some detail, with the result that a sub-committee on this subject was appointed also. Dr. Rowland will be chairman, and Messrs. McCants, Adams and Hyatt will complete the committee. This committee will report on the general situation in this field with the possibilities of effective work in the field by the committee.

A third sub-committee was appointed to bring about greater publicity for the educational work of electric railways. The committee comprises Mr. Norris, chairman, and Messrs. Boyce, Dewhurst and Burke.

It was deemed necessary this year to send out a questionnaire to gather facts on educational activities in the industry, but this will be so worded as to call for a minimum of time in the compilation of the replies. The committee will also bring up to date the bibliography on educational work which formed an appendix to the report for last year.

In the interest of conservation of time and energy at the disposal of the committee it was decided to omit the educational exhibit at the 1927 convention and to concentrate upon the phases of the work assigned to the sub-committees named. As a guide to future activities a chart will be prepared showing the ramifications of educational and training work on an electric railway property. Thus the committee this year and later will have a guide by which to prepare its plans, taking up at one time only those lines of work that are timely and promising.

Bus Operation

GENERAL discussion of various phases of operation was participated in by the members of the committee on bus operation of the T. & T. Association at its meeting held in Toledo, Ohio, on Feb. 3. A check-up was made of the replies to the questionnaire which was sent to 51 companies. It was found that nineteen companies had been heard from. It was decided that the chairman would follow up the members responsible and attempt to get the data all in within the next two weeks.

Progress was reported by the subcommittee chairmen on the four subjects which are being studied. Much of the work is awaiting the tabulation of material from the questionnaires.

It was decided to hold the third meeting of the committee in Chicago, Ill., on April 8 at 9 a.m. Central Standard time, the meeting place to be arranged for by B. W. Arnold.

Those present at the meeting were Sponsors Paul E. Wilson and A. R. Myers, Chairman R. N. Graham, D. L. Fennell, S. W. Greenland, M. L. Harry, Adrian Hughes, Jr., D. S. Mackay, Thomas Noonan and D. A. Scanlon, members, and G. C. Hecker, R. E. Plimpton, W. W. Holden, C. D. Smith and R. F. Palmblade, guests.

The News of the Industry

$750,000 for Rehabilitation in Phoenix

The City Commission of Phoenix, Ariz., has unanimously approved an ordinance calling for a special municipal election on March 12, at which the public will be asked to approve an issue of bonds totaling $750,000 for the purchase of new cars, rails, ties and other necessities for bringing the present municipal railway up to date. The ordinance calls for the rehabilitation of the entire system, including the Washington Street, the Brill, the Indian school, the Grand Avenue, the Kenilworth and the Hollywood lines.

The ordinance adopted by the commission asks approval of the issuing of 750 bonds of a denomination of $1,000 each. The bonds are to bear interest at a rate not exceeding 5 per cent per annum, payable semi-annually, maturing at the rate of $30,000 annually, over a period of 25 years beginning in 1932. Under this plan the system will be operated for a period of five years before the sinking fund begins to operate.

Parking Regulations in Philadelphia Opposed

Hardly had the enforcement of the new parking regulations in Philadelphia been in effect when a demand was forwarded to the Mayor and Director Elliott for their modification. In a set of resolutions the Market Street merchants asked for half-hour parking, claiming that the restrictions are driving trade away. So far has the protest gone that an ultimatum was delivered to the city administration on Feb. 11 by the Market Street Merchants' Association stating that unless the parking ban on Market Street was modified the association would file an injunction demanding enforcement.

In response Director Elliott has told the Market Street Merchants' Association that he would fight all attempts to modify the anti-parking ordinance until it has had a fair trial. His attitude met the approval of several traffic organizations and officials, including the traffic committee of the Chamber of Commerce and Kane S. Green, president of the Automobile Club of Philadelphia. Director Elliott told the representatives of the association that he would make no change in the regulations until all the "no parking" signs had been erected and the ordinance had received a reasonable test. Then he and Superintendent Mills would report to the City Council.

When the parking bill was signed the warning signs were still in preparation. Under the ruling of the court these signs are a necessary preliminary to the enforcement of the rule. The recent parking regulations have been referred to before in the ELECTRIC RAILWAY JOURNAL.

The latest move on the part of the Market Street Merchants' Association was the drafting of a parking bill on Feb. 15, the third ordinance since the anti-parking dispute. Two of the ordinances providing for restricted parking in the central city district were introduced in the Council on Feb. 17. Director Elliott refused to comment other than to say that enforcement of the parking ban was uppermost in his mind.

One-Man Car Right Sustained

Toronto Transportation Commission Wins Point Over City's Complaint—Review of the Situation in Canadian City—Amalgamated President Defends New Equipment

BY JUDGMENT of the Ontario Railway Board, the application brought by the city of Toronto to restrain the Toronto Transportation Commission from using one-man cars has been dismissed with costs. The decision was based upon an investigation conducted by its officers which resulted in the finding that accidents occurring with one-man cars could not have been prevented by the two-man type. Vice-Chairman Ingram said:

> If the people of Toronto are dissatisfied with the one-man car it is their duty to present their feelings to the Transportation Commission. It has not been shown that there have been accidents due to this type of car, and that is the only phase in which we are interested.

During the hearing of the application it was contended by Controller MacGregor that the opinion of the City Hall was unanimously in favor of the removal of the one-man cars. This statement, however, was sharply challenged by I. S. Fairty, K.C., counsel for the Transportation Commission, who stated that Controller MacGregor did not represent the unanimous opinion of the City Council, and could not get such a motion through if he wanted to. Mr. Fairty objected to statements made by Controller MacGregor during his election campaign, characterizing these as "reckless and wild."

Mr. Fairty declared that it would have been much more sporting for the city to have gone to the Toronto Transportation Commission and asked it to abandon the one-man cars than to apply to the board. He regretted that much election propaganda had been spread on the question. The commission, he said, had spent thousands of dollars in remodeling cars with the approval of the Board of Control.

CONTROVERSY IN MONTREAL

Agitation in Canada against the use of the one-man car was not confined to Toronto. The Montreal Trades and Labor Council's objection to the one-man cars was expressed in a resolution passed on Nov. 4. A copy of the resolution was sent to the Montreal Tramways management, accompanied by a letter which said in part:

> We hope you will give the resolution deserved consideration, as this is a vital question in the interest of the Montreal public, and, as a public body, we would like to have an opportunity to discuss this question with your company.

Julian C. Smith, president of the Montreal Tramways, replied in part:

> We believe that further study of the situation will convince you of the material benefits which the community gains through the operation of the one-man cars. We will be very happy to discuss the situation with you, and if you will advise me when it will be convenient to meet yourself and any other representatives of the Montreal Trades and Labor Council at the tramway offices, I will be glad to arrange to have with me some of our people who can discuss intelligently the features of the one-man cars that you refer to.

The Trades and Labor Council also sent its resolution to the Montreal Tramways Commission, and it received a letter from the commission about the same time as it received Mr. Smith's. The Trade and Labor Council considered these communications, and one-man car operation generally, at a meeting late in Nov., 1926, and reports indicated that the discussions were, in the main, far from harmonious. It was decided that no delegation should be sent to consult with the tramway management, on the ground that the company is not a controlling body, and that action to be taken on the commission's communication should be left to the Council.

The Trades and Labor Council's president, Mr. Foster, was very critical of the tramway union. It was a strange thing, he said, for the tramway union to denounce one-man cars and ask the T. and L. Council to do the same and then send a delegation on a tour to determine if its criticisms were correct. He felt that the union might have made sure that one-man cars are undesirable before asking the T. and L. Council to go on record against them.

Julian Smith, a few days later, stated that the protests against one-man car operation had been made before the equipment had been given a fair trial. He said that the fears held by labor that one-man car operation would reduce employment were groundless and pointed out that the fact of one-man cars constituting 30 per cent of the street cars operating in North America would indicate that they had merit.

He said the company had no desire to force on the public something it does not care to engage in any controversies.

not want, and that the one-man cars were introduced solely in keeping with the company's policy to give the public the best service possible.

G. Gagnon, president of the Montreal Tramways Employees' Union, was unable to accompany the delegation appointed to inquire into one-man operation in other cities and was replaced by R. Trepanier. Messrs. Trepanier, Champagne and Manion visited Detroit, Toledo, Cleveland, Pittsburgh, Trenton, Youngstown, Elizabeth, Scranton, Newark, New York, Bridgeport, Philadelphia, Albany and Troy in the latter part of November and their report was considered at a union meeting on Dec. 1.

It stated that one-man car operation was practically universal in all the cities visited, and of even greater importance, it indicated that informed people everywhere, inside the electric railway and outside of it, are convinced of the desirability of one-man cars and of their safety and economic value.

In Detroit the delegates met W. D. Mahon, president, and W. B. Fitzgerald, vice-president of the Amalgamated Association of Street and Electric Railway Employees of America, who impressed upon them their view that the one-man car is a modern development and a natural outgrowth of the march of progress; that its coming was inevitable, and that controversy in regard to its use has been settled by the courts in its favor, and, finally, that one-man car operation has not been injurious to the employees' interests.

The delegates suggested to Mr. Mahon that possibly the Montreal Tramways was violating the contract with its employees in placing one-man cars in operation, but their attention was called to a clause in that contract stipulating that one-man car operators are to be paid 5 cents an hour extra, implying that when the contract, all the conditions of which the men accepted, was entered into, operation of one-man cars had been in view.

The union's chief executives acquainted the delegates with the fierce competition electric railways have had to face, and with the fact that one-man cars constitute one of the best weapons the electric railway management have to meet that competition and hold their traffic. It is probable that at the end of the interview the delegates had come to a realization of the fact that the one-man car is just as beneficial to the electric railway employees, as a class, as to any one else.

Japanese Railway Representative Visits America

Gitaro Ishida, assistant to director of the Japanese Government Railways, Kobe region, is making a tour of the United States to study transportation methods more particularly in the electric railway and bus fields. Arriving in California on Nov. 14 he spent a week making observations in San Francisco and a month in Los Angeles and its vicinity. He is now in New York and will remain there until Feb. 20, when he will depart for a visit to various Western cities. He plans to see Philadelphia, Cincinnati, St. Louis, St. Paul, Minneapolis, Chicago, Detroit and Cleveland.

Hearing in Oakland Postponed

Pending the completion of an inventory and valuation of the company's properties, the hearing on the application of the Key System Transit Company for adjustment of rates was postponed on Feb. 1 by the California Railroad Commission until May 10. It is expected that the valuation survey will be completed by April 15, thus giving the experts time in which to check over their figures.

This valuation is of Dec. 31, 1926. It is based on unit prices over a three-year period ended June 30, 1926. In addition to a reproduction cost at new and at present values and a reproduction cost new less depreciation, a historical reproduction cost value will be made.

At the Feb. 1 hearing in Oakland, Herman Phleger, counsel for the Key System, filed a report which showed that despite a temporary increase in revenue granted by the authority of the Railroad Commission on Dec. 31, 1925, the additional revenue has fallen short of expectations.

When the 7-cent railway fare and the 21-cent ferry fare were officially authorized it was estimated by experts of the Railroad Commission that the company would require $800,000 additional revenue in 1926 to obtain the finances necessary to make improvements and to cover the $400,000 wage increases.

Mr. Phleger, in his report, pointed out that the revenue of the company in 1926 exceeded that of 1925 by $277,000 and that bond interest paid in 1926 exceeded that paid in 1925 by $125,857. During 1926 the company spent $4,549,196, made up as follows: Cars, $940,646; automotive equipment, $198,901; boats, $1,794,977; service equipment, $99,436; way and structures, $1,515,235.

The money for these improvements was obtained through the issue of the following securities: First mortgage 5½ per cent bonds, $2,500,000, an annual charge of $137,500; first mortgage 6 per cent bonds, $1,500,000, an annual charge of $90,000, and equipment trust 6 per cent bonds, an annual charge of $93,500.

The company is proceeding with the formulation of plans for changes in its pier, the report declares, and its officers are conferring with the city of Oakland regarding the making of a solid fill, but in view of increased operating costs in 1926 and the insufficient increase in revenue it has not been possible to do any work on the pier "and it will not be prudent to attempt to do so until the finances of the company are in better condition."

The two new ferryboats now in course of construction at an Oakland shipyard will be ready for service early in March.

Pennsylvania Railroad Talks of a Future Power Plant

An announcement made at Philadelphia by the Pennsylvania Railroad on Feb. 10 said that conferences had been held between the officials of the Pennsylvania Railroad, Philadelphia Electric Company, Philadelphia Rapid Transit Company, Public Service Corporation of New Jersey, Philadelphia Suburban Gas & Electric Company and Counties Gas & Electric Company (the latter two being subsidiaries of the United Gas Improvement Company) looking toward the construction of a power plant of sufficient capacity to provide for the rapidly increasing needs of these properties, especially for 25-cycle energy. In printing this announcement the newspapers said that the site of the plant would probably be on the Delaware River near Trenton, N. J.; that it would cost about $10,000,000, and that the power generated would be applied in extending the electrification of the Pennsylvania Railroad. Contradictory reports concerning the conferences, however, at once followed, the Philadelphia Electric Company and the Philadelphia Rapid Transit Company denying that they had taken part in such negotiations. A five-year contract between the Philadelphia Electric and the Philadelphia Rapid Transit for the supply of power to the latter will expire in the spring.

Status of Winnipeg Franchise

There have been no new developments in the Winnipeg electric railway franchise situation. The City Council had the right under the original contract made 35 years ago to take over the system in 1927 at its physical value by giving the company six months notice of its intention to do so. Such notice would have had to be given not later than Aug. 8, 1926. The City Council failed to give this notice and consequently the franchise is automatically extended for five years dating from Feb. 8, 1927. The right of the city to take over the system recurs every five years from now on.

New Ticket Rates in Tacoma

Tickets good for six rides, with transfer privileges, on all lines of the Tacoma Railway & Power Company, Tacoma, Wash., will be sold on street cars, effective Feb. 8, 1927, for 50 cents. This new fare does not replace either the token or the 10-cent cash fare offering similar riding privileges. The 5-cent inner zone fare will likewise remain.

Decision to institute the new fare was reached after conferences between city officials and members of the City Council. The new fare is simply another experiment designed to provide still further evidence of what is desired by the riding public, and how the necessary amount of revenue can best be obtained. Offer of the new fare came from Richard T. Sullivan, manager of the railway. It will give a fare of 8¼ cents for riders who do not care to invest $1 in tokens, or who do not find it convenient to go to one of the regular token-selling places. The wide difference between cash fares at 10 cents and the token at 6⅔ cents has led many people who would otherwise not bother with tokens to purchase them, Mr. Sullivan states. The new ticket fare will practically restore the former 8-cent cash fare.

Report of the railway for December, with about ten days under the zone system included, showed an increase in gross earnings but a decrease in earnings per mile.

New York City's Transit Bills Introduced

Bills embodying the New York City administration transit program were introduced in the Senate and Assembly on Feb. 17 by Minority Leaders Bernard Downing and Maurice Bloch.

One bill amends Sections 32, 39, Chapter 4, laws of 1891 (New York City rapid transit act) by authorizing acquisition of any railway by eminent domain in the event that terms and conditions may not be agreed upon between the board or commission representing city and owners or operators of the railway.

A second measure amends Section 11, city home rule law, by empowering local legislative body of city to enact laws for ownership, establishing, construction, acquisition and operation of municipal bus and trackless trolley lines.

A third measure adds new Section 134-a to the Chapter 480, laws of 1910, public service commission law, giving the Board of Transportation such additional powers and duties as may be conferred by local legislative body of city under the city home rule law.

A fourth bill amends Section 134, public service commission law, by stripping the Transit Commission of all powers except that relating to the rapid transit readjustment plan and conferring such powers on the transportation board.

The fifth bill adds new subdivision 12, Section 49, public service commission law, by authorizing any municipality to cancel a contract, franchise or certificate for privilege of transporting passengers or property if lessee, operator or grantee thereunder shall petition, or accept the benefit of the exercise of, the powers by the commission in altering, changing or modifying the rate of fare fixed in contract.

Another Finding in Superior

A coroner's jury exonerated the one-man street car operator, grade crossing switchman and train engineer of all blame for the street car-passenger train crash at Superior, Wis., on Jan. 6. The Duluth Street Railway was censured because of the use of one-man cars at this dangerous point, negligence was charged on the part of the Railroad Commission because it refused a previous petition for extension of a viaduct over the tracks where the accident occurred, neglect was intimated in the case of the Great Northern Railroad for allowing its trains to operate at an excessive rate of speed over the crossing, and negligence was charged on the part of the Northern Pacific Railroad because the gates at the crossing had not functioned properly at the time of the accident.

Department Store's Full-Page Ad Features Pittsburgh Service

One of the most remarkable examples of the co-operation between the Pittsburgh Railways, Pittsburgh, Pa., and other interests of the community is the full-page advertisement which Boggs & Buhl ran in the Pittsburgh newspapers on Jan. 19 to feature their annual "Remnant Day." The announcement was repeated the next day, but in smaller space.

The Boggs & Buhl department store is on the so-called Allegheny side of the city and therefore not in the general metropolitan shopping area of Greater Pittsburgh. On that account many Pittsburgh prospects must figure on using transfers.

To offset the disadvantages of location, Boggs & Buhl have worked in closest harmony with the commercial department of the Pittsburgh Railways to assure ample service for their patrons. Their annual "Remnant Day" is a really big feature in Pittsburgh's retail merchandising and the Pittsburgh Railways made every effort to see that ample service would be provided. In turn, Boggs & Buhl showed their appreciation by featuring the electric railway more than the sale itself. The motto seems to have been: "Get 'em on the cars first and the sale will take care of itself." The full-page advertisement was concluded with the slogan: "The Weekly Pass Is a Wise Investment."

Upper Half of Pittsburgh Ad—Lower Half Listed Routes

New Name for Inland Empire Under Great Northern Control

After announcing that the properties of the "Inland" and allied interests, recently purchased by the Great Northern Railroad, would be known hereafter as the Spokane, Cœur d'Alene & Palouse Railway, officials at Spokane canceled this new name and have made plans to have the name changed legally to the Spokane & Idaho Northern Railway. Approval of the transfer of the properties to the Great Northern is now pending before the Interstate Commerce Commission.

Commercial organizations in towns of the Idaho panhandle requested the Spokane & Idaho Northern title based on grounds that the name Spokane has always been used in the several titles which these roads have borne, and because the name of the state of Idaho has not been properly recognized and used by business interests. The second change in names was made largely in deference to the wish to foster a spirit of good will.

The properties to be purchased by the Great Northern consist of electric interurban lines out of Spokane, most recently known as the Spokane & Inland Empire Railroad, to Moscow, Idaho, and the Spokane & Inland Empire, operating to Cœur d'Alene, Idaho.

Suburb Agrees to Cleveland Railway Plan

According to the Cleveland *Plain Dealer* the second long step in carrying out the metropolitan traction program for the Cleveland Railway system has been taken by the Cleveland Heights Council. The program was submitted in June, 1925. The Cleveland Council approved it in April, 1926. Now the Heights acts more than eighteen months after the commission finished its work. East Cleveland and Lakewood have yet to act.

The new franchise shows the fruits of negotiation. The company wins the one concession which the metropolitan commission considered essential to the plan; that is, the suburb agrees to pay a fare 1 cent above what city passengers pay. In return for this the company agrees to build extensions on Mayfield and Cedar Roads and to establish a bus line on Fairmount Boulevard. These terms must have the approval of the Cleveland Council, but no difficulty on that point is anticipated. The community now awaits action by Lakewood and East Cleveland.

"No Accident" Reward Plan in Trenton

The Trenton & Mercer County Traction Corporation, Trenton, N. J., has put into effect a "No Accident Bonus Plan," whereby a bonus of $1 a week will be credited to each operator with a clear accident record during that week. Payments of bonus will be made in a lump sum covering four weeks. To be eligible to receive the weekly credit the operator must work at least five days of the week, a regular man must total at least 40 hours and an extra man at least 35 hours.

Notes from Knoxville on Fares and Threatened Bus Competition

C. H. Harvey, president of the Knoxville Power & Light Company, Knoxville, Tenn., says that the new fare arrangement put into effect on Jan. 3, consisting of the sale of weekly passes at $1.25 per week, five tokens for 30 cents and single cash fare of 10 cents, has met with very general public approval, and that the company has had many letters of commendation and oral comments on the convenience of the pass, the purchasers finding so many different ways that the pass can be used to advantage. He feels, however, that the question of whether or not this new system is going to be satisfactory to both the public and to the company can be determined only upon further trial.

In this connection it is of interest to note that the application made some time ago by the Knoxville Rapid Transit Corporation for a franchise has been revived and that early action by the Council has been requested. The position of the Knoxville Power & Light Company with respect to this matter is that the granting of this general franchise for bus operation is undesirable because there is no necessity for the general installation of bus routes in the city and because this kind of competition is ruinous and against the public interest. The Knoxville Power & Light Company has been willing, and is willing, to install and operate buses where and when this service is necessary and bears promise of resulting in a reasonable profit. The position of the company is that it would undoubtedly be in the interests of Knoxville to have any buses installed operated by the utility in conjunction with its street railway system, but it feels this should not be required of the company until the public convenience and necessity is sufficiently great as to justify it.

"Ride in the Street Cars" in Seattle

Plans to make the week of Feb. 21-28 in Seattle, Wash., a "Ride in the Street Cars" week, during which every one will be urged to use the street cars and help put the system on a paying basis, have been adopted by a newly organized "Ride in the Street Cars" Club, in which is represented service clubs, commercial clubs and improvement clubs. All other clubs in the city will be asked to get behind the movement and line up the people in their localities, so that the receipts of the week will help materially in getting the railway back on a cash basis. A speakers' bureau is being organized to cover club meetings for the next three weeks. Automobile owners will be asked to favor the cars for one week, refrain from picking up passengers and give the cars all possible patronage. Clifford Wiley, chairman of the club, states that the movement is in nowise directed against the automobile. He asserts that the fact that practically every club member owns a car does not relieve him of the responsibility of supporting the municipal railway as much as possible.

News Notes

Would Grant Right of Eminent Domain to Interurbans.—The North Carolina Senate has passed and sent to the House a bill to allow interurban railways to do business in the state and to give them the right of eminent domain.

New Franchise in Leavenworth.—Officials of the Kansas City, Leavenworth & Western Railway and the City Commission of Leavenworth, Kan., have agreed upon the terms of a new twenty-year franchise for the railway to operate over city streets.

Fare Increase Proposed in Williamsport.—Little more than a week after the Public Service Commission approved the merger of four railway companies in Williamsport, Pa., the consolidated concerns known as the Williamsport Railways filed a new tariff, increasing the present rates. Under the new schedule, announced by the commission, the present fare of 5 cents would be raised to 8 cents with two tokens for 15 cents. The increase becomes effective March 1.

Fourteen Men Have Perfect Record.—Throughout the year ended Dec. 31, 1926, fourteen employees of the Tide Water Power Company, Wilmington, N. C., held a perfect safety record. During this time they operated cars over the system without a single accident being charged against them. The total car mileage operated during the year was 738,000 miles.

Must Preserve Safety Rules.—Orders have been issued by the Board of Public Utility Commissioners of New Jersey for the Ocean City Electric Railroad, Ocean City, N. J., to improve service over its lines. After investigation the board stipulated that all one-man cars should have properly controlled doors and folding steps, rear doors for emergencies, automatic signals to notify operators when the rear doors are opened and a signal system to enable passengers to notify the operator to stop the car.

All One-Man Cars in Rockford.—The Rockford Public Service Company, Rockford, Ill., which recently acquired the Rockford traction interests, introduced one-man cars on all its lines on Feb. 15. Inclusion of the one-man car clause in the franchise to the new company was considered one of the outstanding features of that grant.

Fine Accident Record in Kansas City.—The 1926 accident record of the Kansas City Public Service Company, Kansas City, Mo., is one of the most impressive the trainmen of the company have ever made. During the year 681 trainmen operated day in and day out without having an accident of any kind for which they were responsible. Motorman J. D. Shepard of Ninth and Brighton headed the list.

Will Look Into One-Man Operation.—City officials of Portland, Ore., recently started an investigation to determine whether the one-man street cars on Broadway Avenue, operated by the Portland Railway & Light Company, at night interfere with traffic. If they do the company will be "invited" to discontinue that sort of operation. The question has also been raised as to the one-man operation of cars on other heavily traveled lines, and the whole question may be considered by the Council at an early hearing. City officials are resentful, it is stated, over the fact that the change in operation had been made without consulting the City Council or traffic department.

Safety Course in Session. — The Beaver County Section of the Western Pennsylvania Safety Council announced the third annual safety lecture course from Jan. 6 to Feb. 24, 1927. The sessions are held every Thursday evening from 8 to 9.30 in the auditorium of the Carnegie Library. This is a course for foremen, superintendents, employers, employees and others interested in the prevention of accidents in the home, the streets, the factory, the mine and mill. In connection with the course H. O. Allison of the Beaver Valley Traction Company invited the trainmen and coach drivers of his company to be present at the lecture on Feb. 3.

Tokens in Seattle Stores.—Tokens for use on the Seattle Municipal Railway, Seattle, Wash., will be sold at all downtown stores beginning Feb. 8. This is part of the plan to speed up cars and reduce operation costs, relieve traffic congestion by quicker loading, and provide a service to the rider. All downtown stores have agreed to co-operate with the railway officials and have offered to make special displays of the tokens, including window displays, to attract customers' attention. Cards have been printed and will be displayed on the cars urging patrons to buy their tokens before getting on the cars. One of the slogans is: "A token in the hand saves time."

Fire Insurance on Railway Property.—The Detroit Street Railway Commission at its meeting on Jan. 25 voted to take out $5,000,000 in blanket fire insurance on municipal railway property and to distribute the insurance equally among six agencies and companies. Sixty-eight bidders were reported, the successful ones selected by the commission being Johnson & Higgins, Willett & Hughes, Michigan Insurance Agency, John A. Parks Company, Edward T. Fitzgerald and Gorman & Thomas.

Commission's Order to Stand.—Under a stipulation filed, the Public Service Commission on Feb. 11 discontinued the proceedings instituted by the Mayor of Elmira, N. Y., against the Elmira Water, Light & Railroad Company over rates charged by it for gas and electricity and street railroad transportation, and permitted the withdrawal of the complaints and cross-complaints. The order provided that nothing therein contained shall affect or impair the order of the commission on May 7, 1925, authorizing a maximum street car fare of 7 cents in Elmira, and the tariff filed under this order is to remain in full force and effect. Commissioner Van Namee said that an increase in rates would be necessary if the company were to obtain anything like a fair return on the value of its property.

Recent Bus Developments

Bus Substitution Considered on New Jersey Interurban

Because of the bad condition of paving on a number of streets over which the Morris County Traction Company operates in Essex and Morris Counties in New Jersey proposals have been made that car service be discontinued and bus service started in its place. The main line of this railway is between Lake Hopatcong and Maplewood, where connection is made with tracks of the Public Service Railway, permitting through operation to the center of Newark. In all, nearly 50 miles of track is operated, about half of which is on private right-of-way.

For a number of years the company has been in financial difficulties. In July, 1923, a receivership was ordered by the court because of the refusal of a minority interest to agree to a refinancing plan. Prior to that, in 1918, the earnings being insufficient to meet the full interest charge on the bonds, the bondholders agreed for a period of five years to exchange the 5 per cent coupons on their bonds for new coupons at 2 per cent and income trust certificates to cover the difference. Under the trust agreement the 3 per cent coupons attached to the income trust certificate were automatically canceled each year when the earnings were insufficient to permit payment. During the following five years the 2 per cent coupons were regularly met and the income trust certificates were canceled.

Before the expiration of this proposal, in 1923, a refinancing plan was submitted to the bondholders. According to this plan they were to accept new bonds at 6 per cent for half of their holdings and non-cumulative preferred stock for the other half. Execution of this plan required the consent of all bondholders. Unfortunately, three individuals out of a total of 286, representing only 3.13 per cent of the bonds, refused to deposit their holdings for exchange and the refinancing plan could not be undertaken.

When the original paving agreements were made macadam paving was in general use throughout the territory in which the company operates, and it was stipulated that the paving work done by the railway should be of this type. In recent years, however, heavier pavements have come into use and an attempt has been made to have the railway install these more expensive kinds. To this the company has objected. As a solution of this difficult problem a bill was introduced in the New Jersey Legislature a year ago to relieve electric railways in part of their paving obligations. Although passed by the Senate and General Assembly, this bill was vetoed by the Governor and the question reverted to its original status. A similar bill has recently been presented to the Legislature, but no action has yet been taken.

Meanwhile O. G. Schultz, general manager of the railway, has proposed to remove the tracks and operate buses from Maplewood to Lake Hopatcong. Formal application for the necessary permits has not yet been made, but it is said that the company is hopeful of making the change by April 15. The municipalities would then do the repaving. Much favorable comment has been made concerning the pavement improvement feature of the plan.

Bus Service for Wisconsin Cities

Service on the lines of the Wisconsin Public Service Corporation in Two Rivers and on the interurban line between Two Rivers and Manitowoc will be abandoned if the Wisconsin Railroad Commission and the cities affected approve the discontinuance. Both the city service in Two Rivers and the interurban service are being run at a loss. In addition the city of Two Rivers has started an extensive paving program on streets occupied by the city lines and the interurban which would entail a burden heavier than the railway feels the traffic can bear.

C. R. Phenicie, vice-president of the company, who appeared before the City Councils of Two Rivers and Manitowoc recently, stated that ever since the corporation purchased the Manitowoc & Northern Traction Company the road has been operated at a loss. It is his idea to discontinue railway service and establish service by bus in Two Rivers and between the two cities. Several months ago railway service was abandoned in Manitowoc due to lack of patronage and the street cars there were replaced by a bus system.

Injunction Sustained at Louisville

A motion to dissolve a temporary injunction restraining the People's Transit Company, Louisville, Ky., from operating buses on Broadway was overruled by the Court of Appeals at Frankford on Feb. 12. The court, in overruling the motion, ordered the case heard on its merits.

The temporary injunction was granted the Louisville Railway by Judge William H. Field recently and carried to the Court of Appeals by the bus company.

The question to be decided, Judge Thomas said, was whether the operators were required to hold a franchise when they have already been granted licenses and permits by the city.

The court said that the question is "a far-reaching one since it would not only affect the various municipalities in the commonwealth, but it might also affect a county if it should attempt to grant such privileges over its public highways." In view of this it ordered the case tried on its merits.

The transit company in its appeal against the injunction said it was operating under a permit and license issued it by the city, while the railroad contended that "privileged" users of highways must have a franchise.

Auto Stages to Replace Interurban Trains in Washington

In the face of considerable opposition, the Department of Public Works at Olympia, Wash., recently granted the application of the Pacific Northwest Traction Company, which operates an interurban-stage line between Seattle and Bellingham, to substitute stages for certain interurban trains between Bellingham and Mount Vernon. The department was urged by the City Council, Chamber of Commerce and practically every civic club in Bellingham to grant the permit, declaring that Bellingham and Whatcom County are being discriminated against because they had no stage connections to Skagit County and Seattle and that the service would be a convenience and necessity.

The department granted the permit after the company testified that the gross operating revenues of the interurban had decreased steadily during the past few years; that it was necessary to increase the revenues between Mount Vernon and Bellingham and to curtail the operating expenses of the electric interurban line, which would require a reduction in the amount of service rendered; that increased patronage might be expected by reason of the coordinated service, and the fact that the bus is able to render more service to intermediate points along the highway than is now furnished by the electric railway.

The permit was opposed by a group of residents of Skagit County in Mount Vernon and Anacortes, who now threaten to carry their fight to the courts. Attorneys for the objectors declared that there was sufficient ground for appeal because of the basis upon which the department rested its decision, which they declared amounted to a subsidy for the railway by the department because the company had not been making sufficient money. The department declared that the objections of the Skagit County residents were not germane to the issues involved and were without the jurisdiction of the department. They include a charge of increased danger to the general public by reason of increased traffic, excessive speed and insufficiency of present tax methods to cover adequately the use of public highways by motor vehicles.

Tax on Interstate Buses Upheld

Much attention has been attracted by the decision of the United States District Court in Connecticut confirming the right of the state to levy a mileage tax on buses engaged in interstate commerce. It appears that a law was passed in Connecticut in 1925 imposing a tax of 1 cent a mile on interstate buses traveling on State highways. The Interstate Buses Corporation contested the act as unconstitutional under Section 8, Article I, which gives to the Congress the regulation of commerce among the several states. The law did not undertake to make interstate commerce subject to the jurisdiction of the utilities commission as the intrastate carrier is in Connecticut.

The opinion was written by Judge

Martin T. Manton of Brooklyn. Another Brooklyn Judge, Marcus B. Campbell, also sat in the court, and the third judge was Edwin S. Thomas of Norwalk, Conn. Judge Manton wrote that there could not now be a serious doubt that where the state had at its own expense furnished special facilities such as highways for the use of those engaged in commerce, interstate as well as domestic, it could exact compensation therefor. The theory of the excise tax, he said, was consistent with the rulings of the United States Supreme Court in cases concerning the use of special privileges and facilities. All that was required was that the tax should be reasonable in relation to the privilege. He wrote:

As long as the discretion exercised by the State goes to the point of exerting its taxing powers in proportion to and adjusting the scheme, basis and amount of the tax to the possible extent and result of the use of the roads it is not an interference against interstate commerce. The state, however, may not enact a statute which requires an interstate carrier of passengers by motor bus to secure a certificate to establish the public convenience and necessity of operating the buses.

Interstate business must pay its way and the expenses to others incident to the use of it.

Steam Bus Tested in New York

The Fifth Avenue Coach Company, New York, is testing a standard bus chassis driven by a new type of automotive boiler. Used with a steam engine of conventional type, the vehicle is said to combine flexibility and economy. The tests are under the supervision of L. H. Palmer, vice-president of the Fifth Avenue Company, and William McClellan of the engineering firm of McClellan & Junkersfeld, Inc. Ten tons of railway car axles are used on the test chassis to approximate the weight of a fully loaded bus. The vehicle is being driven about the city, particularly in the hilly districts of Washington Heights. Both Mr. Palmer and Mr. McClellan said the tests were not far enough advanced to determine definitely how it would operate under actual working conditions. The device is also being studied by one large city electric railway as a substitute for the expensive underground conduit system.

Buses Supplant Cars. — Implying abandonment of its interurban line between Raymond and South Bend, Wash., the Willapa Electric Company has been granted permission to provide service by bus between the two cities.

Applies for Permission to Run Buses. —The St. Louis Bus Company, affiliated with the United Railways, St. Louis, Mo., has applied to the St. Louis Board of Public Service for permission to operate buses on Olive Street when that street is widened from 60 ft. to 100 ft. between Twelfth Boulevard and Channing Avenue. The bus line would cooperate with the cars of the railway.

Buses Replace Cars.—The Worcester Consolidated Street Railway has discontinued railway service on its line between Clinton and Worcester, Mass., and substituted bus service. The change became effective on Feb. 7. C. V. Wood, president, has announced that it is probable other suburban lines operating out of Worcester will be converted to bus operation.

Financial and Corporate

Boston "L" Reorganization

Chairman of the Metropolitan Board Outlines Plan Now Up for Extension of Public Control.

Henry I. Harriman, chairman of the Division of Metropolitan Planning, which has reported to the Legislature of Massachusetts the proposition for reconstruction of the financial structure of the Boston Elevated Railway with a 50-year extension of the term of public control, has submitted to the committee on metropolitan affairs and the committee on street railways of the Legislature a statement of reasons and recommendations.

New Rapid Transit Commission Proposed

He says that a reorganization of the Elevated would be accomplished through the sale of its assets to a new rapid transit corporation for approximately $24,000,000 of common stock upon which 5 per cent was guaranteed and $26,000,000 of preferred stock upon which 4½ per cent was guaranteed, the new transit company, of course, assuming the obligations of the Elevated. Public control would be extended to the new transit company for a period sufficiently long to permit the preferred stock to be retired through the operations of a sinking fund by the end of the new period of public control. He said in part:

In my explanation of the bill I referred specifically to a dividend saving of approximately $800,000 and referred in a general way to additional savings which would be made in tax payments, both under the plan suggested and under a modification of the same which would substitute 4½ per cent debentures for the 4½ per cent preferred stock, it, of course, being understood that the debentures, like the preferred stock, would be tax free in Massachusetts and would be paid off during the period of public control. Since the hearing the details of the tax savings have been worked out and are most interesting and important.

The federal corporation tax is 13½ per cent on the net earnings (which in the case of the Elevated are its dividend payments), and a saving of $800,000 in dividend payments, therefore, means an additional saving in federal taxes of a little more than $100,000, bringing the actual saving under the plan suggested by us to $900,000.

Debentures for Preferred Stock

If debentures are substituted for preferred stock, such substitution will change a dividend payment into an interest payment upon which there is no federal corporation tax. This interest payment will be a trifle under $1,200,000 a year, upon which the federal corporation tax saving will be about $160,000 annually. This saving should be added to the previous saving of $900,000, making the total saving about $1,060,000. The substitution of debentures for preferred stock will also effect a saving to the Elevated road of between $310,000 and $340,000 in its present Massachusetts franchise tax, so that the total immediate saving to the Elevated road resulting from the adoption of our plan of reorganization, modified, however, by substituting debentures for preferred stock, would be approximately $1,400,000, to which should be added a further saving of at least $200,000 in bond interest as old issues mature and new issues at lower rates are put out. This larger saving will make it feasible to set up a somewhat larger reserve for the retirement of the debentures and thus make possible a shorter term of public control, say to 30 years, if it is deemed desirable.

As either the preferred stock or the debentures will be callable for the retirement fund at par it is safe to assume that the retirement fund will be compound at 4½ per cent per annum. Accordingly, the $26,000,000 of debentures or preferred stock of the new company can be retired by an annual payment of $420,000 if the term be reduced to 30 years, or $235,000 per annum if it be reduced to 40 years.

An annual payment of $470,000 would retire both the preferred and common stocks at the end of a 40-year term. With any of the above payments the balance of the savings effected by the reorganization of the Elevated, and available for the payment of the indebtedness to the city and for new subway rentals, would be from $900,000 to $1,200,000. Because of the large savings effected Mr. Harriman recommends the substitution of the tax-free debentures for preferred stock in the reorganization plan.

This substitution of debentures for preferred stock might be objected to by the present bondholders on the theory that it unbalances the present ratio of stock to indebedness. As the debentures would be all guaranteed by the state and would all be retired within the period of public control, it would be perfectly safe to make these debentures junior to the outstanding bonds. It would also be necessary to make the debentures tax exempt in Massachusetts in order to make them a form of security acceptable to the present preferred stockholders.

Gary Employees Subscribe 100 Per Cent for Railway Stock

Employees of the Gary Railways, Gary, Ind., brought to a successful close on Feb. 14 the company's preferred stock sales campaign by subscribing 100 per cent to their allotment. Every one of the 310 employees of the railway subscribed for one or more shares, thus topping the mark established during a similar campaign in the fall of 1925, when 92.6 per cent of the employees purchased stock. The average holding is less than 1½ shares per employee.

The present issue of $200,000 par value of 7.2 per cent class A preferred stock was offered for sale under the customer-ownership plan beginning on Feb. 1 by the Utility Securities Company. Employees of the Gary Railways were the only persons participating in the public sale. Because of the limited number of shares available, orders from employees were given first consideration during the first five days of the sale. Subscriptions from patrons and other investors in communities served by the company were unusually heavy and the issue was oversubscribed within ten days.

The stock was offered at $98 a share, either on cash or deferred payment terms, at which price it yields about 7¼ per cent in annual dividends.

Redemption Plan Suggested

Seattle Bondholders Co-operate with Mayor in Alleviating Railway's Burdens—Herberg Suit Continues

A plan for the reduction of bond redemption payments on the Seattle Municipal Railway, Seattle, Wash., from $833,000 a year to $500,000 a year by extending the bond redemption period over an additional eight years has been placed before Mayor Bertha K. Landes by A. W. Leonard, president of the Puget Sound Power & Light Company, as the reply of the railway bondholders to the request of the Mayor for co-operation in lightening the railway's financial burdens. Mr. Leonard recently returned from Boston, where he conferred with the board of trustees of the Stone & Webster interests.

As a condition the bondholders insist that the present contract provisions giving priority to the bonds over all other obligations of the railway be fully protected by necessary legislation. The present holders of the purchase bonds ask the city to use good faith in endeavoring to obtain an extension of other outstanding bonds, amounting to approximately $1,650,000, which would mature prior to the Stone & Webster bonds if the latter were extended. If this could not be readily arranged, the purchase bondholders will waive priority as to these bonds, with the understanding that no other bonds junior to them would be issued.

The bondholders, in their plan, also suggest that if they are willing to assist the utility $1,000 a day in deferring annual bond payments, it is only fair to the thousands of railway patrons that the city accelerate the steps it has taken to increase earnings and still further reduce operating expenses.

In this connection it has been estimated that a reduction in power costs would save the railway $200,000 a year. The sale of power to the railway constitutes approximately 9 per cent of the light department's business. Mayor Landes and several of the Councilmen favor the plan as a simple way out of the difficulties of the line.

While the Mayor and the City Council are considering the plan suggested by the Puget Sound Power & Light Company to reduce bond redemption payments on the Seattle Municipal Street Railway, litigation involving the railway in the federal and Superior courts is moving forward. Judge Calvin S. Hall of the Superior Court has ruled that the company will be a defendant in the suit started by J. G. Von Herberg to compel the city to apply all receipts of the railway first to wages of its trainmen before any provision for bond redemption or other obligation be made. Immediately after this ruling, Mr. Von Herberg filed a motion in federal court asking that a complaint the company filed there be dismissed so far as he was made defendant.

The city filed a similar motion in the federal court, asking permission to be withdrawn as a defendant in a suit the company filed on Jan. 13. The power company, in its suit, named both the city and J. G. Von Herberg as defendants, asking that the city officials be restrained from withholding payment of the bond redemption and interest on the railway purchase contract until operating expenses of the line have been paid. The city's motion asks that the company's bill of complaint be dismissed in so far as it refers to the city as a defendant.

Action by Mr. Von Herberg and the city indicates that both want to see the railway litigation settled in the state courts rather than in the United States courts. In his suit in the state courts Mr. Von Herberg sought to have the city enjoined from putting money into the railway purchase bond fund until operating expenses had been paid. The city filed a bill of interpleader asking that the power company be made a defendant.

Good Showing in Milwaukee

Net Income in 1926 Increased by $1,186,867—Financial Structure Improved During Year.

Operating revenues of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., from transportation of passengers, freight and express were $10,937,411 for the year ended Dec. 31, 1926, an increase of 3.03 per cent compared with the year 1925. Operating revenues of the electric and heating departments were $15,282,343, an increase of 14.24 per cent over the previous year. Net income available for dividends was $4,025,699, compared with $2,838,831 in 1925. Net capital expenditures for additions to property and for betterments during the year were $7,409,146, after deducting replacements and property that was withdrawn from service. These facts were disclosed in the annual report to the stockholders.

Expenditures in the railway utility include principally the construction of the new rapid transit line, consisting of new double track on private right-of-way; extension of double track on Center Street in the city of Milwaukee to 60th Street; double tracking Downer Avenue; extension of track on First Avenue; extension of double track on Forest Home Avenue; rebuilding and double tracking Twenty-seventh Street, and double tracking Howell Avenue. Approximately 10½ miles of new track was constructed and added to the system during the year.

Forty new one-man safety passenger cars were purchased and placed in service during the month of December. Twenty new buses were purchased during the year. Four new snow sweepers and other necessary transportation utility equipment were purchased or constructed in the company's shops.

The financial structure of the company was considerably altered and improved during the year. The ratio of funded debt to the total capitalization was 64.6 per cent on Dec. 31, 1925, and was reduced to 54.6 per cent on Dec. 31, 1926. This decrease was accomplished by the sale of additional common and preferred stocks to provide funds for retiring $6,500,000 consolidated first mortgage bonds which matured and were paid on Feb. 1, 1926. The proceeds of the sale of common and preferred stock were also used in part to finance new construction during the year. The total par amount of securities retired was $19,576,500 and the total par amount of securities issued was $22,435,900.

S. B. Way, president, states that the transportation revenues of the company showed some improvement over previous years; the operation of an increased number of one-man safety cars during the non-rush hours and improvements to passenger equipment and rapid transit service should improve the future earnings of the transportation department.

The relations between the employees and the company continue to be satisfactory. The Employees' Mutual Benefit Association has now 6,110 members. The Employees' Mutual Savings Building & Loan Association continues to be a very important factor in establishing homes for employees and their families. Upward of $10,801,960 has been provided members for this purpose since the inception of the association in April, 1914.

STATISTICS OF RAILWAY OPERATION AT MILWAUKEE

	1926	1925
Miles of track owned	429.74	419.28
Miles of track leased	1.90	1.90
Miles of revenue track operated	399.00	391.49
Revenue passengers carried	154,908,620	150,591,216
Transfer passengers carried	54,648,880	53,635,554
Per cent transfer to revenue passenger	35.28	35.61
Receipts per revenue passenger	$0.0677	$0.0677
Number of passenger and express cars owned	912	861
Number of passenger motor buses owned	141	124
Kilowatt system demand	182,868	174,604

INCOME ACCOUNT OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

		1926		1925
Operating revenues		$26,219,754		$23,992,653
Operating expenses:				
Ordinary operating expenses	$15,369,656		$14,415,619	
Depreciation	2,043,191		1,847,077	
Taxes	2,283,191		2,160,755	
Total operating expenses		$19,696,038		$18,423,451
Net operating revenues		$6,523,716		$5,569,202
Non-operating revenues		335,348		357,675
Gross income		$6,859,064		$5,926,877
Interest charges:				
Interest on funded debt	$2,266,754		$2,574,457	
Interest on depreciation reserve balance	521,979		471,814	
Interest on other reserves	44,630		41,772	
Total interest charges		$2,833,363		$3,088,043
Net income		$4,025,698		$2,838,831

Balance in Columbus $1,383,483

According to the report of the secretary and auditor of the Columbus Railway, Power & Light Company, Columbus, Ohio, the net balance of the company in 1926 was $1,383,483, against $672,600 for 1925. These facts were contained in the thirteenth annual report of the board of directors to the stockholders. Cyrus S. Eaton, president, states that the continued healthy growth of the company's business is reflected in the reports submitted.

During the year the company issued $1,857,100 of its first preferred 6 per cent stock. Of this amount $1,500,000 went to the public through its bankers and $357,100 to employees and customers. All stock was sold to the public, employees and customers at par in a customer-ownership campaign conducted by the employees of the company and supplemented by schedules of educational advertising in the Columbus daily newspapers.

The company's policy of carrying out an extensive improvement program was continued. This is evidenced by the fact that total expenses chargeable to property account were $3,670,608. Of this amount $541,550 was used for track and roadway projects and $93,331 for cars and equipment. Railway improvements included new track, reconstructed track, track removal and special work. Rolling stock improvements included the overhauling of 166 cars and the painting of 115 cars. In addition six gas-electric buses were purchased during the latter part of the year and put in crosstown service. During the year 1.84 per cent of the gross receipts was used for claims cost.

INCOME ACCOUNT OF THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY

	1926	1925
Railway operating revenues	$3,409,499	$3,383,966
Power, light & heat operating revenues	5,887,572	5,316,787
Non-operating revenues	33,187	10,236
Total gross revenues	$9,330,259	$8,710,989
Operating expenses	$5,086,958	$4,914,303
Taxes	953,239	912,275
Gross income	$3,290,061	$2,884,410
Deductions from gross income:		
Interest charges	$882,702	$848,577
Other deductions	64,126	66,974
Total deductions	$946,828	$915,552
Net income available for sinking fund, dividends and other financial requirements	$2,343,232	$1,968,858
Deductions from net income:		
Sinking found	$304,587	$319,439
Dividends:		
First preferred stock	329,207	164,794
Series B preferred stock	325,954	361,616
Common stock	.....	450,408
Balance (credit to profit and loss account)	$1,383,483	$672,600

PROFIT AND LOSS ACCOUNT OF THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY

	1926	1925
Balance at beginning of year	$3,603,925	$3,053,726
Credits		
Balance from each year's operations	1,383,483	672,600
Delayed income credits	11,668	15,893
Miscellaneous credits	6,913	.....
Total credits	$5,005,990	$3,742,220
Debits		
Dividends (paid in stock):		
Series A preferred stock	.....	.....
Series B preferred stock	.....	.....
Delayed income debits	$63,227	.....
Miscellaneous debits	28,732	$138,294
Total debits	$91,960	$138,294
Balance at end of year	$4,914,030	$3,603,925

TRAFFIC STATISTICS OF THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY

	1926	1925
Revenue passengers	64,841,596	64,591,271
Transfer passengers	16,573,110	16,420,874
Total passengers	81,414,706	81,012,145
Per cent of transfers to total passengers	20.36	20.27
Revenue per revenue passengers in cents	5.09	5.09
Revenue per passenger including transfers, in cents	4.05	4.06
Car mileage	9,521,782	9,464,862

Springfield Property Passes to New Haven

Control of the Springfield Street Railway, Springfield, Mass., passed to the New York, New Haven & Hartford Railroad at a stockholders' meeting on Feb. 14. Directors were increased from seven to nine. They include E. J. Pearson, E. G. Buckland and A. P. Russell, New Haven; W. E. McGregor, Boston; George Dwight Pratt, Charles W. Bosworth, Clark V. Wood, George B. Bulkley and Henry A. Field, Springfield. The last three were re-elected. President Pearson of the New Haven was made chairman of the board, which immediately ratified the $1,500,000 improvement program. The executive staff of the Springfield Street Railway is unchanged. Clark V. Wood remains as active head. At a reorganization of the Springfield Railways E. J. Pearson was made president. New trustees with him are Messrs Buckland and Russell. C. M. Rogerson and Leverett Candee were re-elected vice-president and treasurer respectively of the Springfield Railways. William Crowe continues as secretary of both the Springfield Street Railway and the Springfield Railways and Bentley W. Warren as general counsel.

Approval Sought for Sale of Coral Gables Road

Approval of the sale of the Coral Gables Rapid Transit Company, Coral Gables, Fla., and all equipment is to be requested before the State Railroad Commission. Petition for the approval is to be filed within the next few days by John M. Murrell, Miami, attorney for the company. The monetary consideration involved was not given. It will be recalled that some time ago a proposal was advanced for the sale of the road to the city, but the information at present at hand about this latest move by the company does not make it plain whether or not the application now made is in furtherance of that plan.

Will Discontinue Line.—The Coast Cities Railway, Asbury Park, N. J., will discontinue its inside belt railway on March 1. The company claims that there is no further public demand for the belt line. The poles and tracks will be removed.

Capital Traction Would Buy Leased Line.—The Capital Traction Company, Washington, D. C., has opened negotiations for the purchase of the Washington & Maryland Railway, which runs from Fourteenth and Kennedy Streets, Washington, to Takoma Park, Md., according to reports received by the Public Utilities Commission. The company has been operating the line for the last ten years under a lease which expires on Feb. 19.

Increase in Capitalization Approved.—At the recent annual meeting of the Wisconsin Public Service Corporation, Green Bay, Wis., approval was voted of the plan recently projected to increase the authorized capital stock of the corporation from $8,500,000 to $20,000,000. Consequently the number of preferred shares will be increased from 55,000 to 125,000 valued at $12,500,000, and common from 30,000 shares to 750,000 shares valued at $7,500,000. The value of common stock at par is reduced from $100 to $10. It is not likely that any considerable amount of the stock will be issued in the near future.

$2,500,000 North Shore Notes Issued.—Halsey, Stuart & Company and the National City Company, New York, are offering for subscription at 99½ and interest, yielding more than 5.65 per cent, $2,500,000 of Chicago, North Shore & Milwaukee three-years 5½ per cent gold notes. The notes are dated Feb. 1, 1927, and interest is payable on Feb. 1 and Aug. 1. They are in the denomination of $1,000, $500 and $100.

Financing of New Rockford Companies Approved.—The Illinois Commerce Commission has authorized the Rockford Public Service Company, Rockford, Ill., to issue bonds to the extent of $1,000,000 against the company's holdings and stock to the amount of $500,000. The Rockford - Belvidere Railroad, recently acquired by the Ellis interests, has been authorized to operate the electric railway between Rockford and Belvidere and to issue $150,000 of stock. The formal approval of these plans completes all details of the financing of the successor companies at Rockford.

New British Columbia Director.—W. G. Murrin has been elected a director of the British Columbia Electric Railway, Vancouver, B. C., Canada. Mr. Murrin is vice-president of the railway.

Valuation of Discontinued Properties Computed.—Electric railway systems of the aggregate value of $591,225, located in Salem and Eugene, Ore., have discontinued operations owing to the failure of the public to support them adequately. The Public Service Commission has also authorized the Willamette Valley Southern Railway to discontinue the operation of 12 miles of railway in the Salem district. The books of the State Tax Commissioner show that the apportioned valuation placed on all these discontinued rail systems is $377,021. This source of state revenue will, necessarily, cease with the dismantling of the carrier lines in question. The Willamette Valley Southern is owned and operated by the Portland Electric Power Company, while the Salem and Eugene systems have been operated by the Southern Pacific Company.

Personal Items

G. R. Green Heads Master Mechanics

Superintendent of South Bend Road Heads Central Equipment Men's Organization

George R. Green, general superintendent of the Chicago, South Bend & Northern Indiana Railway, Michigan City, Ind., and its affiliated lines, the Southern Michigan Railway and the Railway Transit Company, a bus operating organization, has been elected president of the Central Electric Railway Master Mechanics' Association. Few men in mechanical circles in the Central Electric Railway Association's territory are better known than is Mr. Green; few men have had a career more spectacular than he and few have risen through the ranks to greater responsibility.

G. R. Green

Twenty-six years ago Mr. Green started to work at the age of fourteen as an armature winder's helper with the Detroit United Railway. He was not content merely to assist in winding armatures and then to wind them himself. He studied the whys and the wherefores. It did not militate one iota against his upward progress that he remained with the Detroit United property for eighteen years, except for three years between 1909 and 1912, during which time he was master mechanic of the Saginaw & Flint Railway.

At first promotions came slowly and advancement was by small steps, but initiative, persistence and hard work, combined with an interest in the problems of his company outside of his immediate duties, won for him deserved recognition. He finally rose to the position of general foreman of interurban equipment with the Detroit United Railway, but when he did attain that position, few other men in the country were better qualified by experience and training than was he.

In July, 1920, Mr. Green went to South Bend as superintendent of equipment. So thoroughly impressed was the management with the man's ability that when it appeared that railway service might be supplemented with buses, he was selected to study bus operation in other cities. When the new service was decided upon, he was placed in charge of starting the buses and operating them. Next followed his appointment to be general superintendent of the rail lines and buses. He was appointed to this post in March, 1925.

Retirements and Changes in Rockford

A. P. Lewis of Wichita, Kan., has been appointed general superintendent of the Rockford Public Service Company, recently acquired by T. M. Ellis. Mr. Lewis succeeds Archie Andrew, who retires from the post as superintendent of transportation of the old Rockford City Traction Company after 25 years service. Five veteran department heads in executive positions are retired under the new ownership. Besides Mr. Andrew they are Edwin Main, maintenance of way engineer; Shell R. Smith, claim agent; H. D. Hollenbeck, purchasing agent, and Otis R. Hill, superintendent of equipment.

J. D. Whittemore Resigns from Wheeling Company

Joseph Damon Whittemore has resigned as vice-president and general manager of the Monongahela West Penn Public Service Company, Wheeling, W. Va. He became connected with the Wheeling property in July, 1924. Three years prior to that he was associated with W. S. Barstow & Company, New York, as supervising executive of several utility properties in the East. During his residence in Wheeling he had charge of the operations of properties in Wheeling and Morgantown.

Mr. Whittemore is a New Englander by birth. In the time that he was at Wheeling the Monongahela West Penn Public Service Company expanded widely and practically all of the independent properties in northern West Virginia were purchased and amalgamated with the Monongahela West Penn Public Service Company.

Howard R. Whitney has been named operating vice-president of the Worcester Consolidated Street Railway, Worcester, Mass., as the personal representative of President Clark V. Wood to supervise and carry through the program of rehabilitation sponsored by the New York, New Haven & Hartford Railroad. Mr. Whitney is also vice-president of the Springfield Street Railway, but his office there will not be filled for the present. Mr. Whitney is being assisted in his work in Worcester by Henry C. Page, general manager of the Consolidated.

E. F. Kelley Assigned Additional Duties at Louisville

Edward F. Kelley, secretary to President James P. Barnes, Louisville Railway, Louisville, Ky., was recently appointed purchasing agent in addition to his secretarial duties. He succeeds in that capacity C. Edward Earley, to whom less arduous duties have been assigned.

Mr. Kelley is well known in the railway field, not only because of his work assisting Mr. Barnes but also as editor of the *News Service Bulletin*, a bimonthly publication of the Committee on Public Utility Information of the Kentucky Association of Public Utilities. It was his keen knowledge of electric railway affairs of the state and country and his realization of the difficulties confronting the utility companies and their relation to the public which brought him the editorship of the bulletin. In that work he has been constantly improving the understanding between the public and the company. He is also editor of *Trolley Topics*, the house organ distributed by the Louisville Railway among its employees.

E. F. Kelley

Mr. Kelley became associated with Mr. Barnes in 1905. Prior to that he was with the New York Central and thereafter with Mr. Barnes at Syracuse, Utica, Rome, Little Falls, Oneida, Rochester and Schenectady, N. Y. In 1920 he became secretary to Mr. Barnes at Louisville.

In his new work he will have complete charge of the purchase of supplies and materials for all departments of the Louisville Railway, the Louisville & Interurban Railroad and the Kentucky Carriers, Inc., as well as being superintendent of the office building in charge of maintenance of that building.

Besides the offices already mentioned Mr. Kelley is secretary of the Kentucky Association of Public Utilities and secretary and director of the Kentucky Committee on Public Utility Information. He is also secretary of the Louisville Kiwanis Club, which position he has held for the past seven years, and for a while was district secretary of the Kentucky-Tennessee District Kiwanis Clubs.

W. W. Foster Heads New York Interurban

Former Secretary, Treasurer and Manager of Rochester-Buffalo Road Is Made President—Other Changes

William W. Foster, for many years secretary, treasurer and general manager of the Rochester, Lockport & Buffalo Railroad Corporation, Rochester, N. Y., was elected president of the company to succeed E. R. Wood, Toronto, who retired, at a meeting of directors and stockholders in Rochester on Feb. 8.

Joseph D. Nailor was advanced from superintendent of transportation and equipment to general manager and treasurer. Mr. Nailor began his railway career eighteen years ago as a motorman.

Jerry D. Foster becomes secretary of the corporation, but retains his present position as auditor.

Allen S. Muirheid, Toronto, was re-

W. W. Foster

elected vice-president. Herman L. Lang, trainmaster, was promoted to superintendent of transportation and Donald Dewitt was advanced from special agent to general traffic agent. L. D. Harner, general shop foreman, becomes master mechanic.

It was stated at the headquarters of the company in Rochester that Mr. Wood retired to devote his attention to other interests nearer his home in Canada, and that there would be no change in policy or operation as a result of the changes in personnel.

Mr. Foster, the new president, is very well known in New York State, not only for his association with electric railway activities but also for his banking and business affiliations. At the age of sixteen he entered the employ of the First National Bank of Syracuse as a clerk. Two years later he entered the service of Holden & Sons, wholesale coal dealers, as an accountant and cashier. In 1905 he became identified with electric railway interests when he went with the Beebe Syndicate as general auditor and assistant treasurer. This syndicate operated five interurban electric railways, including the Buffalo, Lockport & Rochester Railway, which was taken over in 1911.

In the railway field Mr. Foster seemed to have found his chief interest. In June, 1915, the Buffalo, Lockport & Rochester Railway was segregated from the Beebe Syndicate and at that time he became auditor, secretary and treasurer, moving his offices to Rochester, N. Y. A little more than two years later he was appointed general manager of the company, but still retained the position of secretary-treasurer. In April, 1919, the company was reorganized and the name changed to the Rochester, Lockport & Buffalo Railroad Corporation. Then it was that he was elected a director and appointed to the positions of secretary-treasurer and general manager. In June, 1926, he was elected president of the New York Electric Railway Association. He was born in Syracuse on Jan. 1, 1873.

The road he heads operates 67.9 miles of interurban railway across western New York connecting the important cities of Buffalo and Rochester, through transfer at Lockport, its western terminus. The line in general follows the route of the Barge Canal, serving the communities in the prosperous Lake Ontario fruit belt.

President Ready in New Office

The directors of the Key System Transit Company, Oakland, Cal., at their monthly meeting, held on Dec. 16, formally elected Lester S. Ready to the presidency. He assumed his new duties on Jan. 3, taking complete charge of the entire system. The new president has been chief engineer of the California Railroad Commission. His career has been reviewed before in the ELECTRIC RAILWAY JOURNAL.

Mr. Ready has accepted the presidency of the Key System Transit Company believing that with his thirteen years experience in the observation of public utility operation and in the active work of the regulation of these utilities he can be of material assistance both to the company and the people of the East Bay.

As he sees it, the development of a great metropolitan area such as the East Bay district is dependent upon utility transportation. A large part of the public must rely upon the facilities of the Key System for its means of travel. At the present time the Key System Transit Company is responsible for the safe, convenient and rapid transportation of at least 50 per cent of the traveling public of the East Bay district. Experience of other cities indicates that as the population grows a greater and greater percentage of the public must depend upon street car and bus transportation. Mr. Ready realizes that it is important that the problems of traffic and public transportation be solved correctly.

He has said that the aim and duty of the Key System Transit Company are to render to the rapidly growing East Bay district a good utility transportation service. As an evidence of the company's disposition to do this Mr. Ready recalled that during the last two years and ten months approximately $6,500,000 has been spent to enlarge and improve the facilities of the company that a better service may be rendered. Further improvements will be made as rapidly as it is financially possible.

Convinced that the best service can only be rendered to the community through the whole-hearted co-operation between the company and the public, Mr. Ready has stated for the company that it is ready and willing to co-operate with the public as far as it can and that he will appreciate suggestions from the public. Thus he enters upon his new duties convinced that, in view of the importance of adequate transportation to the development of a community, the problem can be worked out so as to be profitable both to the company and to the public it serves.

C. G. Adsit a West Towns Official

Charles G. Adsit, nationally known as an engineer, has been elected a director of the Chicago & West Towns Railway, Oak Park, Ill. He has long been interested in the affairs of the Georgia Railway & Power Company and is vice-president and executive engineer of that company. Previous to

C. G. Adsit

his affiliation with the company at Atlanta he had extensive engineering experience in the western part of the United States, in South America and in Mexico. His association with the Georgia company actually dates back to 1911, when he became resident engineer on the Tallulah Falls hydroelectric development. Later he was made consulting engineer and chief engineer, and had charge of the development of Mathis dam and reservoir and Burton dam and reservoir and the Tugalo development. On April 1, 1922, he was made executive engineer with authority and jurisdiction over engineering work of all departments. In May of the same year he was made a vice-president of the company.

Ezra Brainerd, Jr., Nominated for I.C.C.

Ezra Brainerd, Jr., Muskogee, Okla., was nominated to be a member of the Interstate Commerce Commission on Feb. 16 by President Coolidge, succeeding Frederick I. Cox of New Jersey, whose reappointment was rejected. This action eliminates Pennsylvania from the contest for the post for which Cyrus E. Woods, backed by Senator Reed of Pennsylvania, was first nom-

inated by President Coolidge. Mr. Brainerd is a lawyer and vice-president of the oldest bank in Oklahoma. He was graduated from Colgate University and the University of Michigan Law School. He is a Republican and was recommended by Senator Harreld.

New Commercial Department Functioning at Youngstown

With the appointment of D. J. Graham as assistant manager of railways of the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, at the opening of the year the ride-selling activities of the Penn-Ohio System have been concentrated in a well-organized commercial department.

In this department will be centered all matters that have to do with checking and developing the service of the various transportation lines and making them have a stronger and stronger appeal to the traveler and to the people of the communities served. Here also will center the development of freight traffic, a branch that has been of steadily increasing value.

Associated with Mr. Graham as his aids in carrying on this work will be:

Charles J. Collins, general freight agent, in charge of the freight service of the system.

Donald S. James, general passenger agent, directly engaged in the duty of developing passenger business.

H. H. Best, supervisor of schedules, in charge of analysis and preparation of schedules of service.

Perry Weller, statistician, who will develop and keep records and checks of service.

The purpose of the commercial department will be to sell more rides through the application of good salesmanship in every department of the service—to build up and develop both freight and passenger business.

Victor Emanuel to Return to Utility Field

Victor Emanuel, former chairman of the National Electric Power Company, is planning to return to the utility field. He resigned as chairman last year, but continued as a director after the company was acquired by Samuel Insull. The National Electric Power Company was founded by Albert Emanuel, father of Victor Emanuel. It was learned recently that Mr. Emanuel had formed in New York State last October the United States Electric Power Corporation, which through a subsidiary, has acquired small utility properties in the State of Washington. The United States Electric Power Corporation has applied for permission to increase its capital from 100,000 shares of no par or nominal value to 800,000 shares.

C. E. Earley, who has been purchasing agent of the Louisville Railway, Louisville, Ky., for the last eight years, has at his own request been transferred to duties less arduous. Mr. Earley has been connected with the company for 35 years. He entered the service when he was only 15 years of age as a trolley boy and worked his way up to the position of purchasing agent.

Obituary

O. C. Macy

O. C. Macy, vice-president of the Chicago, Harvard & Geneva Lake Railway, Walworth, Wis., died recently. Early in his career Mr. Macy had been superintendent of the electric railway lines in Cairo, Ill. In 1908 he became affiliated with the East St. Louis & Suburban Railway in charge of the Alton division. In this work he continued until 1915, when he took charge of the East St. Louis, Columbia & Waterloo Railway. After severing his connection with the latter property he was employed in the automobile sales business for a while and then went to Chicago, where he served as vice-president of the Chicago, Harvard & Geneva Lake Railway. This property connects Harvard and Big Foot, Ill., and Walworth and Fontana, Wis. Late last year Mr. Macy came East on a business trip and became suddenly ill. He was taken to the Mountainside Hospital at Montclair, N. J., where he died of pneumonia.

Albert Bath

Albert Bath, one of the executives of the Detroit Department of Street Railways, died on Jan. 30. At the time of his death and for about two years previous he was division superintendent of the Trumbull-Northwestern belt line of the Municipal system.

Late in 1907 he became night foreman at the Trumbull Avenue carhouse of the Detroit United Railway. He was transferred soon after to the Jefferson carhouse and in May, 1909, was made day foreman of the Fourteenth Street carhouse. His promotion to assistant division superintendent of the Fourteenth and Crosstown lines followed in October, 1909. He was made division superintendent of the Harper-Sherman-Baker lines of the Detroit United Railway in July, 1915, and was transferred to the Trumbull Northwestern belt lines in January, 1925. Mr. Bath was born in Rochester, N. Y., in 1880.

Russell Robb

Russell Robb, senior vice-president and treasurer of Stone & Webster, Inc., died at Phillips House, Boston, on Feb. 15. Mr. Robb was one of the pioneer associates and earlier members of the firm of Stone & Webster and was known throughout the public utility industry as a sagacious leader of its inner councils. Modest and kindly in disposition, he was much beloved by those who came in contact with him.

The development of Stone & Webster's organization from its small beginnings nearly 40 years ago to its present magnitude and influence is, of course, due to no single individual, but as the first partner in this enterprise to enter the firm after Messrs. Stone and Webster, Mr. Robb's share in its upbuilding and his sound influence upon the utility industry cannot be reduced to measurement.

He was born at Dubuque, Iowa, Dec. 6, 1864; was graduated from the Massachusetts Institute of Technology in 1888, being a classmate of Charles A. Stone and Edwin S. Webster, and after two years of engineering service with the Thomson Electric Welding Company at Lynn, Mass., joined the engineering organization of Stone & Webster at Boston in 1891. In 1905 he was made a member of the firm and in 1920 was made senior vice-president and treasurer of the company which succeeded the former organization.

Mr. Robb was an officer and director in a long list of public utilities in the traction, light and power field. In 1896 he was the author of a book on "Electric Wiring," and in 1909-11 he lectured at Harvard University on public utility topics, his "Lectures on Organization" being privately printed in 1909. He was prominent in civic life in his home town of Concord, Mass., and was a member of the American Institute of Electrical Engineers and many other organizations and clubs.

John W. Smith, director of the Indianapolis Street Railway, Indianapolis, Ind., and also of the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind., died recently. He was 67 years old.

Jeston N. Chamberlin, secretary of the Beckwith-Chandler Company, Newark, N. J., died on Feb. 6 at Jefferson Hospital, Philadelphia, Pa., following an operation. Mr. Chamberlin had been connected with the Beckwith-Chandler Company fourteen years as secretary in charge of railroad sales. He was 46 years old.

Louis Lewis, formerly of Richmond, who assisted in building the first electric railway in Richmond, died recently in Philadelphia. At the time of his death he was president of the Central Automatic Sprinkler Company, Philadelphia. Following his work in the railway field, Mr. Lewis designed and built the electric power equipment in many large mills and institutions in the country. He was 78 years old.

Robert W. Seebaum, assistant claim agent for the Cincinnati Street Railway, Cincinnati, Ohio, died at his home in that city on Jan. 11 following a long illness. Mr. Seebaum, had been connected with the claim department of the railway for 23 years. He was graduated from Columbia University and attended the Cincinnati Law School.

Lynn Shaddeau, purchasing agent of the Saginaw Transit Company, Saginaw, Mich., died suddenly on Jan. 18. Mr. Shaddeau had been connected with the Saginaw Transit Company and the Saginaw-Bay City Railway, its predecessor, for twenty years. His death marks the first break in the new organization since its inception three years ago. Mr. Shaddeau was born in Saginaw in 1886.

John S. Moore, general passenger and freight agent of the Chicago, South Bend & Northern Indiana Railway and the Southern Michigan Railway, both of South Bend, Ind., died recently. Mr. Moore had been connected with these companies since 1918. Previous to that time he had been in the freight department of the South Shore Railway and had been employed by the Wabash Railroad in the capacity of station agent at different points on its line.

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

$724,372 Net Profit for Brill

Car Builder Reports Approximately $7,250,000 of Work on Hand Jan. 1, 1927

For the year 1926 the combined output of the J. G. Brill Company's four plants amounted in sales value to $10,416,381.

The combined output for each of the past seven years follows:

1920	$17,537,293
1921	7,647,898
1922	10,177,582
1923	18,167,486
1924	8,721,726
1925	9,101,909
1926	10,416,381

After deducting from earnings all cost of operations, in which are included maintenance and repairs and depreciation for the year amounting to $507,602 and after setting aside out of earnings reserve for federal income taxes, not yet due, of $109,178 the result of the operations of all the plants of the company shows a net profit for the year of $724,372.

The amount of work on hand on Jan. 1, 1927, was approximately $7,250,000, compared with $3,850,000 at the same time last year.

CONSOLIDATED PROFIT AND LOSS AND EARNED SURPLUS ACCOUNTS OF THE J. G. BRILL COMPANY AND SUBSIDIARIES FOR YEAR 1926.

Total net sales billed		$10,416,381
Cost of sales, including operating, selling, administration and general expenses and depreciation for the year, less miscellaneous income		9,582,831
Operating profit		$833,550
Less estimated federal income and state taxes for 1926		109,178
Net profit to earned surplus		$724,372
Earned surplus at Dec. 31, 1925		$4,916,668
Surplus adjustments		
		$4,916,668
Add profit as above		724,372
		$5,641,000
Less dividends paid—		
Preferred	$320,600	
Common	200,425	521,025
Earned surplus at Dec. 31, 1926		$5,120,015

Milwaukee Company Has $5,000,000 Railway Budget

Nearly $5,000,000 will be spent for railway and bus improvements by the Milwaukee Electric Railway & Light Company and five other North American subsidiary companies, according to a recent statement issued by S. B. Way, president of the Milwaukee utility. The entire addition and betterment program will cost approximately $11,449,000. Of this amount $4,492,184 for improvements and additions to the electric railway and bus transportation service in the Milwaukee area. In the territory served by the Wisconsin Gas & Electric Company, operating in Racine, Kenosha, Waukesha, Watertown, Burlington and a score of smaller communities in southeastern Wisconsin, $105,334 will be expended for railway and bus improvements. While in the Appleton district, the Wisconsin Traction, Light, Heat & Power Company is slated to spend $152,314 in improving its railway and bus service.

Montreal Tramways Has $1,000,000 Rolling Stock Program

Fifty new street cars and ten new auto buses to cost approximately $1,000,000 shortly will be added to the equipment of the Montreal Tramways. Although plans for the cars have not been completed, it is understood the order will include 25 double-truck cars of a different design from those now in use on the St. Denis route. Each car will cost $17,000 and delivery is expected in the early fall. Approximately $130,000 is being spent by the company for new auto buses, each bus to cost approximately $15,000. They are being manufactured by the Yellow Truck & Coach Manufacturing Company. Delivery on this order of ten buses has already commenced, five of them having reached Montreal from Chicago last week. The buses have a seating capacity of 34 passengers each as compared with the 29-passenger type now in service. Contract for the cars will be awarded shortly.

De Luxe Car Service for Washington & Baltimore Soon

Ten articulated cars recently ordered by the Washington, Baltimore & Annapolis Railroad are to be placed in service very shortly, according to a recent announcement made public by President J. J. Doyle. It is understood that five of the cars will be in operation by the end of February.

The new rolling stock, for which contracts were awarded the J. G. Brill Company and the Westinghouse Electric & Manufacturing Company, represent an outlay of $500,000. They will be the first of their type chosen for operation by any high-speed interurban line in America. As detailed in the JOURNAL for Jan. 22, page 165, the cars are connected or articulated by a center truck.

The decision to provide a new and exceptionally luxurious type of car for the patrons of the Washington, Baltimore & Annapolis line was made by officials of the company when it was realized that the advent of the beautifully finished and smooth riding buses attracted thousands of electric car riders to the auto coaches. It was then decided to furnish equal riding luxury on the electric cars, which, with traffic over a carefully guarded right-of-way and with rigidly maintained schedules capable of meeting any transportation demands, day or night, would afford the riding public the greatest degree of safety.

Rockford & Interurban to Order Seven New Interurban Cars

From official circles it is learned that the Rockford & Interurban Railway, Rockford, Ill., shortly will place contracts for seven new one-man interurban cars and that it will immediately convert two of its present interurban cars to the one-man type. Plans also call for rebuilding a third car along these lines in the near future. Delivery of the new rolling stock is set for May 1. Thus the information was incorrect which appeared in an article in the JOURNAL for Feb. 5, page 270, in which it was stated that ten cars had already been ordered by the company at a cost of $100,000. Recent advices raise this figure to $160,000 for the seven new cars.

Omaha Company Allots $80,000 for Trackwork

According to the annual forecast of the Omaha & Council Bluffs Street Railway several important improvements are contemplated for the coming year. Among them is the widening of the Q Street viaduct in South Omaha, which has just been ordered by the City Council. The cost of this project is estimated at $200,000, of which the company's proportion, including trackwork, will be about $36,000. Another item is the widening of Twentieth Street between Dodge and Harney Streets. This work is expected to cost in the neighborhood of $25,000 and will involve the realignment of tracks. Another improvement includes the expenditure of $30,700 for the repaving of Sixteenth Street between Farnam and Leavenworth Streets. Paving of Vinton Street between 24th and 25th in Omaha and the resurfacing of Broadway in Council Bluffs between First Street and Franklin Street are other contemplated improvements, for which the company estimates it will spend $15,000.

Giant Electric Engine Goes West for Great Northern

Great Northern Railway, St. Paul, Minn., will soon put into service in the Pacific Northwest a giant two-unit motor-generator electric locomotive recently completed jointly by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company of East Pittsburgh. The locomotive is now being piloted through the Northwest states by T. E. McGettigan and E. R. Randolph, making stops at the principal cities, perhaps going as far as Vancouver, B. C., for exhibition purposes. The locomotive weighs 715,000 lb. and is 94 ft. 4 in. long over all between faces of buffers.

The motive-power will operate on the Great Northern line between Skykomish and the summit of the Cascades on the Everett-Wenatchee division, and later, when the new Cascade tunnel is ready, will haul trains through the 7¾-mile bore.

Orders for Electrical Goods Increase

New orders booked during the fourth quarter of 1926, as reported to the Department of Commerce by 72 manufacturers of electrical goods, were $246,711,426 as compared with $229,423,549 for the third quarter of 1926 and $234,871,751 for the fourth quarter of 1925. The total bookings for 1926 for these concerns were $963,852,642, as compared with $900,985,980 in 1925.

Rolling Stock

Springfield Street Railway, Springfield, Mass., and **Worcester Consolidated Street Railway, Worcester, Mass.,** have completed specifications and will shortly call for bids on approximately 100 new cars of the one-man, two-man type.

Fitchburg & Leominster Street Railway, Fitchburg, Mass., has recently ordered four double-truck safety cars from J. G. Brill Company. The specifications include Brill 117-E trucks.

J. G. Brill Company, Philadelphia, Pa., has received an order for five 50-ft. 6-in. passenger and smoking car motor bodies from the Philadelphia & Western Railway, Philadelphia, Pa. The bodies will be mounted on Brill 27 M.C.B. trucks.

Portland Electric Power Company, Portland, Ore., has received a new six-cylinder Mack bus with street car body for use on the bus line to Marquam Hill.

Phoenix Municipal Railway, Phoenix, Ariz., will purchase a number of new cars if the voters on March 12 approve a program calling for the expenditure of $175,000 in rehabilitating the property.

Fageol Company, Kent, Ohio, reports the delivery of eleven coaches, type DD to the Department of Street Railways, City of Detroit, Mich. All the coaches are equipped with Westinghouse air brakes.

Track and Line

Tidewater Power Company, Wilmington, N. C., owned by the Fitkin interests, will reconstruct its line between Wilmington and Wrightsville Beach, North Carolina, at a cost of approximately $50,000. The project will include the relaying of 32,000 ft. of new and heavier rail. Charles Brooks, general manager railways for the company, has charge of the work, which is scheduled to begin about March 1. Wrightsville Beach is North Carolina's leading ocean resort and the new line will double the service capacity.

Trenton & Mercer County Traction Corporation, Trenton, N. J., will commence shortly the construction of a loop in the Wilbur section of the city, the work having been approved by the Board of Public Utility Commissioners.

Wisconsin Public Service Corporation, Green Bay, Wis., has completed its budget for 1927, which calls for the expenditure of $1,680,000 for improvements and additions to its properties in Wisconsin. To improve its electric railway and bus properties, approximately $625,000 will be spent during 1927.

Tri-City Railway, Davenport, Ia., is installing a new trolley wire on Harrison Street. The wire is being strung from Second Street north to Eighth Street for use of the Vander Veer Park and Gaines Street line. The improvement will cost about $1,000.

Seattle Municipal Street Railway, Seattle, Wash., through its superintendent, D. W. Henderson, is urging the immediate reconstruction of Westlake Avenue car tracks, and has asked the Council utilities committee to make $55,000 available for the work at once. Rails and other materials worth more than $30,000 were purchased three years ago, but the railway fund has never been able to finance the installation. The project extends from Roy to Fulton Street. Mr. Henderson suggests that the $55,000 be appropriated as a loan from the depreciation reserve.

Shops and Buildings

Cincinnati, Hamilton & Dayton Railway, Dayton, Ohio, will erect eight new automatic stations between Dayton and Cincinnati at a total cost of $200,000. This is part of a $1,500,000 rehabilitation program which has just been launched.

Hartford & Springfield Coach Company is removing all steam and electrical equipment from the old power plant at Warehouse Point, Conn., and is installing automatic machinery for rebuilding and repairing buses for its own and other lines. Among the concerns to be served are the Interstate Buses Corporation, Long Island Coach Company and Colonial Coach Company of Newport, R. I. Carl Derr is superintendent of the maintenance operations.

Trade Notes

Rome Wire Company, Rome, N. Y., announces the opening of a new warehouse to serve the Detroit territory. Herman C. Jobs will be in charge of the new service station.

Universal Car Parts Corporation has just been organized in Baltimore, Md., for the purpose of manufacturing and installing car parts and accessories and having as its special product the "Universal joint coupler," of which Joseph M. Saurez is the inventor. The corporation will concentrate its energies and resources on introducing Mr. Saurez's invention, a two-ball coupler designed to take the shortest curves and most abrupt change of grades and lateral inclinations. Offices of the corporation will be at 6 East Mulberry Street, Baltimore, Md.

Tide Water Oil Sales Corporation has secured a yearly contract for gasoline from the Fifth Avenue Coach Company, the Yellow Taxi Cab Corporation, and the Hertz Driv-Ur-Self Sales Corporation. The probable amount of gasoline which will be used by these corporations for the year is between 16,000,000 and 20,000,000 gal.

ELECTRIC RAILWAY MATERIAL PRICES—Feb. 15, 1927

Metals—New York

Copper, electrolytic, cents per lb.	12.435
Lead, cents per lb.	7.425
Nickel, cents per lb.	35.00
Zinc, cents per lb.	7.00
Tin, Straits, cents per lb.	68.625
Aluminum, 98 or 99 per cent, cents per lb.	26.00
Babbitt metal, warehouse, cents per lb.:	
Commercial grade	61.00
General service	31.50

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	$4.825
Somerset mine run, Boston	2.125
Pittsburgh mine run, Pittsburgh	1.85
Franklin, Ill., screenings, Chicago	2.05
Central, Ill., screenings, Chicago	1.875
Kansas screenings, Kansas City	2.50

Track Materials—Pittsburgh

Standard steel rails, gross ton	$43.00
Railroad spikes, drive, ⅝ in. and larger, cents per lb.	2.90
Tie plates (flat type), cents per lb.	2.35
Angle bars, cents per lb.	2.75
Rail bolts and nuts, cents per lb.	4.20
Steel bars, cents per lb.	1.90
Ties, white oak, Chicago, 6 in.x8 in.x8 ft.	$1.45

Hardware—Pittsburgh

Wire nails, base per keg	2.40
Sheet iron (24 gage), cents per lb.	2.80
Sheet iron, galvanized (24 gage), cents per lb.	3.70
Galvanized barbed wire, cents per lb.	3.25
Galvanized wire, ordinary, cents per lb.	2.40

Waste—New York

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

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), cents per lb.	10.80
White lead in oil (100 lb. keg), cents per lb.	14.50
Turpentine (bbl. lots), per gal.	$0.76
Putty, 100 lb. tins, cents per lb.	5.25–5.50

Wire—New York

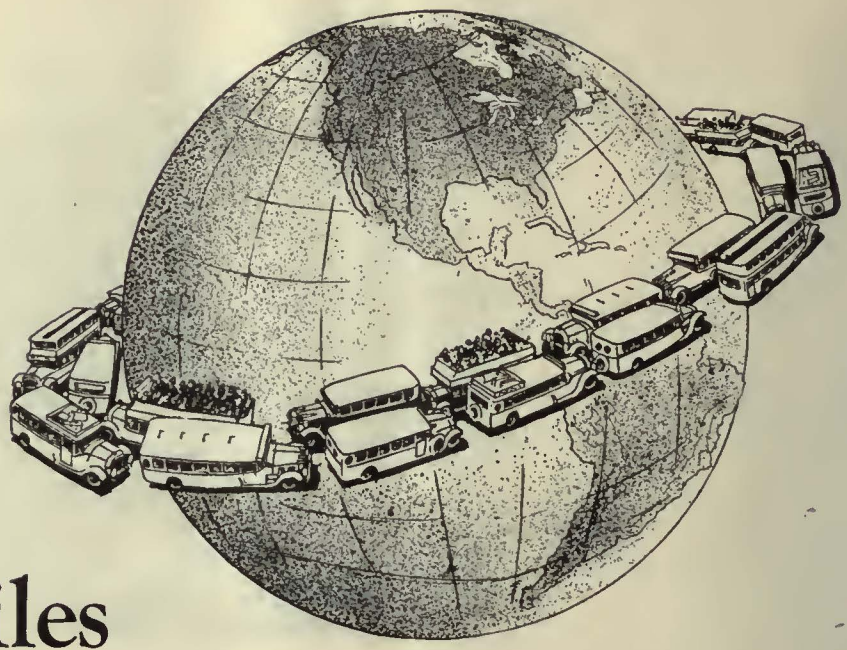
Copper wire, cents per lb.	14.50
Rubber-covered wire, No. 14, per 1,000 ft.	$5.50
Weatherproof wire base, cents per lb.	16.25

Paving Materials

Paving stone, granite, 5 in. New York—Grade 1, per thousand	$142.40
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd.	$2.70
Paving brick 3½x8½x4, N. Y., per 1,000 in carload lots	51.00
Paving brick 3x8½x4 N.Y., per 1,000 in carload lots	45.00
Crushed stone, ½-in., carload lots, N. Y., per cu.yd.	1.94
Cement, Chicago consumers' net prices, without bags	2.05
Gravel, ½-in., cu.yd., f.o.b. N. Y.	1.75
Sand, cu.yd., f.o.b. N. Y.	1.00

Old Metals—New York and Chicago

Heavy copper, cents per lb.	10.50
Light copper, cents per lb.	9.25
Heavy brass, cents per lb.	6.7
Zinc, old scrap, cents per lb.	4.00
Lead, cents per lb. (heavy)	6.00
Steel car axles, Chicago, net ton	$17.25
Cast iron car wheels, Chicago, gross ton	15.25
Rails (short), Chicago, gross ton	16.75
Rails, (relaying), Chicago, gross ton (65 lb. and heavier)	20.00
Machine turnings, Chicago, gross ton	7.25



Over a million miles on Budd-Michelin Dual Wheels ...*without a holdup!*

O. W. Townsend, of the Cornhusker Stage Lines, Hastings, Nebraska, operates 21 buses equipped with Budd Duals. He says:

> *"We have operated these buses in excess of a million miles. We have never experienced a wheel failure nor have we ever replaced a wheel for ANY cause. Our past experience prompts us to continue specifying your equipment."*

That's dependability! And that's why all veteran bus owners *continue to specify* Budd Duals. They *know* what to expect from them.

BUDD
WHEEL COMPANY
Detroit

One of the 100%-Goodyear-equipped motorbus fleet of Chicago and West Towns Railway Company

GOODYEAR

"Gladly recommend them to anyone using tires"

Chicago and West Towns Railway Company operates 22 motorbuses in connection with its electric railway service through the populous and growing communities that border Chicago on the West.

Each bus travels from 61 to 189 miles a day, the usual running fleet of 19 of them covering about 2600 miles a day and carrying more than 9300 passengers.

All of them are equipped with Goodyear Pneumatic Bus Tires.

* * *

"We have records of any number of Goodyears that have gone over 35,000 miles in our service," writes Mr. C. N. Hebner, Secretary of the Company.

"In checking back our records, I find that we have discarded 20 tires that the register shows averaged 36,695 miles.

"I also wish to say that the service we have received from the Goodyear people has been exceptionally good. They have always been ready to co-operate with us so that we would get the proper service out of the tires we were using. I can gladly recommend them to anyone using tires."

* * *

In urban, suburban and highway service of all kinds, Goodyear Pneumatic Bus Tires make records for durability, for cushioning, and for dependable performance at low cost per tire-mile.

Goodyear Tires are made with SUPERTWIST, the extra-elastic, extra-enduring cord fabric developed by Goodyear for Goodyear Tires.

Goodyear Tires, made with the famous All-Weather Tread for tractive power and with SUPERTWIST for great durability, give more in results—yet they cost you no more.

More people ride on Goodyear Tires than on any other kind

BUS TIRES

Made with SUPERTWIST

An investment in good will

Type 900-D

Shown above is the single-end car type. For double-end cars the chair has another arm and a rotating base. Upholstered in leather or fabric, the 900-D has air and spring cushion pads. Can be made with leg support instead of Hollow Steel Base as shown.

With so much competition in travel vehicles, passengers expect and demand comfortable riding facilities. Buses and railway cars can no longer furnish hard unyielding seats and expect to hold their passengers' goodwill.

Each Hale-Kilburn seat is designed primarily for passenger comfort. Seats are more restful, backs are at the proper angle. At the same time they are lighter, stronger and more graceful than ever before.

Passengers appreciate Hale-Kilburn comfort, and the difference shows up in cold cash.

Make sure your lines are H-K equipped. May we send the catalog?

HALE-KILBURN COMPANY

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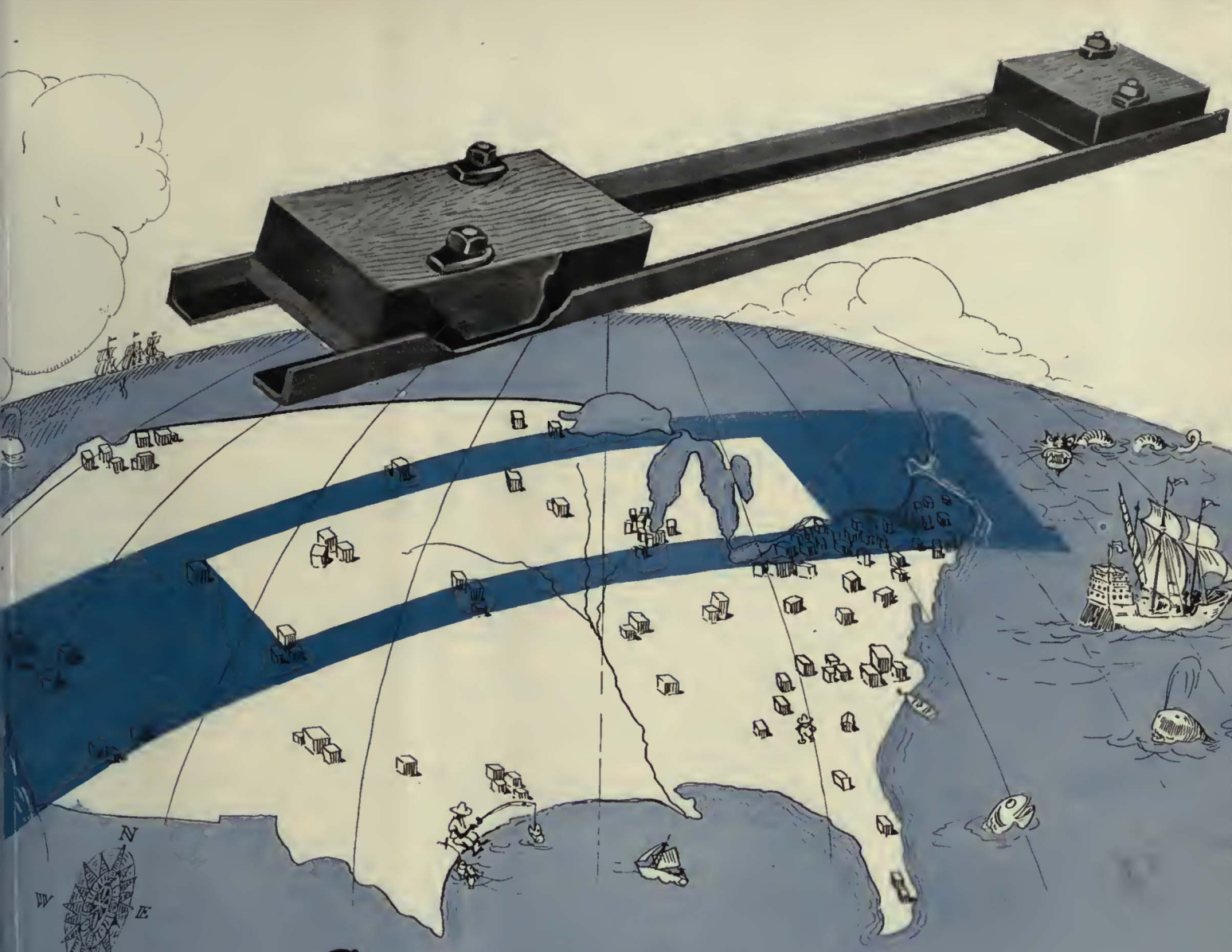
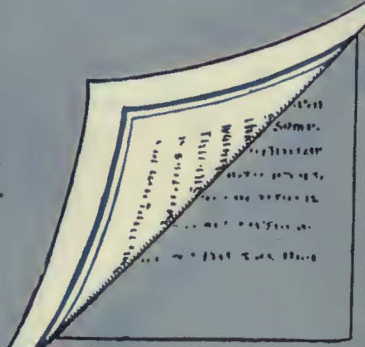
T. C. Coleman & Son, Starks Bldg., Louisville
W. L. Jefferies, Jr., Mutual Bldg., Richmond
W. D. Jenkins, Praetorian Bldg., Dallas, Texas
H. M. Euler, 46 Front St., Portland, Oregon

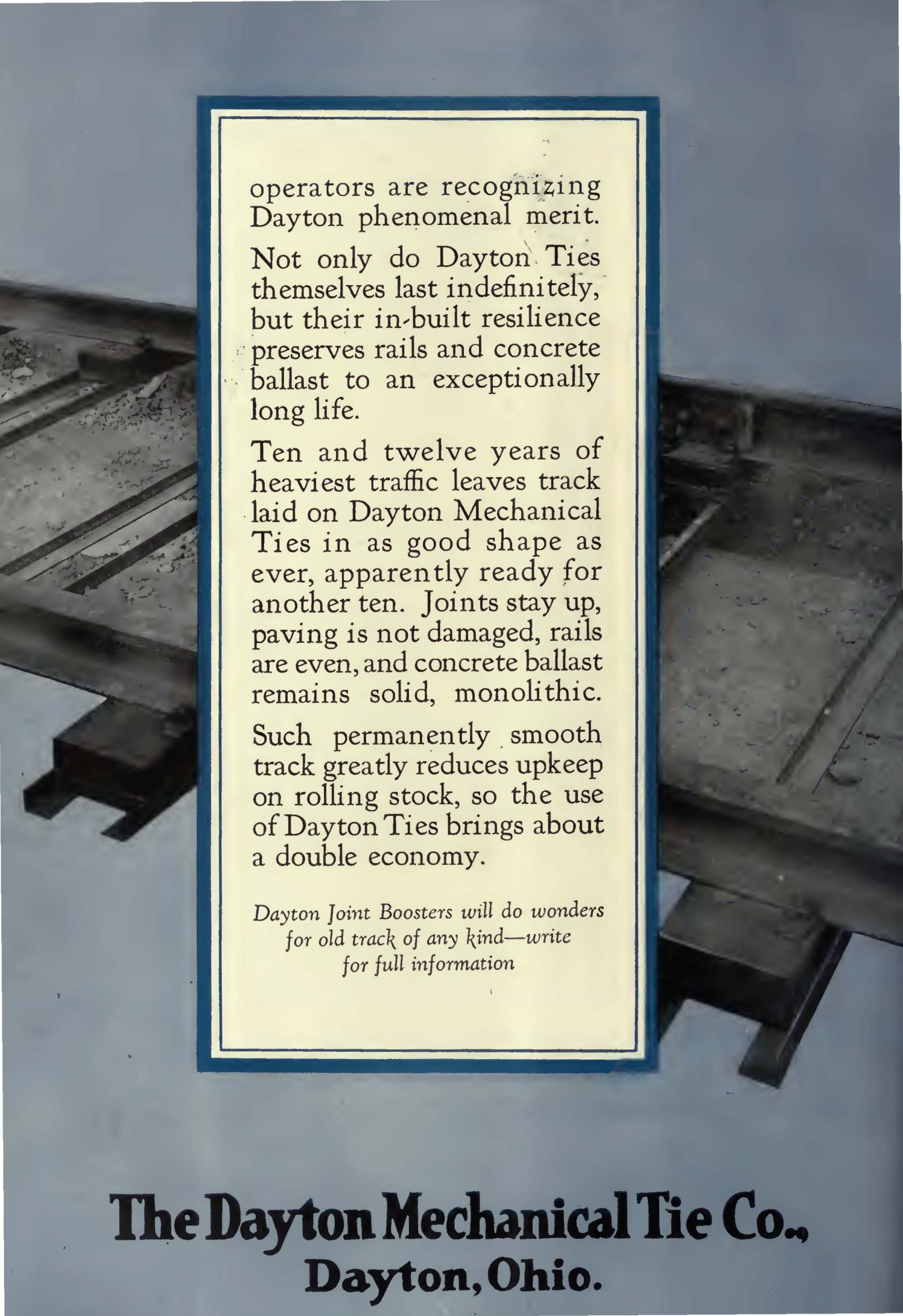
Hale and Kilburn SEATS



Street Railways In 127 Cities Now Use Dayton Mechanical Ties

The 127 cities having installations of Dayton Mechanical Ties are spread not only all over the United States, but into Canada and foreign countries. Everywhere electric railway





operators are recognizing Dayton phenomenal merit.

Not only do Dayton Ties themselves last indefinitely, but their in-built resilience preserves rails and concrete ballast to an exceptionally long life.

Ten and twelve years of heaviest traffic leaves track laid on Dayton Mechanical Ties in as good shape as ever, apparently ready for another ten. Joints stay up, paving is not damaged, rails are even, and concrete ballast remains solid, monolithic.

Such permanently smooth track greatly reduces upkeep on rolling stock, so the use of Dayton Ties brings about a double economy.

Dayton Joint Boosters will do wonders for old track of any kind—write for full information

The Dayton Mechanical Tie Co.,
Dayton, Ohio.

renders a verdict of "Guilty" case of Mr. "Tool Steel" Gear

The Judge Hears the Report of the Jury—

1. A.E.R.A. Equipment Committee—82% are "Tool Steel" gear users.
2. A.E.R.A. Question Box finds "Tool Steel" best.
3. Electric Traction Trophy Winner used "Tool Steel" gears in winning car.
4. Western Canada is unanimous in favor of "Tool Steel" gears.
5. Europe says no other American manufacturer touches "Tool Steel."
6. South America is almost exclusively "Tool Steel."
7. Australia is buying "Tool Steel" heavily for new British made motors.
8. Ohio, the home state is practically unanimous in selecting "Tool Steel."
9. C.E.R.A. Master Mechanic Officers are 82% "Tool Steel" users.
10. Southern Equipment Men praise "Tool Steel" highly.
11. Holland specifies "Tool Steel" gears when buying German motors.
12. A.E.R.A. Equipment Committee Questionnaire answers were from Companies, 88% of whom used "Tool Steel" gears.

The Tool Steel Gear & Pinion Company
Cincinnati, Ohio

Steel" Gear a life sentence of hard continuous service.

STEEL QUALITY
AND PINIONS

COMING - - -

the most complete

Annual MAINTENANCE *Number*

Dated March 19

Ever published by

ELECTRIC RAILWAY JOURNAL

The greatest maintenance year in the electric railway industry is assured.

With the economies and profit making possibilities of new cars firmly established operators all over the country are turning their attention to "Maintenance for the Car Rider."

The appearance of the car, its cleanliness, its smooth uninterrupted operation, the condition of the track, right of way and overhead, all are contributing factors to public good will and increased patronage.

Millions of dollars will be spent this year for shops, for machines, tools and maintenance equipment and supplies.

Electric railway men are looking eagerly for equipment to increase efficiency, they are seeking tools and devices which make transportation service more attractive, they are intensely interested in equipment that will help them render modern transportation service.

They will look for the latest information on the whole range of maintenance work in the Annual Maintenance Number of *Electric Railway Journal.*

For more than a generation this issue has been a handbook of maintenance fact. This year's issue will contain the greatest gathering of vital information under one cover on this important subject ever published.

The editorial pages will focus attention on the most modern practices in shop construction and operation and the most effective policies of track construction and the most reliable methods of line maintenance.

The advertising pages will focus attention on the leading devices, tools, machines and equipment needed in modern maintenance work.

An entire industry needs and wants manufacturers' assistance. Tell them through an issue that reaches the industry when spring plans are being considered.

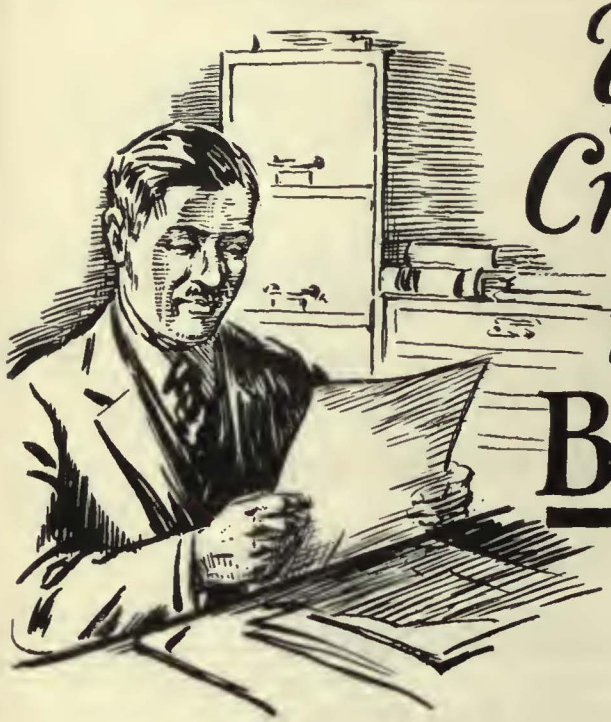
Last forms close March 12

Write or wire your reservation.

ELECTRIC RAILWAY JOURNAL

Tenth Avenue at 36th Street, New York

ANNUAL MAINTENANCE ISSUE



You are your Credit Man When it comes to Buying *Orders*

THE orders you take come under the watchful eye of the credit man.

How about the orders your company places—the orders that you make?

If the reliability of the manufacturer is checked when you sell it should be checked when you buy.

Whether his is a dependable source of purchase is important to learn before—not after his products are in your plant.

What can you expect in the way of prompt and continuous deliveries?

What about quality uniformity?

Has he the ability to finance your orders?

* * *

A reliable aid is here—in this publication. Most of the manufacturers in this issue have been running their advertising in this publication continuously year after year.

They are established. They do not advertise something they cannot deliver. They cannot deliberately exaggerate product merit or institutional service.

Why? Because this publication is A.B.P.—meaning it is a member of the Associated Business Papers. This means, broadly, that this publisher has that basic A.B.P. requirement—integrity.

If a product you need is not advertised in this publication, ask the publisher to direct you to a reliable source.

This publication is a member of

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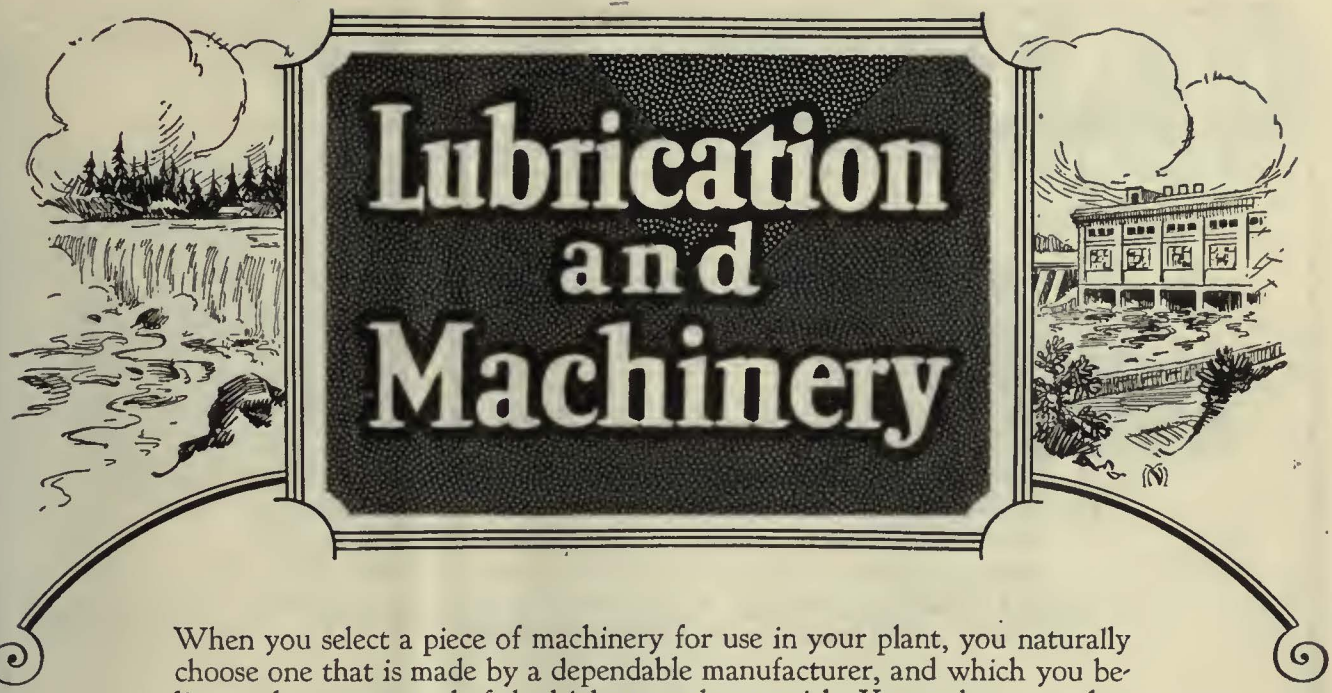

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0170

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TRACK foreman, experienced in track and paving work. Energetic man wanted. Give references and experience in detail. P-968, Electric Railway Journal, Tenth Ave. at 36th St., New York.

POSITIONS WANTED

ADVERTISING and public relations specialist, extensive experience in electric railways, will make preliminary survey if desired. PW-966, Electric Railway Journal, 604 Colo. Bldg., Washington, D. C.

EQUIPMENT engineer and maintenance executive, six years' factory engineering experience and seven years' maintenance work with large railway company, desires change. College graduate with A-1 references. PW-967, Electric Railway Journal, 7 So. Dearborn St., Chicago, Ill.

OPERATING man; capable of taking charge of transportation department of electric railway. Practical experience in each of its branches. Highest references. PW-944, Electric Railway Journal, 7 So. Dearborn St., Chicago, Ill.

SUPERINTENDENT of rolling stock, 24 years' experience, open for position. PW-960, Electric Railway Journal, Tenth Ave. at 36th St., New York.

SUPERINTENDENT of transportation available, broad experience and fine record of achievements on large properties in East and Central West. Recognized as operating official of exceptional ability, successful in public relations, rehabilitation of properties, skilled in handling labor; capable taking over any property and getting results under any condition. High-class references. Correspondence invited and treated confidential. Willing to locate anywhere. PW-949, Electric Railway Journal, Guardian Bldg., Cleveland, Ohio.

TRACK engineer with twenty years' electric railway experience desires change in location. Thoroughly understands modern track and special work design, practice and necessity for economy. PW-969, Electric Railway Journal, 1600 Arch St., Phila., Pa.

UTILITIES executive available. Engineering graduate, broad operating and executive experience, railway, also light and power. Young and progressive with tried and proven ability. Railway activities known to the industry. At present employed; seek opportunity with larger interests. The opportunity for past successful methods to produce relatively greater results. PW-972, Electric Railway Journal, Tenth Ave. at 36th St., New York.

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Christensen Air Brake Co.
Westinghouse Air Brake Co.

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

Armature Shop Tools
Columbia Machine Works & M. I. Co.
Elec. Service Supplies Co.

Automatic Return Switch Stands
Ramapo Ajax Corp.

Automatic Safety Switch Stands
Ramapo Ajax Corp.

Axles
Bemis Car Truck Co.
Bethlehem Steel Co.
Brill Co., The J. G.
Carnegie Steel Co.
Cincinnati Car Co.
Standard Steel Works Co.
Westinghouse E. & M. Co.

Axles, Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Babbitting Devices
Columbia Machine Works & M. J. Co.

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

Bearings
Ahlberg Bearing Co.

Bearings, Anti-Friction
Hyatt Roller Bearing Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
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Cincinnati Car Co.
Columbia Machine Works & M. I. Co.
General Electric Co.
Westinghouse E. & M. Co.

Bearings, Center and Roller Side
Cincinnati Car Co.
Columbia Machine Works & M. I. Co.
Stucki Co., A.

Bearings, Roller
Hyatt Roller Bearing Co.

Bearings, Roller and Ball
Timken Roller-Bearing Co.

Bells & Buzzers
Consolidated Car Heating Co.

Bells and Gongs
Brill Co., The J. G.
Cincinnati Car Co.
Columbia Machine Works & M. I. Co.
Elec. Service Supplies Co.

Bonding Apparatus
Amer. Steel & Wire Co.
Elec. Service Supplies Co.
Ohio Brass Co.
Railway Trackwork Co.
Una Welding & Bonding Co.

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

Book Publishers
McGraw-Hill Book Co.

Braces, Timber
Duff Mfg. Co.

Braces, Trench
Duff Mfg. Co.

Brackets, Hand Rail
Columbia Machine Wks.

Brackets and Cross Arms (See also Poles, Ties, Posts, etc.)
Columbia Machine Works & M. I. Co.
Electric Railway Equipment Co.
Elec. Service Supplies Co.
Hubbard & Co.
Ohio Brass Co.

Brake Adjusters
Brill Co., The J. G.
Cincinnati Car Co.
Westinghouse Tr. Br. Co.

Brake Shoes
American Brake Shoe & Foundry Co.
Bemis Car Truck Co.
Brill Co., The J. G.

Brake Testers
National Railway Appliance Co.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Columbia Machine Works & M. I. Co.
General Electric Co.
National Brake Co.
Westinghouse Traction Brake Co.

Brakes, Magnetic Rail
Cincinnati Car Co.

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

Brushholders
Columbia Machine Works & M. I. Co.

Bulkheads
Haskelite Mfg. Corp.

Bus Lighting
National Railway Appliance Co.

Buses, Motor
Brill Co., The J. G.
Cummings Car & Coach Co.
Studebaker Corp. of Amer.

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

Cables (See Wires and Cables)

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Irvington Varnish & Ins. Co.
Mica Insulator Co.

Carbon Brushes (See Brushes, Carbon)

Car Lighting Fixtures
Elec. Service Supplies Co.

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

Car Steps, Safety
Cincinnati Car Co.

Car Wheels, Rolled Steel
Bethlehem Steel Co.

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

Cars, Gas-Electric
Brill Co., The J. G.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Cars, Gas, Rail
Brill Co., The J. G.

Cars, Passenger, Freight, Express, etc.
Amer. Car Co.
Brill Co., The J. G.
Cincinnati Car Co.
Cummings Car & Coach Co.
Kuhlman Car Co., G. C.
Wason Mfg. Co.

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Electric Equipment Co.

Cars, Self-Propelled
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General Electric Co.

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Columbia Machine Works & M. I. Co.

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American Steel Foundries
Bemis Car Truck Co.
Columbia Machine Works & M. I. Co.
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American Brake Shoe & Fdry.
Bemis Car Truck Co.
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Earll, C. I.
Elec. Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

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Archbold-Brady Co.

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Pantasote Co., Inc.

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Haskelite Mfg. Corp.

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Electric Service Supplies Co.

Change Trays
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Westinghouse E. & M. Co.

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Elec. Service Supplies Co.
General Electric Co.
Hubbard & Co.
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Westinghouse E. & M. Co.

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Cincinnati Car Co.
Ohio Brass Co.

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Columbia Machine Works & M. I. Co.
General Electric Co.
Westinghouse E. & M. Co.

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

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Westinghouse E. & M. Co.

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General Electric Co.
Sullivan Machinery Co.
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Sullivan Machinery Co.

Compressors, Gas
Sullivan Machinery Co.

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

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Dossert & Co.
Westinghouse E. & M. Co.

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Columbia Machine Works & M. I. Co.
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Elec. Service Supplies Co.
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Wm. Wharton, Jr. & Co., Inc.

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Wm. Wharton Jr. & Co., Inc.

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Cincinnati Car Co.
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Drills, Track
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Ohio Brass Co.
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Railway Trackwork Co.

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Star Brass Works

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Heaters, Car, Hot Air and Water
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Irvington Varnish & Ins. Co.

Insulator Pins
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Hubbard & Co.

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Columbia Machine Wks.
Duff Mfg. Co.
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Duff Mfg. Co.

Jacks, Lifting
Duff Mfg. Co.

Jacks, Pipe Forcing
Duff Mfg. Co.

Jacks, Pole
Duff Mfg. Co.

Jacks, Push and Pull
Duff Mfg. Co.

Jacks, Special Purpose
Duff Mfg. Co.

Jacks, Track
Duff Mfg. Co.

Joints, Rail (See Rail Joints)

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

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Elec. Service Sup. Co.
General Electric Co.
Westinghouse E. & M. Co.

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

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Elec. Service Supplies Co.
Nichols-Lintern Co.
Ohio Brass Co.

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Cincinnati Car Co.
Haskelite Mfg. Corp.

Lighting Fixtures, Interior
Electric Service Supplies Co.

Lightning Protection
Electric Service Sup. Co.
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Locking Spring Boxes
Wm. Wharton, Jr. & Co., Inc.

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Cumminga Car & Coach Co.
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St. Louis Car Co.
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Universal Lubricating Co.

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Amer. Insulating Mach. Co.

Manganese Parts
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Manganese Steel Castings
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Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Mica
Mica Insulator Co.

Mirrors, Inside and Outside
Cincinnati Car Co.

Motor Buses (See Buses, Motor)

Motor and Generator Sets
General Electric Co.

Motor Leads
Dossert & Co.

Motors, Electric
General Electric Co.
Westinghouse E. & M. Co.

Motorman's Seats
Brill Co., The J. G.
Cincinnati Car Co.
Electric Service Sup. Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.
Wood Co., Chas. N.

Nuts and Bolts
Bemis Car Truck Co.
Bethlehem Steel Co.
Cincinnati Car Co.
Hubbard & Co.

Oils (See Lubricants)

Omnibuses (See Buses, Motor)

Oxy-Acetylene (See Cutting Apparatus Oxy-Acetylene)

Packing
U. S. Rubber Co.
Westinghouse Traction Brake Co.

Paints and Varnishes (Insulating)
Electric Service Sup. Co.
Irvington Varnish & Ins. Co.
Mica Insulator Co.

Panels, Outside, Inside
Haskelite Mfg. Corp.

Pavement Breakers
Sullivan Machinery Co.

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

Paving Material
American Brake Shoe & Fdry.

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

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

Pinions (See Gears)

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

Pipe Fittings
Standard Steel Works Co.
Westinghouse Tr. Brake Co.

Planers (See Machine Tools)

Plates for Tee Rail Switches
Ramapo Ajax Corp.

Pliers, Rubber Insulated
Electric Service Sup. Co.

Plywood, Roofs, Headlining Floors, Interior Panels, Bulkheads, Truss Planks
Haskelite Mfg. Corp.

Pole Clamps
Clark-Williams Eng. Co.

Pole Line Hardware
Bethlehem Steel Co.
Electric Service Sup. Co.
Ohio Brass Co.

Poles, Metal Street
Electric Railway Equipment Co.
Hubbard & Co.

Pole Mountings
Clark-Williams Eng. Co.

Pole Reinforcing
Hubbard & Co.

Poles, Ties, Posts, Piling and Lumber
Naugle Pole & Tie Co.

Poles, Trolley
Bayonet Trolley Harp Co.
Bell Lumber Co.
Electric Service Sup. Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Electric Railway Equipment Co.
Electric Service Sup. Co.

Portable Grinders
Buda Co.

Potheads
Okonite Co.
Okonite-Callender Cable Co. Inc.

Pressings, Special Steel
Cincinnati Car Co.

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

Pumps, Air Lift
Sullivan Machinery Co.

Pumps, Vacuum
Sullivan Machinery Co.

Punches, Ticket
International Register Co.
Wood Co., Chas. N.

Rail Braces and Fastenings
Ramapo Ajax Corp.

Rail Grinders (See Grinders)

Rail Joints
Carnegie Steel Co.

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

Rails, Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Rail Welding
Metal & Thermit Corp.
Railway Trackwork Co.
Una Welding & Bonding Co.

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

Rattan
Brill Co., The J. G.
Cumminga Car & Coach Co.
Electric Service Sup. Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Registers and Fittings
Brill Co., The J. G.
Cincinnati Car Co.
Electric Service Sup. Co.
International Register Co.

Reinforcement, Concrete
Amer. Steel & Wire Co.
Bethlehem Steel Co.
Carnegie Steel Co.

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

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

Replacers, Car
Cincinnati Car Co.
Electric Service Sup. Co.

Resistances
Consolidated Car Heating Co.

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

Retrievers, Trolley (See Catchers and Retrievers, Trolley)

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

Roller Bearings
Hyatt Roller Bearing Co.

Roofing, Car
Haskelite Mfg. Corp.
Pantasote Co., Inc.

Roofs, Car & Bus
Haskelite Mfg. Corp.

Rubber Specialties of All Kinds
U. S. Rubber Co.

Sanders, Track
Brill Co., The J. G.
Electric Service Sup. Co.
Ohio Brass Co.

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

Sash, Metal, Car Window
Hale-Kilburn Co.

Scrapers, Track (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Electric Service Sup. Co.

Seating Materials
Brill Co., J. G.
Hale-Kilburn Co.
Haskelite Mfg. Corp
Heywood-Wakefield Co.
Pantasote Co., Inc.

Seats, Bus
Brill Co., The J. G.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Seats, Car (See also Rattan)
Brill Co., The J. G.
Cincinnati Car Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Second Hand Equipment
Eastern Mass. Str. Ry. Co.
Electric Equipment Co.
Hyman Michaels Co.
Salzburg Co., Inc., H. E.
Van Loan Corp., Irving S.

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

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

Shovels, Power
Brill Co., The J. G.

Side Bearings (See Bearings Center and Side

Signals, Car Starting
Consolidated Car Heating Co.
Electric Service Sup. Co.
National Pneumatic Co., Inc.

Signal Systems, Block
Electric Service Sup. Co.
Nachod & U. S. Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod & U. S. Signal Co.

Signals, Warning
American Stromboa Co.

Slack Adjusters (See Brake Adjusters)

Slag
Carnegie Steel Co.

Sleet Wheels and Cutters
Bayonet Trolley Harp Co.
Cincinnati Car Co.
Columbia Machine Works & M. I. Co.
Electric Railway Equipment Co.
Electric Service Sup. Co.
Nuttall Co., R. D.

Snow Plows
National Railway Appliance Co.

Snow-Plows, Sweepers and Brooms
Brill Co., The J. G.
Columbia Machine Works & M. I. Co.
Consolidated Car Fender Co.
Cummings Car & Coach Co.

Snow Sweeper, Rattan
J. G. Brill Co.
Heywood-Wakefield Co.

Soldering and Brazing Apparatus (See Welding Processes and Apparatus)

Spacer, Tie
Duff Mfg. Co.

Special Adhesive Papers
Irvington Varnish & Ins. Co.

Special Trackwork
Bethlehem Steel Co.
Lorain Steel Co.
Wm. Wharton, Jr. & Co., Inc.

Spikes
Amer. Steel & Wire Co.
Illinois Steel Co.

Splicing Compounds
U. S. Rubber Co.
Westinghouse E. & M. Co.

Splicing Sleeves (See Clamps and Connectors)

Springs
National Railway Appliance Co.

Springs, Car and Truck
American Spiral Spring Co.
American Steel Foundries
Amer. Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Standard Steel Works Co.

Sprinklers, Track and Road
Brill Co., The J. G.
Cummings Car & Coach Co.

Steel and Steel Products
American Steel & Wire Co.
Carnegie Steel Co.
Illinois Steel Co

Steps, Car
Brill Co., The J. G.
Cincinnati Car Co.

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

Storage Batteries (See Batteries, Storage)

Strain, Insulators
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Strand
American Steel & Wire Co.
Roebling's Sons Co., J. A.

Street Cars (See Cars, Passenger, Freight, Express, etc.)

Superheaters
Babcock & Wilcox Co.

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

Switch Stands and Fixtures
Ramapo Ajax Corp.

Switches and Switchboards
Consolidated Car Heating Co.
Electric Service Sup. Co.
General Electric Co.
Westinghouse E. & M. Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track (See Track Special Work)

Tampers, Tie
Railway Trackwork Co.

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

Tee Rail Special Track Work
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co. Inc.

Telephones and Parts
Electric Service Sup. Co.
Telephone & Telegraph Wire
American Steel & Wire Co

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

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

Ticket Choppers & Destroyers
Electric Service Sup. Co.

Ties, Mechanical
Dayton Mechanical Tie Co.

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

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

Tires
General Tire & Rubber Co.
Goodrich Rubber Co., B. F.
Goodyear Tire & Rubber Co.

Tongue Switches
Wm. Wharton, Jr. & Co., Inc.

Tool Steel
Bethlehem Steel Co.
Carnegie Steel Co.

Tools, Track & Miscellaneous
Amer. Steel & Wire Co.
Columbia Machine Works & M. I. Co.
Electric Service Sup. Co.
Hubbard & Co.
Railway Trackwork Co.

Torches, Acetylene (See Cutting Apparatus)

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

Tower Wagons and Auto Trucks
MacCardell & Co., J. R.

Track Expansion Joints
Wm. Wharton, Jr. & Co., Inc.

Track Grinders
Metal & Thermit Corp.
Railway Trackwork Co.
Ramapo Ajax Corp.
Una Welding & Bonding Co.

Track, Special Work
Bethlehem Steel Co.
Columbia Machine Works & M. I. Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co., Inc.

Trackless Trolley Cars
Brill Co., The J. G.

Transfers (See Tickets)

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

Treads Safety Stair Car Step
Cincinnati Car Co.

Tree. Wire
Okonite Co.
Okonite-Callender Cable Co.

Trolley Bases
General Electric Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
General Electric Co.
Nuttall Co., R. D.
Ohio Brass Co.

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

Trolley Material (Overhead)
Electric Service Sup. Co.
Ohio Brass Co.
Westinghouse E. & M. Co.

Trolley Shoe
Miller Trolley Shoe Co.

Trolley Wheel Bushings
Star Brass Works

Trolley Wheels (See Wheels, Trolley)

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

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

Trucks, Car
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Cummings Car & Coach Co.

Truss Planks
Haskelite Mfg. Corp.

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

Turbines, Steam
General Electric Co.
Westinghouse E. & M. Co.

Turnstiles
Electric Service Sup. Co.
Perey Mfg. Co., Inc.

Turntables
Electric Service Supplies Co.

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

Varnished Papers and Silks
Irvington Varnish & Ins. Co.

Ventilators, Car
Brill Co., The J. G.
Cincinnati Car Co.
Consolidated Car Heating Co.
Nichols-Lintern Co.
Railway Utility Co.

Vestibule Linings
Haskelite Mfg. Corp.

Welded Rail Joints
Lorain Steel Co., The
Metal & Thermit Corp.
Ohio Brass Co.
Railway Trackwork Co.
Una Welding & Bonding Co.

Welders, Portable Electric
Metal & Thermit Corp.
Ohio Brass Co.
Railway Trackwork Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Welders, Rail Joint
Ohio Brass Co.
Railway Trackwork Co.

Welding Processes and Apparatus
General Electric Co.
Metal & Thermit Corp.
Ohio Brass Co.
Railway Trackwork Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Welding Steel
Railway Trackwork Co.
Una Welding & Bonding Co.

Welding Wire
American Steel & Wire Co.
General Electric Co.
Railway Trackwork Co.
Roebling's Sons Co., J. A.

Welding Wire and Rods
Railway Trackwork Co.

Wheel Guards (See Fenders and Wheel Guards)

Wheel Presses (See Machine Tools)

Wheels, Car Steel & Steel Tire
American Steel Foundries
Bemis Car Truck Co.
Carnegie Steel Co.
Standard Steel Works Co.

Wheels, Steel Disc
Budd Wheel Co.

Wheels, Trolley
Bayonet Trolley Harp Co.
Columbia Machine Works & M. I. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Nuttall Co., R. D.
Star Brass Works

Wheels, Wrought Steel
Carnegie Steel Co.

Whistles, Air
General Electric Co.
Ohio Brass Co.
Westinghouse E. & M. Co.
Westinghouse Traction Brake Co.

Window Guards & Fittings
Cincinnati Car Co.

Wire Rope
Amer. Steel & Wire Co.
Roebling's Sons Co., J. A.

Wires and Cables
Acme Wire Co.
American Brass Co.
Amer. Electrical Works
Amer. Steel & Wire Co.
Anaconda Copper Min. Co.
Bridgeport Brass Co.
General Electric Co.
Okonite Co.
Okonite-Callender Cable Co.
Roebling's Sons Co., J. A.
Westinghouse E. & M. Co.

There's no better "foundation" for Modern Cars—

Williamsport's new cars mounted on latest type of Brill truck.

Superlatively good riding action and general truck efficiency are recognized as essential to present-day light-weight cars. To this undeniable fact is attributed much of the popularity of the Brill light-weight solid-forged side-frame truck No. 177-E, and the particularly large percentage of new cars for which it is specified.

The 177-E truck is a development from the well-known 77-E type, the motors being mounted inside between the axles, and possesses all the essential features of this particularly successful truck. Our bulletin No. 306 describes it. May we send you a copy?

Brill 177-E Truck

Specially designed light-weight solid-forged sideframes insure durability and minimum maintenance, while such patented Brill features as Graduated Spring System, Bolster Guide, Half-ball Brake Hanger, oil-retaining center bearing and Twin Links contribute to its superlatively good riding action and general efficiency.

THE J. G. BRILL COMPANY
PHILADELPHIA, PA.
AMERICAN CAR CO. ST. LOUIS MO. — G.C. KUHLMAN CAR CO. CLEVELAND, OHIO. — WASON MANF'G CO. SPRINGFIELD, MASS