ANNUAL MAINTENANCE AND CONSTRUCTION NUMBER

ELECTRIC RAILWAY JOURNAL

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576,000

MILES —*without rewinding*— *farther than a round trip to the moon or 24 trips around the world.*

In an unsolicited letter from Mr. A. T. Clark, Superintendent of Rolling Stock and Shops of the United Railways & Electric Company, he states:

"In passing through our shops the other day my attention was drawn to a Westinghouse 101-B armature in for certain repairs. Upon making closer investigation we found it had the factory winding on it. We, therefore, became interested in learning something of its history and find that since 1904, when it was first purchased, down to date it has gone over 576,000 miles without a rewinding, really a very wonderful record"

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Electric Railway Journal

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THE MAY NUMBER of ELECTRIC RAILWAY JOURNAL will contain an industry wide study of the results obtained from new cars, and an article by a nationally known engineer who has made a broad analysis of traffic signals. These are typical of the class of articles you may expect to find regularly in the new monthly Journal. Take our tip—don't miss the May number.

NEXT WEEK the first issue of *Electric Railway Journal News* will be mailed on April 6 to all present subscribers of ELECTRIC RAILWAY JOURNAL. Subsequent issues of the weekly *News* will be mailed only to those who have indicated their desire to have their subscriptions applied to include the weekly as well as the monthly publication.

Advertising Index—Alphabetical, 138-139; Searchlight, 134-135-136-137

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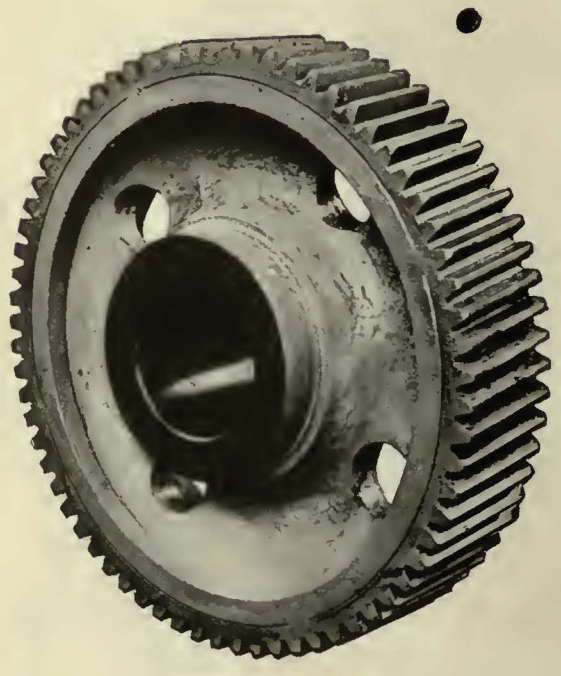

In addition to these silencing qualities, Westinghouse-Nuttall has developed a device which eliminates the high-pitched ringing sound characteristic of all metallic gears. This consists of a wrought iron ring built rigidly into the rim on each side of the gear, with a non-metallic layer interposed between the rings and gear rim. This is the exclusive Westinghouse-Nuttall method of eliminating noise from these gears.

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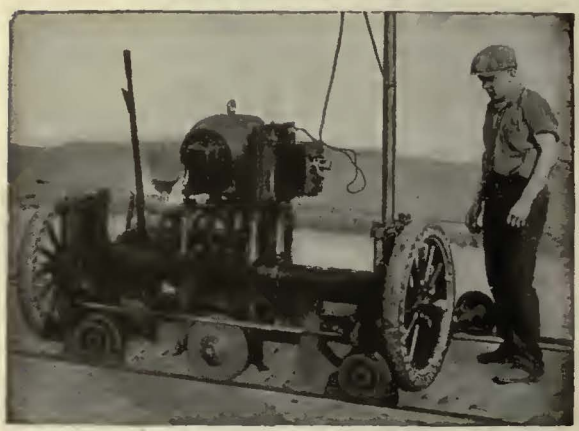
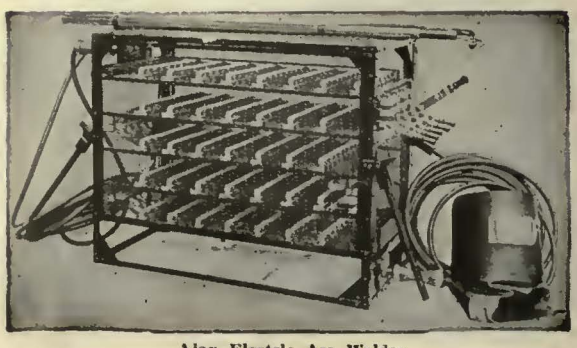


Imperial Track Grinder



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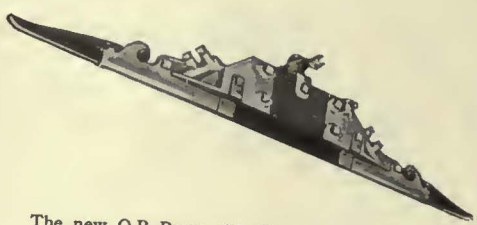
The Marathon Ear, the outstanding trolley ear of the industry. Page 534, O-B Catalog No. 20.

The O-B Type C Splicer provides unusual wheel clearance. Wire enters in straight line, no forming being necessary. Page 542, O-B Catalog No. 20

The O-B Duplex Frog, which permits pan renewal without removal of span or trolley wires. Page 30, Supp. No. 2 to O-B Catalog No. 20.



The new O-B Renewable Underrun Section Insulator, which permits replacement of entire underrun without removing span or trolley wires. Page 26, Supp. No. 2 to Catalog No. 20.

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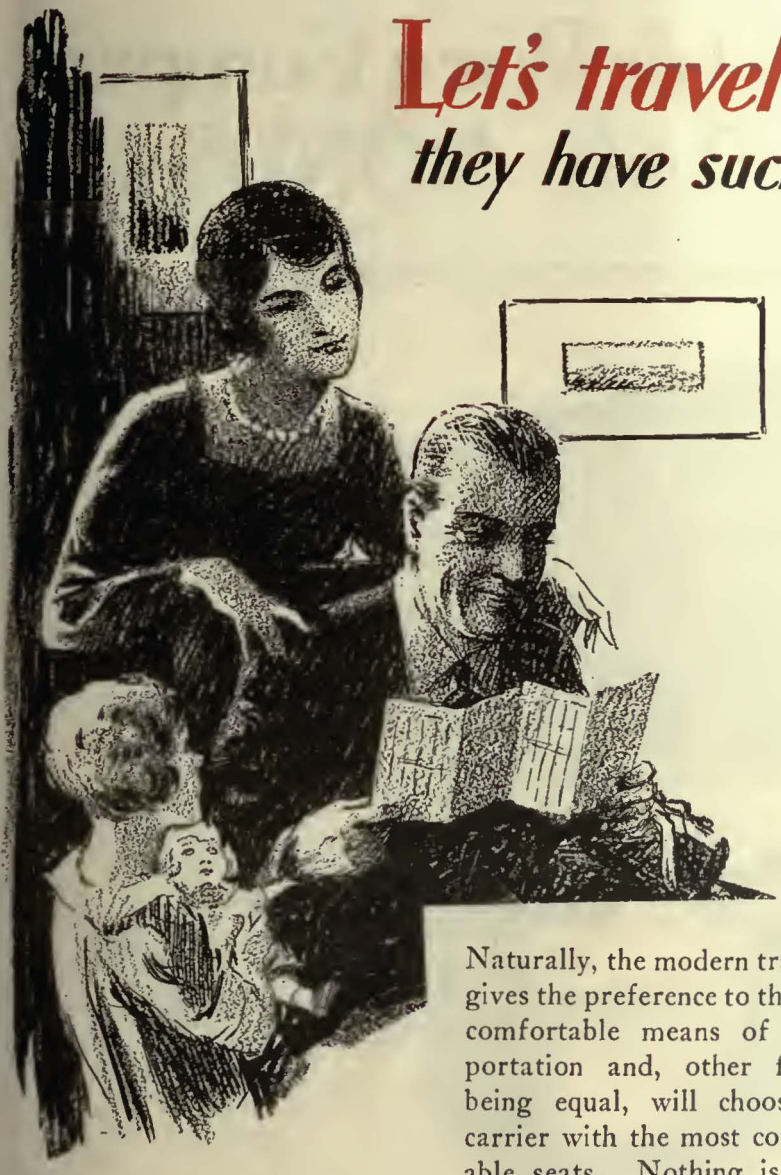

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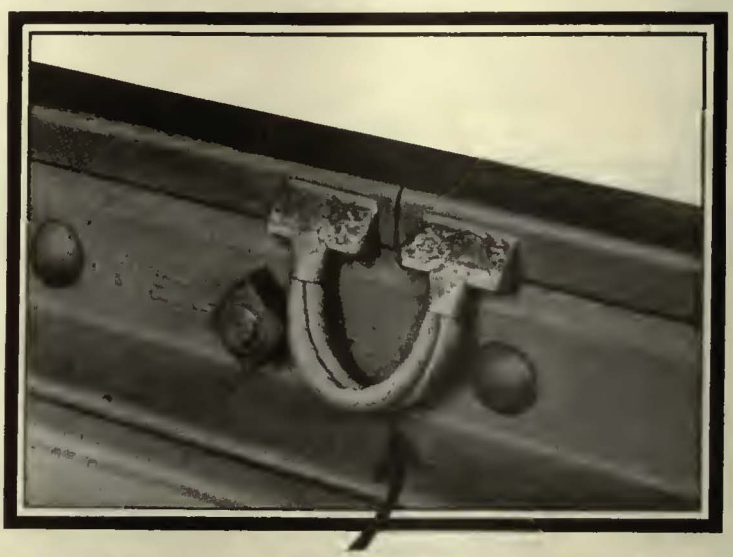

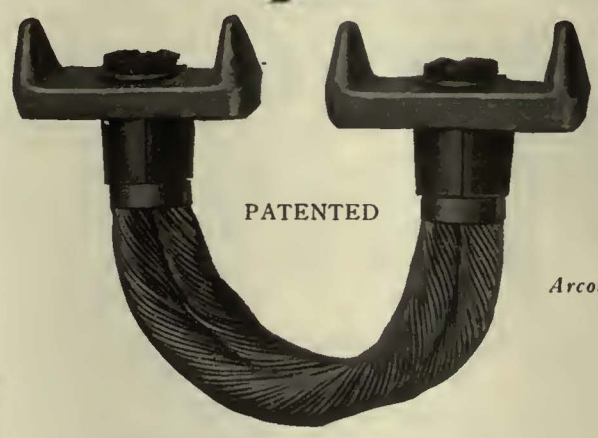

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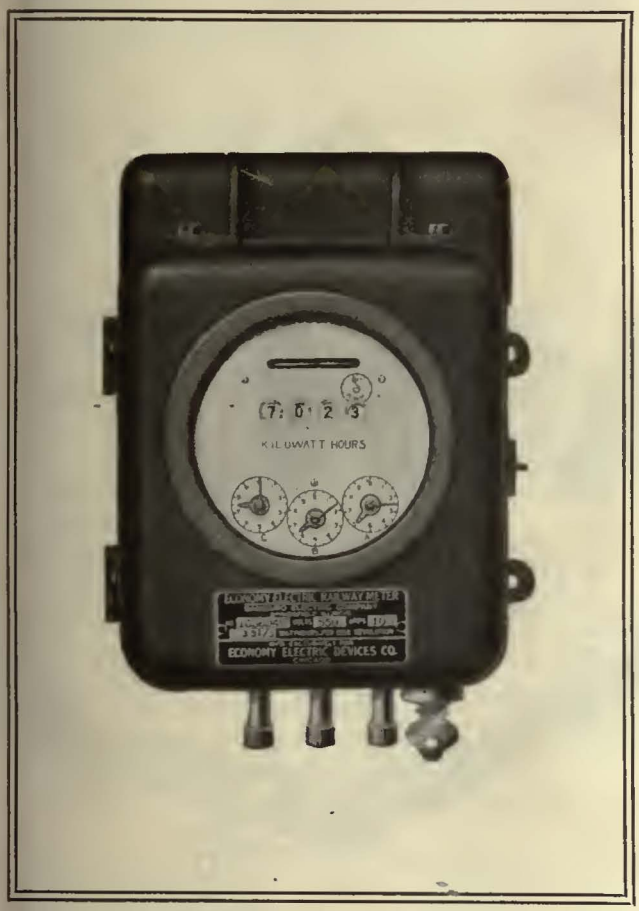

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ORDERS COMPLETE EQUIPMENT ECONOMY METERS WITH CAR INSPECTION DIALS

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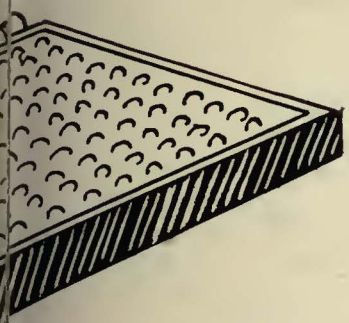

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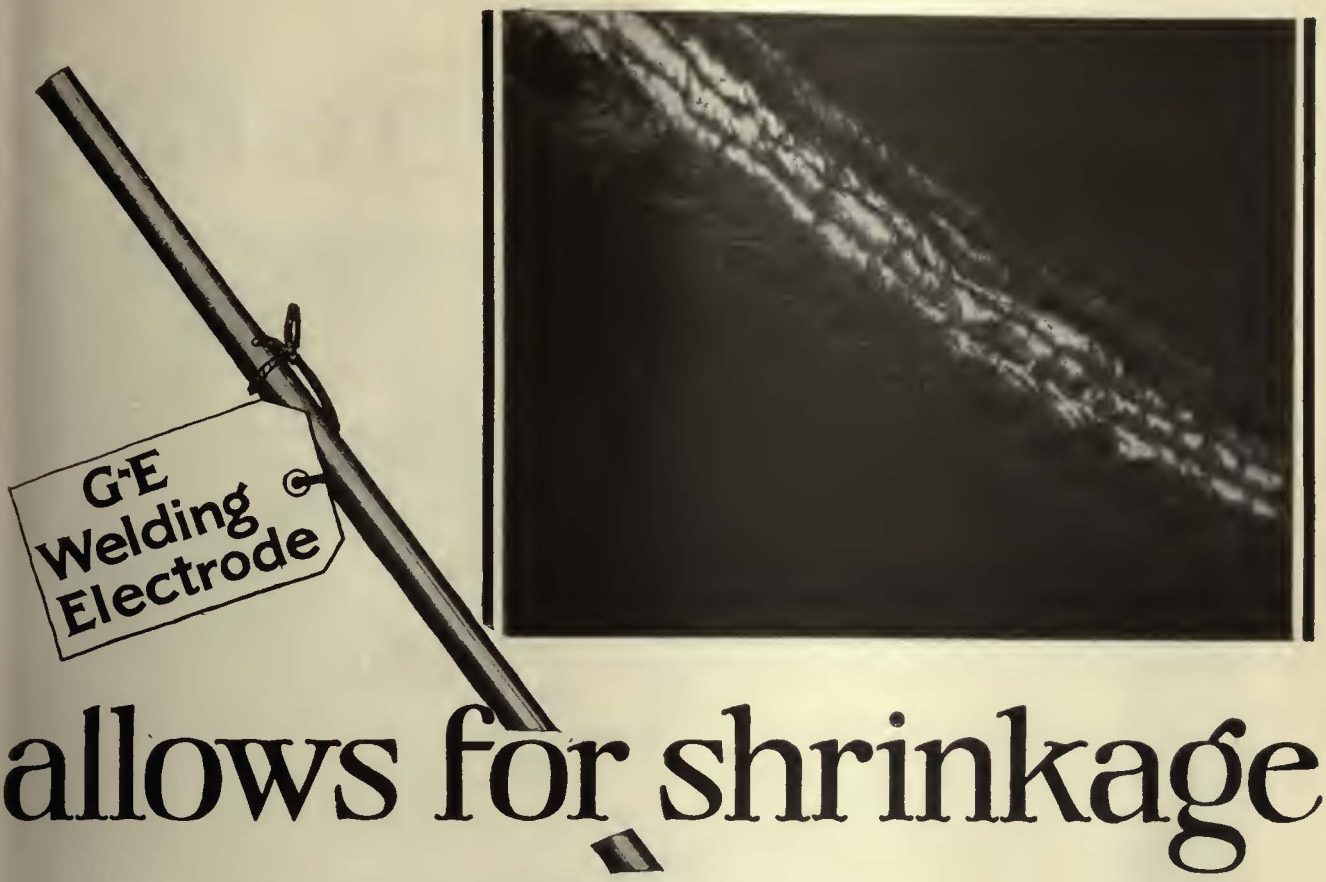
Firestone Dealers can save you money and serve you better

Firestone

Gum-Dipped Truck and Bus Tires



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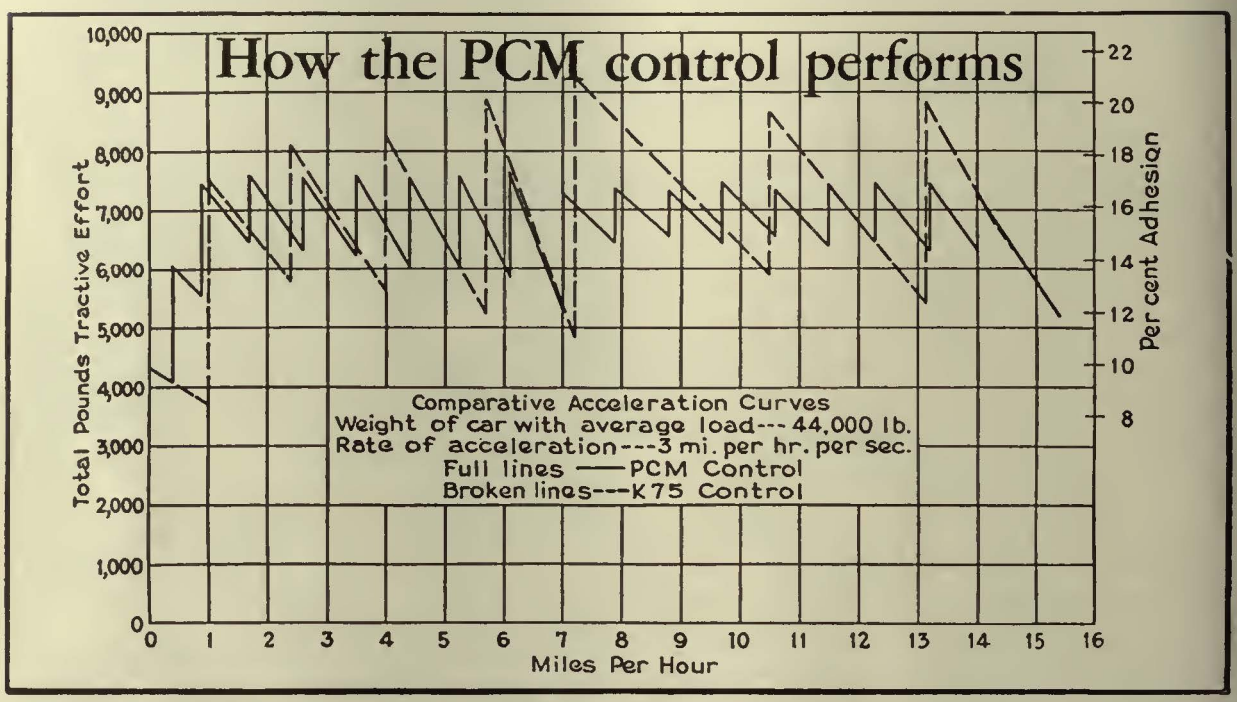

IF fast schedules are to be maintained, the cars must keep ahead of traffic at the "go" signal. The necessary fast acceleration, at least 3 mi. per hr. per sec., is practical only if it is smooth—free from jerking and jolting.

The new PCM control is used for just this service. Its eighteen points give the car a rapid acceleration with a smoothness not heretofore attained. Automatically operated, it does not require a skillful operator, since sliding over points is impossible.

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Electric Railway Journal

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Volume 73 New York, April, 1929 *Number 13*

Leadership Requires Perspective

UNDER the pressure of daily activities, there is always danger that attention may become so focused upon routine details as to lose sight of major objectives; that the distinction between the means and the end may become obscured. An enterprise which loses sight of its primary objectives is like a ship without a pilot. So also is an industry which fails to establish a chart of sound principles by which to judge whether it is moving ahead on a definite course or merely drifting with currents of opinion and the tide of circumstances. Of course, even without policies established or principles determined, circumstances and exterior forces may combine to bring about considerable success when results are measured only in immediate profits. But without adequate soundings to guide them through dangerous channels, and without the vision of capable leadership, many businesses have all too soon found themselves upon the shoals of economic desperation.

THERE is more group thinking in business today than ever before, and never has there been keener appreciation of the importance of leadership. In the local transportation industry, growing realization of this need has been manifested during recent months by a persistent demand for a better understanding of fundamentals. There is less inclination today to drift with the tide of events than at any time in the past decade. There is less readiness to be guided by opinion or to be satisfied with expedients which promise only temporary relief. There is a growing demand for a clearer understanding of transportation economics. An effort is being made to develop a clearer understanding of the economic interrelation between transportation and the community itself.

Experience has indicated that the huge costs of rapid transit facilities cannot be carried by operating revenues at any reasonable rate of fare, if service is to be maintained at modern standards of comfort and convenience. Furthermore, transportation men are beginning to understand that it is not alone sufficient that rapid transit construction costs be borne by the community. The method of financing is equally important. Most of those who have given the matter intensive study have become convinced that property values created by transit construction should supply the funds for the structure and right-of-way, for after all a new transit line is merely a special form of street or highway. If this principle applies to rapid transit why should it not likewise apply to rail lines laid in the street itself for public transportation? When some of these fundamentals are considered, there are presented new fields of research and study that indicate how little, after all, is known of the fundamentals of this business which plays so important a part in the life of the modern community.

BUT the need for more fundamental thinking in the industry is not limited alone to broad questions of management and economics. It is important likewise that each principal department maintain its own perspective and sense of proportion. Whether the direct responsibility be operation or maintenance; and whether the latter be the maintenance of equipment or track or buses or electrical system, the distinction between problems of daily routine and broad problems of departmental policy is important. The department head who, though he be ever so capable a technician, loses sight of the broader objectives of the industry, and of the relation between his own work and that of associated departments, is headed toward ultimate difficulty.

This issue of Electric Railway Journal indicates in a striking way the fact that electric railway maintenance executives are alert to the needs of the times and are themselves engaged in critical analysis of methods and previously accepted precedents. In all four departments of electric railway maintenance—track, equipment, distribution system and buses—current practices and methods are being examined with a critical eye. There is a demand for performance and efficiency transcending former accepted standards. There is a frankness in discussion, a freedom in the interchange of information between properties and an open-minded attitude toward the other man's methods, that promises accelerated improvement and progress.

A GREATER tendency exists today than for many years in the past to emphasize the objectives as well as the methods of maintenance. This has resulted in a radically changed concept of the maintenance departments' work. The old idea of repair after failure is being superseded by the modern policy of preventive maintenance. This has been proved to be good business not only from the standpoint of avoiding service interruptions, but from the standpoint of economy as well. The rapid progress that has been made on many properties toward this modern concept indicates that the alert maintenance executive is maintaining his perspective, thereby proving his right to leadership.

Maintenance Achievement Worthy of Emulation

HAD anyone said ten years ago that it would be possible to keep street cars in service for more than 20,000 miles without a pull-in he would have been considered a dreamer. And had he asserted that this could be done not once, but kept up for six years as the average on four leading properties, it would have been considered preposterous. Then add that while making such a record the railways participating would save $2,000,000 in the maintenance of equipment, and he would have been branded a fool.

Yet this is the record achieved by member companies of the Electric Railway Association of Equipment Men, Southern Properties. The association, formed more than six years ago, has had as its object the improvement of performance and the reduction of costs. That it has been successful in this is proved by the figures quoted. It is the more remarkable that the record was made in a period when costs of labor were rising and prices of materials remaining at or near the post-war maximum.

There are other properties that have made comparable improvements in keeping equipment in service and in reducing maintenance costs. But the work of this association is remarkable in that these results have been achieved not by one company alone, but by a group of properties in a widely scattered territory. The accomplishment is worthy of the highest praise. And what is more, it is worthy of emulation the country over.

Chromium Plating Has Many Uses

NEW uses of chromium plating merit careful investigation by electric railways. The most extensive present application is its use instead of nickel for the finish of radiators, headlights, and other exterior fittings of automobiles. In this field it is proving of advantage particularly for its freedom from tarnish. Following along this line it should prove of advantage for the finish of car fittings such as grab handles, stanchions, window catches, window guards, etc.

But in addition to its use as a decorative finish, the great hardness and wear-resistant properties of chromium are leading to its use for finishing surfaces that are subject to wear. Its principal mechanical application so far has been on measuring devices, such as plug gages; snap gages; drawing, stamping and forming dies; jig bushings, etc. For such uses it is applied in thicknesses of 0.002 in. to 0.004 in.

Chromium should prove valuable as a bearing surface because of its low coefficient of friction and its resistance to abrasion and chemical action. This last characteristic permits the use of certain oils that are efficient lubricants but which have been limited in use during the past because of their acid content that attacks most metals. For bearing surfaces, chromium can be applied satisfactorily in thicknesses up to 0.015 in. In repair work it may prove useful for building up worn surfaces where the wear is very slight, such as the outside surfaces of armature and axle bearings, housing fits, etc. Its use in this field up to the present has been entirely experimental.

Another application which promises to be of interest to electric railways is in providing a wearing surface for such parts as gears, brake cylinders, pistons, coupler faces, door operators, etc. Chromium is applied by plating. To get good adherence to the base metal the part being plated must be cleaned perfectly. The extreme brittleness of chromium accounts largely for the tendency of relatively thick deposits to chip when subjected to impact. The relative coefficients of thermal expansion of chromium and the base metal upon which it is applied determine largely its adherence when subjected to any great change in temperature. The expansion of chromium under temperature change is similar to that of glass and platinum but is much less than that of iron, copper, nickel and zinc. Results obtained from the experimental uses of chromium plating vary greatly, but its possible applications by electric railways certainly merit careful consideration and investigation.

Properly Designed Records Guide Future Practice

TO GAIN a true insight into any branch of maintenance work by an electric railway it is necessary to have properly detailed records. All companies keep records of their various activities—in fact, most of them actually keep too many—but in every department numerous records may be found that merely require valuable space for filing and which serve no useful purpose. The big problem, therefore, is not necessarily to create new classifications and forms to increase the number, but to choose those which will be of the most benefit in analyzing costs, in determining which products are giving the best service, and in apportioning material and labor to obtain the highest efficiency and least wastage in repair work. It is a real problem and one that requires careful thought and study over a long period of time.

A few railways have departed from the easy and usual methods of recording maintenance details and the results attained on these properties are convincing proof that it is worth while. An excellent example of what can be accomplished is afforded in the experience of the New Orleans Public Service, Inc., whose methods of recording track maintenance costs are described elsewhere in this issue. The company classifies all of its trackage according to the type and age of construction, and keeps accurate records of all expenditures for each section. These figures are so compiled that an intelligent analysis of the various track designs and maintenance methods can be made. The company also has adopted a system of inspection reports which is used in assigning repair work. They are particularly helpful in apportioning the proper amount of materials and the proper number of men to each repair job.

Track maintenance, however, is only one of four major maintenance activities. Cars, buses and overhead all require heavy and continuous expenditures for materials and labor. To determine which tires give the best service on buses it is necessary to have records that tell the full story of the conditions to which each tire was subjected and its service history. Likewise, records of cars and buses, railway motors, armatures, trucks, compressor equipments, controllers and other parts, should all be designed for the ready comparison of performance and cost, and to serve as a guide in determining future purchases and maintenance policies.

Although fewer records are being kept today than were maintained in the past, there is no need for increasing the number. As a matter of fact, when fewer records are kept, closer attention can be paid to each, with resulting greater usefulness. The important thing in setting up records is to make them more than a history

of what has occurred. Each record should have as its ultimate purpose the improvement of future practice on the basis of past experience.

Adequate Bus Maintenance Facilities Are a Good Investment

OPERATION of buses by electric railways has expanded rapidly in recent years, but in many instances this expansion has occurred without any definite forethought. Consequently it is not surprising to find that adequate maintenance facilities have not always been provided. Many garages are simply converted carhouses. Such buildings usually are far from ideal places for doing bus maintenance and repair work. Because of the use of internal combustion engines for buses the problem of ventilation in a garage is entirely different from that in a carhouse. So also are the pit requirements, as most of the heavy parts can be lowered from the underside of a car while they must be removed by lifting from the chassis of a bus. In other ways also, an old carhouse is not entirely satisfactory for bus maintenance work.

In the matter of machine tools the present status of electric railway garages shows signs of unplanned development. Many are poorly provided with equipment, considering the number of buses operated. Apparently this is the result of a recent increase in the number of vehicles without a corresponding increase in maintenance facilities. Need for economy undoubtedly is the reason for these conditions. But despite the compelling force of this necessity, the fact must not be lost to sight that in the long run the provision of adequate maintenance facilities always proves to be the most economical policy.

That the truth of this is recognized by many progressive managements is clearly shown by the information gathered in a survey including 41 of the largest electric railway bus operating companies in the United States and Canada, a summary of which appears elsewhere in this issue. While some companies have been compelled to follow the policy of using old carhouses for garage purposes, the majority opinion is strongly in favor of buildings especially designed for the purpose and provided with ample maintenance equipment and tools to insure expert workmanship and real efficiency.

A Distinction Between Information and Propaganda Is Accuracy

ELEGANCE of expression is always to be desired, but no phrase other than "How do they get that way?" appears to fit the case of the Florida Public Utility Information Bureau in its discussion in its bulletin of Feb. 25 of the subject "Street Cars or Buses in Jacksonville." That city is in the throes of growing pains. It needs more transportation. The disposition of the Jacksonville Traction Company appears to be to give the citizens what they most desire, more service by bus or street car. It favors bus service to the outlying districts. This is the progressive attitude where density of traffic and prospective business do not warrant the building of street railway lines, but the information bureau appears to be taking upon itself a great responsibility when it proclaims through its bulletin that "the company does not want to lay double tracks on Main Street to clutter up the landscape, interfere with auto service and parking." So street cars interfere with parking. Since when? The general impression among railway men and many others was that parking interfered with the street cars. But that isn't all. According to the Florida sage, "double-tracking on a busy street is out of date, handicaps modern transportation and demonstrates lack of knowledge of modern ideas." The JOURNAL stands second to none in its enthusiasm for the bus. It is not disposed to enter again here into a discussion of the economics of various forms of transportation or of the economics of the use of the streets. It would be easy to correct charitably authors not properly informed who make statements of this kind about such matters, but the Florida Bureau should be in a position to know better. Regardless of the objective it may have in mind for Jacksonville, this statement is both a misrepresentation and an exaggeration.

The Association's Loss Is Baltimore's Gain

FOUR years ago Lucius S. Storrs was chosen managing director of the American Electric Railway Association. It was a new office, but Mr. Storrs' contact with association affairs had extended over the years and he was in thorough sympathy with the objectives for which the Advisory Council was formed. The industry needed leadership. Most of its problems were generally to many properties and there was need for group thinking and organized attack on common difficulties.

There have been no heroics in the conduct of the affairs of the association under Mr. Storrs, but there has been steady progress in the creation of greater group consciousness among electric railways and in the stimulation of the interchange of ideas, methods and information between properties through the medium of the association. In Mr. Storrs, the industry has had a national spokesman on questions of taxation, legislation and relations with other industries—activities the value of which are not readily apparent unless the results are viewed collectively. As for the individual properties, there have been available to them, in addition, the personal services of the association staff.

In his new post as executive chairman of the board of the United Railways & Electric Company of Baltimore, Mr. Storrs takes the leadership of an individual property. His advice will still be available in the councils of the association. In addition, he may be expected to apply in Baltimore the policies which he has advocated for the industry, and through demonstration of their efficacy he will continue to help in guiding the industry. Mr. Storrs assumes his duties in Baltimore with an enviable record of achievement in management. It was largely his accomplishments as president of the Connecticut Company that led to his selection as managing director of the association. From that post he takes with him a still broader outlook and understanding of transportation fundamentals.

If the citizens of Baltimore are expecting the spectacular from Mr. Storrs they are doomed to disappointment. But if they are prepared for that gradual upbuilding which is the result of the most careful study and deliberation and is the sign of permanence, they may expect their patience to be rewarded. The present management of the United Railways & Electric Company welcomes Mr. Storrs' leadership. If the JOURNAL is correct in its conceptions of Baltimore and its transportation problem, he may be expected to initiate a program that will redound to the mutual and permanent advantage of the community and the security holders of its transportation system.

Four Southern Properties

Save $2,000,000 in Equi

By

G. C. HECKER

Special Engineer American Electric Railway Association

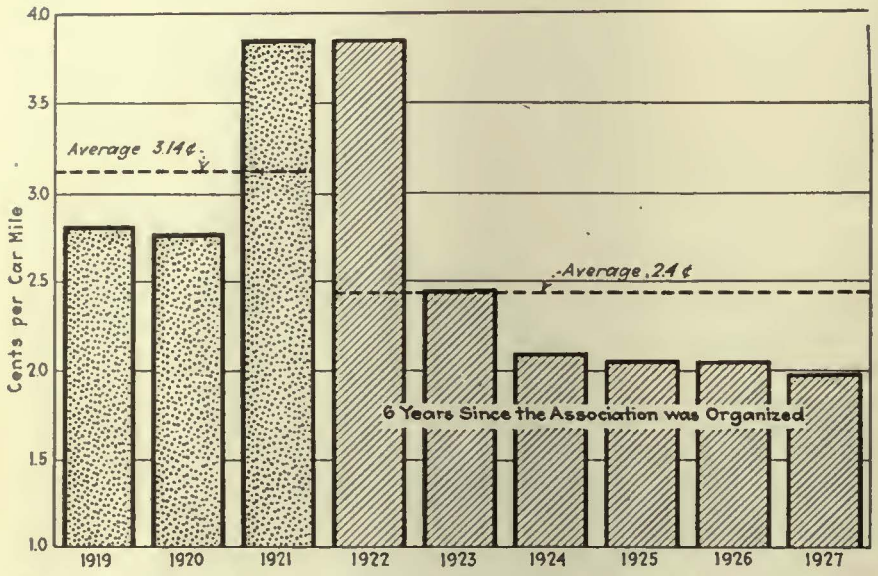


Fig. 1—A striking record of equipment maintenance costs of four important Southern companies, showing how interchange of experience and records through the Association of Equipment Men, Southern Properties, has resulted in major reductions

IN APRIL, 1922, a small group of superintendents of equipment of Southern electric railways met in Memphis, Tenn., to exchange operating experiences and to discuss maintenance methods, costs and other common problems. Uppermost in the minds of these men was the question of how the efficiency of their mechanical departments could be increased. During the meeting a comparison of operating costs and car failure records paved the way for an animated discussion of inspection and maintenance methods, which brought to light many divergent opinions and many interesting practices.

As the discussion continued the conviction grew among those present that this frank interchange of information and ideas had been extremely helpful and that each man had benefited greatly by it. It was agreed unanimously that regular interchange of maintenance data and costs and the periodical discussion of this information would provide a means of creating a spirit of friendly competition among the mechanical departments which would inevitably result in each one striving to improve its performance and its relative standing in the group. Before adjourning this group organized the Electric Railway Association of Equipment Men, Southern Properties, the charter members representing the mechanical departments of the properties in Birmingham, Nashville, Knoxville, Little Rock, Dallas, New Orleans, Mobile, Atlanta and Memphis.

Each member furnishes the secretary his monthly maintenance of equipment costs and his record of car failures, or pull-ins. In order to secure uniformity in the pull-in records, the association established the following definition for the guidance of the members:

> A car which has to be removed from service prior to completion of its regular prescribed run for any mechanical, electrical or man failures or accident, is termed a "pull-in."

These figures are compiled each month by the secretary and are printed and distributed to all members of the association. Not only are these data available to the department heads and supervisory forces for study, but they are posted in the shops and carhouses so that the rank and file of the employees on each property can see the standing of their own company in the group. The association meets semi-annually to discuss questions of interest to members and for the presentation of papers and discussions on timely shop and equipment subjects. A feature of these gatherings is the inspection trip through the shops and carhouses of the property in the city where the meeting is being held.

It is now seven years since the association was organized. Has it justified its existence? Did it result in any real accomplishment? The answers to these questions should be found in the maintenance records of these properties. With that thought in mind the writer has compiled and studied data furnished by four large companies represented in the charter membership of the association, viz., Memphis, Atlanta, Birmingham and New Orleans. A larger group would have been included in the study had it been possible to obtain continuous records, both prior to and since the organization of the association. As such figures were not available for all of the nine companies represented in the charter membership, the study has been confined to the above-mentioned companies.

The accompanying table shows the combined figures of these four properties. For the three years prior to the formation of the association, the combined main-

ent Maintenance

During Six Years

FREE INTERCHANGE of cost records, comparison of methods and critical self-analysis resulting from the activities of the Association of Equipment Men, Southern Properties, have brought about improved maintenance performance which has attracted widespread attention. A consolidated study of the records of four companies — at Memphis, Atlanta, Birmingham and New Orleans —gives a striking summary of the results accomplished.

tenance of equipment costs averaged 3.14 cents per car-mile. For the first six years of the existence of the association, these costs averaged 2.4 cents per car-mile, a decrease of 23½ per cent. Fig. 1 shows that since 1922 there has been a consistent, steady downward trend in maintenance costs. Comparing the 1927 cost with the year just before the association was formed, we find a maximum reduction of 49 per cent.

In order to translate the accomplishments of the mechanical departments into dollars and cents, the average reduction in maintenance cost per car-mile during the six years from 1922 to 1927 has been multiplied by the average car-miles operated during the same period. This shows an annual saving of roughly $350,000 per year, or for the six-year period approximately $2,100,000. Comparing the average cost for the three years prior to the formation of the association with the 1927 cost, we find that the maximum annual saving has been roughly $556,000.

COMBINED STATISTICS OF MECHANICAL DEPARTMENTS AT MEMPHIS, ATLANTA, BIRMINGHAM AND NEW ORLEANS

Year	Maintenance of Equipment Cents per Car-Mile*	Pull-ins Due to Equipment Failures	Car-Miles per Pull-in	Car-Miles Operated	Cars Operated	Carhouse and Shop Employees	Motor Cars Purchased
1919	2.8	15,000	3,300	49,396,000	†	841	35
1920	2.759	15,700	3,200	50,421,000	†	971	30
1921	3.864	12,632	3,900	49,385,000	1,259	1,019	45
Average of above three years	3.141	14,477	3,457	49,725,000	....	943	37
1922	3.825	6,028	7,720	46,554,000	1,234	911	100
1923	2.399	3,425	14,100	48,479,000	1,244	944	40
1924	2.118	2,388	20,100	48,401,000	1,251	872	103
1925	2.048	1,955	24,100	47,185,000	1,266	764	100
1926	2.050	1,579	30,300	47,838,000	1,286	745	118
1927	1.976	1,566	30,500	47,778,000	1,291	737	40
Average of above six years	2.403	2,824	21,133	47,706,000	1,263	829	83

*Depreciation not included. Maintenance costs include standard accounts 29—41 inclusive.
†Complete figures were not available.

Fig. 2 shows the record of car failures. These are the pull-ins due only to equipment failures and do not include those due to man failures nor accidents. During the first six years of the existence of the association the average number of pull-ins for the four properties was approximately 2,800 as compared with an average of 14,500 for the three previous years, or an average reduction of 77½ per cent. Car failures, like maintenance costs, have been reduced steadily until in 1927 the pull-ins were only 1,566. Compared with the year 1921, this is a maximum reduction of 87½ per cent in car failures due to mechanical or electrical defects.

In order to permit comparisons with other properties, this car failure record has been converted in Fig. 3 to "car-miles operated per pull-in." It will be observed that the car-miles per pull-in have been increased steadily from approximately 3,500 to 30,500. The average miles prior to 1922 were 3,457. The average for the six years following the organization of the association was 21,133.

The average daily cars operated on the four properties during the years 1922 to 1927 inclusive totaled 1,263. Thus it will be seen that the car failures have been steadily reduced until during the year 1927 there were about 1¼ failures per car operated. Here is a record of splendid achievement. How are we going to account for the reduced maintenance costs and the improved performance of equipment, which began almost simultaneously with the organization of this association?

Obviously, not all of this splendid improvement in performance can be attributed to the activities of the association, as there are many other factors which may influence the maintenance costs and the car failures. Among these might be mentioned the new cars purchased

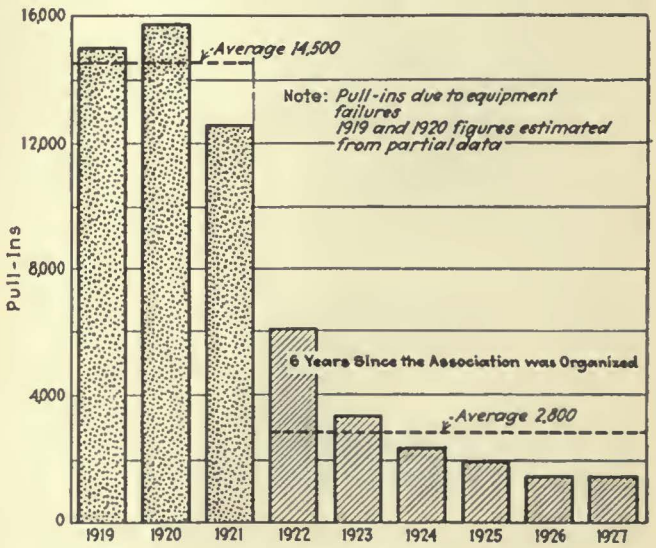


Fig. 2—Steady reductions in pull-ins for mechanical failures indicate that the standards of maintenance were being raised while costs were being reduced. This chart is compiled from the combined figures for Memphis, Atlanta, Birmingham and New Orleans

OFFICE OF SECRETARY
E. R. A. E. M., SOU. PROP.
601 N. 18 ST.
BIRMINGHAM, ALA.

	Chargeable to Carhouse	New Orleans		Nashville		Atlanta		Knoxville		Birmingham		Little Rock		Dallas Ry. & Terminal Co.		De
		December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	
1	Armatures		5		7	1	13	1	12	5	80	1	14	5	59	
2	Armature Bands				1					3	12		1	1	4	
3	Armature Shafts		2				2			2	18				4	
4	Armature Bearings Hot			1	4		1				8				11	
5	Axle Bearings Hot				1					2	2				2	
6	Brush Yoke														1	
7	Commutator		2								2		1			
8	Brushes & Holders				1		4		1	3	17		4		3	
9	Fields				3	1	12				40		8	1	10	
10	Field Jumpers						1			1	3		5		10	
11	Motor Leads						4									
12	Gears & Pinions															
13	Gear Cases															
14	Other Motor Troubls															
15	Trolleys															
16	Circuit Breakers															
17	Line Breakers															
18	Main Fuse															
19	Controller															
20	Cables															
21	Rheostats															
22	Air Brakes															
23	Safety Car Equipment															
24	Door Engines															
25	Whistles															
26	Frozen Air															
27	Other Air Troubles															
28	Lights															
29	Headlights															
30	Signal Lights															
31	Door Switch															
32	Heaters															
33	Electric Bells															
34	Lightning															
35	Car Charged															
36	Axles															
37	Wheels															
38	Journals & Boxes															
39	Hot Journals															
40	Hand Brakes															
41	Slack Adjusters															
42	Brake Rigging															
43	Other Truck Troubles															
44	Doors and Riggings															
45	Door Treadles															
46	Windows															
47	Seats															
48	Steps															
49	Registers															
50	Signs															
51	Gongs															
52	Sand Rigging															
53	Fenders															
54	Draw Bars															
55	Snow Scrapers															
56	Other Body Troubles															
57	Unclassified															
58																
59																
	Total chargeable to equip.	0														
	Total Car Miles	1,140,836	13,605.													
	Average Pull-Ins Per Day	.0														
	Average Mi. Per Pull-In	1,140,836	544.													
	Not Chargeable to Carhouse															
60	Accidents	4														
61	Split Switches															
62	Derailments															
63	Doors and Steps															
64	Broken Glass															
65	Trouble Reported, None Fd.															
66	Unclassified															
67																
	Total not chargeable to equip.	4														
	Avg. Pull-Ins Per Day	.13														
	Avg. Mi. Per Pull-In	285,209	170.0													
	Total Pull-Ins	4	10													
	Total Avg. Pull-Ins Per Day	.13	2													
	Total Avg. Mi. Per Pull-In	285,209	121.													

OFFICE OF SECRETARY
E. R. A. E. M., SOU. PROP.
601 NO. 18 ST.
BIRMINGHAM, ALA.

FOR CARS AND EQUIPMENT OF CITIES NA

		SUPT. OF EQUIPT.				PASS. and COMB. CARS				FRT. and EXPRESS CARS				SERVICE EQUIP		
		Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927
1	Lexington	2.51	2.35	2.95	2.66	6.83	7.04	9.12	8.15	.09	.47	1.29	.39	.32	.83	.22
2	Little Rock	1.41	1.54	1.09	1.09	9.18	9.97	10.37	7.59					.02	.05	
3	Memphis	1.00	1.07	1.07	1.10	11.12	11.84	11.02	9.74					.17	.25	.15
4	Atlanta	.84	.87	.60	.60	7.28	10.55	9.51	10.24					.03	.03	
5	Covington	1.00	1.02	1.00	1.12	10.77	10.46	11.40	11.73					.03	.03	.01
6	Fort Worth	1.26	1.47	1.25	1.46	11.38		9.40	10.47						.17	.01
7	New Orleans															
8	Knoxville															
9	Louisville															
10	Richmond															
11	Miami															
12	Dallas															
13	Birmingham															
14	Houston															
15	Mobile															
16	Montgomery															
17	Baltimore															
18	Cincinnati															
19	Roanoke															
20	Chattanooga															

since 1921, the fluctuations in wages and in material prices and the general managerial policy with respect to the maintenance budget.

From 1919 to 1927, inclusive, these four companies purchased 611 new motor cars. In 1919, 1920 and 1921 an average of 37 motor cars per year were purchased, this being approximately 3 per cent of the total cars operated. From 1922 to 1927, inclusive, the average number of cars purchased annually was 83, or approximately 6.6 per cent of the total cars operated. Undoubtedly, the increase in the number of new cars placed in service each year has had some effect on the maintenance costs, but the significant thing to keep in mind is that the maintenance costs have continued a steady downward trend. And it is interesting also to know that the 1928 maintenance costs, which have been compiled only very recently, show a further slight decrease.

Moreover, these reductions are not the result of a managerial policy simply to cut maintenance costs regardless of the condition of the equipment. The fact is that the rolling stock on these properties is maintained in excellent condition. Its appearance testifies to the high standard of maintenance, and if appearance is not sufficiently conclusive the records of car failures should be

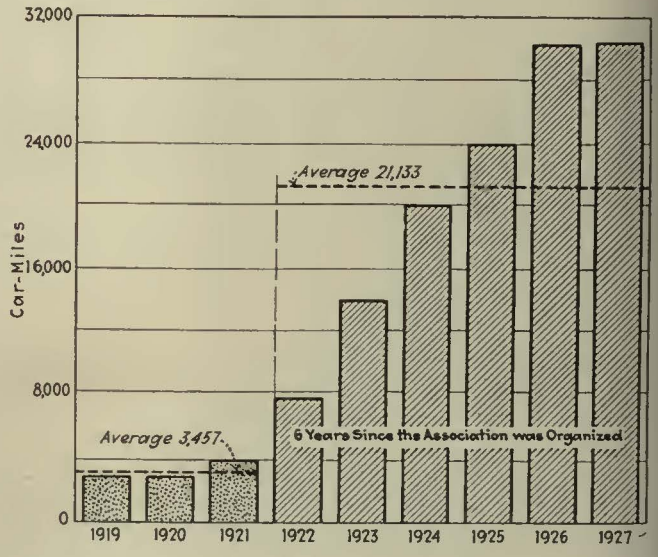


Fig. 3—Car-miles operated per equipment failure were increased from approximately 3,500 in 1921, before the present free interchange of maintenance practices and records, to 30,500 at the present time. The average number of cars operated on these four properties from 1922 to 1927, inclusive, was 1,263. In 1927, equipment failures for the year averaged 1¼ per car operated

COMPARATIVE STATEMENT

OF CAR PULL-INS ON THE STREET CAR SYSTEMS OF THE CITIES NAMED FOR MONTH OF DECEMBER, 1928, AND FOR YEAR TO DATE

OTE: A car which has to be removed from service prior to completion of its regular prescribed run for any mechanical, electrical, man failure, or accident, will be termed a pull-in.

Covington		Mobile		Baltimore		Charlotte		Pittsburgh		Miami		Richmond		
ber	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	December	Yr. to Date	Decem
2	40	2	23	14	261		32	30	261	1	12	12	126	
			1	2	11		1						27	
					1							2	17	
	1		2		5						1		10	
							1					2	11	
					1									
				4	12	1	7				3		18	
1	9		3		29	1	6	11	59		6	4	29	
1	11		1	2	61	1	18	4	115		6	3	55	
				3	52									

Comparative statements ot maintenance costs and detailed pull-in records are compiled monthly by the secretary of the E.R.A.E.M., Sou. Prop., and sent to each member company

COMPARATIVE STATEMENT

F AINTENANCE COST PER 1,000 CAR MILES

R ONTH OF DECEMBER, 1928, AND FOR YEAR TO DATE COMPARED WITH THE SAME PERIOD FOR PREVIOUS YEAR

EL. EQUIPT. OF CARS			SHOP TOOLS and EQUIPT.				SHOP EXPENSES				MISC. EQUIPT.				TOTAL MAINTENANCE *				CAR CLEANING and INSP.				R. and R.				
ve. Yr. to Date 28	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	Dec. 1928	Yr. to Date	Dec. 1927	Yr. to Date	
1.77	.99	1.44	.42	.29	1.57	.35	1.85	1.27	1.48	1.20					13.58	14.02	17.62	15.85	5.99	5.97	6.12	8.11					1
3.88	2.99	3.55	.17	.28	.29	.20	.73	1.00	1.23	.96					15.09	16.75	15.00	13.51	8.39	7.65	7.61	8.87					3
3.75	2.91	4.07	.09	.09	.04	.11	.85	.85	.93	.89					15.94	17.85	16.06	16.11	8.78	8.87	8.55	8.86					3
4.70	3.88	5.40	.09	.05	.15	.04	1.83	1.71	2.00	2.15		.003		.01	13.66	17.90	16.97	18.45	9.09	10.29	9.14	8.45	789.47	788.89	3.97		4
4.96	3.71	6.00	1.24	.49	.03	.09	1.76	1.38	1.72	1.40					20.79	18.31	19.41	20.55									5
4.35	3.92	4.29	.08	.20	.04			1.06	1.22	1.09					18.35	19.86	15.88	17.48	5.97	5.89	5.61	5.71					6

entirely convincing. Poorly maintained rolling stock could not have made the performance shown in Figs. 2 and 3.

Furthermore, the reduction in maintenance cost has been achieved in spite of the fact that wages have increased 38 per cent since 1919 and material prices have gone up slightly. It is interesting to note that the present high standard of maintenance is accomplished with fewer employees than were required ten years ago. From 1919 to 1921, inclusive, the average number of shop and carhouse employees was 943. The average for the next six years was 829, an average reduction of 12 per cent. The number of employees in these departments has been steadily reduced until in 1927 only 737 men were required. From incomplete figures available for 1928 still further substantial reductions are indicated.

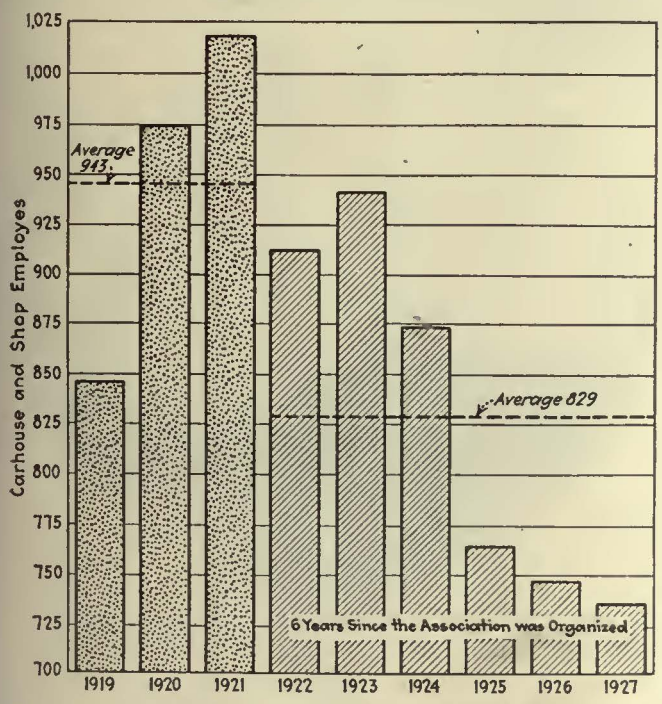


Fig. 4—Although wages for maintenance employees have increased approximately 38 per cent since 1919 on the four Southern properties included in this study, there has been a considerable reduction in the number of men on carhouse and shop work. Better organization, closer supervision and more thorough inspection have made possible this steady decrease in man power

Just what has happened on these properties to account for these very favorable mechanical department records? The writer firmly believes that the most influential factor is the free and frank interchange of operating data and maintenance experience and the discussion of common problems among the mechanical men comprising this group of properties. Their association is the vehicle through which they interchange their information and ideas. The publication of the cost data and the service records of equipment undoubtedly has stimulated the interest of every man in the mechanical departments. There has been created through this medium a desire on each property to improve past performance and to raise the standard of each company in the group.

Naturally, this spirit had to be fostered by those in charge of the work. Back of the performance on each of these properties lies a story of careful organization, painstaking study and critical analysis of methods, with unceasing effort to improve conditions. Inspection has been put on a very thorough and systematic basis which makes it possible to locate and remedy incipient defects before they become sufficiently serious to cause car failures. Overhauling of equipment is done periodically and most thoroughly. The intervals between overhauls are such that the cars may reasonably be expected to operate without serious trouble.

EDITOR'S NOTE—This study of the records of these four Southern properties will be followed in a later issue by a discussion of the methods through which maintenance costs and equipment failures were reduced.

Trolley Wire Breaks

PREVENTED

by Alert Maintenance

By
W. T. TRAUTMAN
Superintendent of Emergency Division
United Railways & Electric Company
of Baltimore

Hangers and ears have been reduced in number at Baltimore by elevating the curve pull-off wires so that they pass over the contact wires without the necessity of being attached thereto. The picture in the circle shows how well this has been done.

STEADY reduction in the yearly number of trolley breaks from a peak of 1,321 in the year 1918, when 32,569,906 car-miles were operated, to only 30 in the year 1928, when 33,013,320 car-miles were recorded, is the record of the United Railways & Electric Company of Baltimore. Moreover, only fifteen of last year's breaks affected main lines and eight of these were chargeable to unpreventable and foreign causes. With the knowledge that trolley wire breaks not only seriously impair the service but also are potentially hazardous on heavily-traveled thoroughfares, the company in 1920 inaugurated a complete program of preventive measures including the rehabilitation of the overhead trolley wire system together with a plan for inspection and maintenance to insure the detection and elimination of incipient faults before failures developed. The success that has attended these efforts is attested by the physical results achieved as well as by the consequent decrease in maintenance costs to the extent of $30,000 annually.

Whereas under former practice all trouble crews were held in idleness at their respective stations, awaiting emergency calls, the plan now in effect employs the majority of these forces actively and usefully in inspection and maintenance work. The results thereby obtained reaffirm the truth of the old adage about "an ounce of prevention being worth a pound of cure." As now organized, the emergency division of the power department functions not only in all emergency cases of whatever nature, but it is also

During past decade the United Railways & Electric Company of Baltimore has effected a steady reduction from 1321 to 30 breaks per year. Annual maintenance costs have been cut by $30,000. Taut contact wire, slack spans, shorter ears and U-groove wheels have been instrumental in this improvement

responsible for the general condition of the entire overhead trolley structure. Five crews comprise the day shift and four are used on the night shift, each crew consisting of a lineman, a helper and a chauffeur, together with a tower truck especially designed and equipped for the purpose. Line cars also are available at convenient locations and are used instead of the motor trucks when more suitable for work on suburban sections having open track construction.

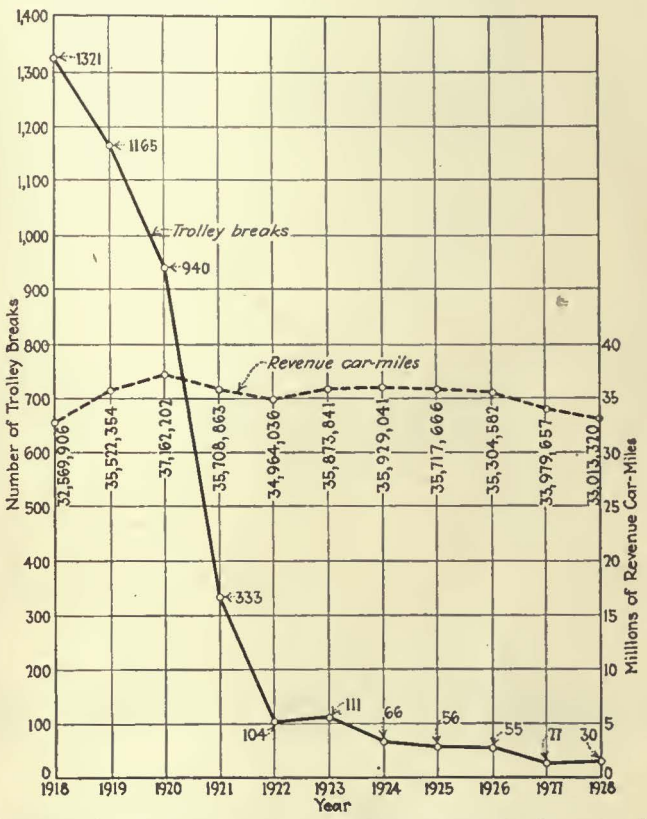
One crew is normally held at division headquarters at all times in readiness to respond to emergency calls such as fires, accidents, blockades, etc., and for the duration of the morning and afternoon peak hours all crews stand by at their respective stations so as to be immediately available if needed. During the remainder of the time, however, all except the single crew held for emergency service inspect and maintain the overhead structures. They keep in frequent communication with the emergency dispatcher so they can be readily located whenever required to augment the reserve crew. Each crew is assigned a certain portion of the system, approximately 60 miles of single track, and is held accountable for the upkeep and general condition of the overhead structures. In this way the entire system is covered thoroughly not less than once a month with the result that practically all defective conditions are discovered and remedied before they have a chance to develop into hazards or service detentions.

Alert and skilled inspection and maintenance have been largely responsible for the record of diminishing trolley breaks, but certain other important factors have also contributed in no small measure to the results that have been realized.

Of primary importance is the matter of trolley wire. Bronze wire of the highest grade obtainable is now purchased under rigid specifications, as compared with the former method of buying on price, and a company engineer inspects and tests the wire at the point of manufacture, all reels not meeting the specification requirements being rejected. The amount of wire required each year for section renewals is purchased in one lot on competitive bids, and is usually erected in the spring of the year when temperatures are mild and uniform. The wire is stretched taut when erected, a dynamometer being used to determine when the definite tension required with the prevailing ambient temperature conditions has been obtained, in accordance with the tension-temperature curves shown in an accompanying chart for Nos. 00 and 000 bronze wire having an ultimate tensile strength of approximately 65,000 lb. per square inch.

In order to mitigate as much as possible the injurious effects of suspension "hard spots," the supporting span wires are kept as slack as practical, consistent with the height of the poles and the standard clearance that has to be maintained above the rails. Wear is watched carefully, especially at vulnerable locations, and any wire reported by the crews as being worn beyond the allowable limit is personally inspected by the superintendent of the division before renewal is made.

One of the most pertinent factors related to any study of how to keep overhead trolley structures in condition is, obviously, the design of the trolley wheel collector. After all, it is the functioning of this device that is responsible for the ultimate destruction of the contact conductor and its accessories. Several years ago in Baltimore it was recognized that a trolley wheel having a wider and differently shaped groove than the one then in use would be considerably less injurious to the trolley wire and fixtures, especially by minimizing arcing and reducing excessive impact on the wire at the leaving ends of ears and other attachment fittings. Accordingly, the V-groove wheel then in use was superseded by a modified U-groove type of wheel with excellent results in reducing unnecessary wear of the wire and also in greatly prolonging the life of the supporting ears, as shown by the fact that the number of ears renewed each year has since decreased from approximately 48,000 in 1925 to about 12,000 at present. Worn-out, defective and improperly lubricated wheels, if permitted to remain



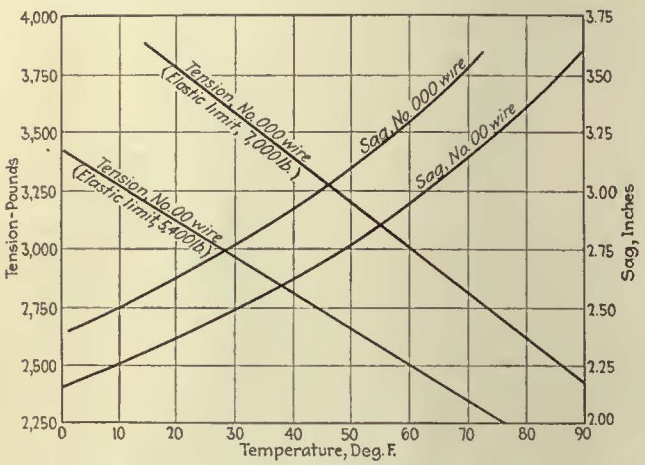
The number of trolley wire breaks has been greatly reduced while the number of car-miles operated has remained practically constant

in service for any length of time, are exceptionally severe on the overhead contact structures and may cause many dollars' worth of damage. Consequently, whenever an arcing or noisy wheel is noticed it is immediately reported to the proper carhouse for attention.

Still another factor which influences to an appreciable extent the work of maintaining the overhead structure efficiently and economically is the type and character of the trolley supporting ear used at suspension points. Extensive study has been given to this troublesome problem and various service tests are in progress to determine the device best suited generally for the purpose. One of the essential features, of course, is that the ears should have proper taper-ground ends to provide a smooth approach and runoff for the trolley wheels, and all ears now purchased for use on this property satisfy this requirement. As a result of using high-grade ears of an approved design and, as previously mentioned, slack span wires, taut trolley wire and U-groove trolley wheels, the well-known and highly destructive gouging or cupping form of wear on trolley wire encountered at the ends of ears has now been virtually eliminated.

During the past several years, 9-in. ears have been used in the erection of new trolley wire, the original intention having been to replace these when worn out with ears of 12-in. length, should the wire show evidence of cupping, and later on with 15-in. ears if necessary to cover up and protect new depressions. So far, however, by reason of the almost complete disappearance of this form of wear, it has not been found necessary to resort to the longer ears, and the 9-in. ear is, consequently, now being used almost exclusively on the entire system.

At special work locations, where the most severe and troublesome conditions are encountered, wire life has been prolonged, the use of expensive fittings reduced, and better alignment is being maintained through the elimination of all fittings not actually required to support the trolley wires or hold them in place. Accompanying illustrations show how a number of hangers



Tension and sag of bronze trolley wire

Temperature range—0 to 90 deg. F., pole spacing—110 ft. Wind and sleet loads were neglected in calculating stress and sag. Modulus of elasticity = 18.14×10^6. Coefficient of linear expansion = 9.39×10^{-6}.

and ears have been removed advantageously from special work by elevating the curve pull-off wires to a point on the poles, so that they will pass over the straight line portions of the contact conductors without the necessity of being attached thereto in accordance with the customary practice.

Additional savings are also being realized as a result of protecting all splicing ears and the approaches to frogs with bronze trolley armor, which is ground to a taper finish on each end to provide a smooth approach and runoff for the trolley wheels. Trolley armor is appreciably cheaper than splicing ears and prolongs the life of the fittings indefinitely.

Further economies and fewer service interruptions have also resulted through reducing the number of accidental car pull-downs by equipping all frogs and small-degree crossings with pans specially designed to prevent trolley harps from becoming caught in the crotches of these fixtures in cases of dewirements.

Although the number of trolley breaks due to causes within the direct control of the company decreased rapidly under the co-ordinated program of inspection and maintenance, it was noted several years ago that a comparatively large number of breaks continued to occur as a result of burn-downs by cranes, steam shovels and similar equipment operated by other utilities and contractors. The problem of reducing the number of burn-downs chargeable to these foreign causes was approached by addressing letters to all the contractors in the city operating such equipment, outlining the hazards and inconvenience incident to a broken trolley wire and requesting their co-operation in preventing such occurrences by notifying the trouble dispatcher of the intention to move the equipment so that a trouble crew might be sent without charge as a convoy to assist in moving the apparatus across the company's tracks. The response to this request has been almost unanimous, and burn-downs due to contractors' equipment are now very infrequent.

As a direct result of these various measures and methods the company has succeeded, in a comparatively short time, in establishing a record in the reduction of trolley breaks and service detentions far beyond original expectations; and, as a byproduct, has been further rewarded with a material reduction in maintenance expense. The success of the undertaking, however, must be credited in great measure to the untiring efforts and initiative of the men of the emergency division, who have shown an eagerness and persistency that could scarcely have resulted otherwise.

Auxiliary Rain Troughs for Bus Engines

AS A double precaution against motor failure during severe rain storms from the leakage of water through the engine hoods onto the ignition wiring, the International Bus Company, subsidiary of the International Railway, Buffalo, N. Y., and the Philadelphia Rapid Transit bus organization, has equipped its whole fleet—90 buses in Buffalo, 610 in Philadelphia—with an auxiliary rain trough of its own design.

The rain trough is made of ordinary light-weight sheet metal, so shaped as to fit snugly over the radiator tie rod and slope sufficiently toward the rear to lead all water away from the ignition circuits

The rain trough is located directly beneath the center hinge of the engine hood and rests on the radiator tie-rod. Constructed of sheet metal, it is so designed as to drain the water to the rear of the engine and away from all electrical circuits. Simple as this addition to the bus engine seems, it has served to eliminate all complaints arising from the short-circuiting of the ignition system of the bus engine during bad storms.

Night shovel gang at work on Euclid Avenue track reconstruction job

Careful Organization Essential for Rapid Track Reconstruction

By
HOWARD H. GEORGE
Superintendent of Way
Cleveland Railway

Greatest possible speed is desirable from standpoint of public relations. To accomplish this the working force must be thoroughly trained in their jobs, and every detail planned in advance. Recent track renewal in Cleveland furnishes an example of how this was done successfully

GENERALLY speaking, speed is desirable in any construction operation, and within certain limits results in the greatest economy. Speed in construction, however, involves two important factors: i.e., proper equipment and proper organization. The maintenance of a street railway naturally involves a certain amount of work during the entire year, but, unfortunately, it is impossible to spread the work uniformly over the entire period, particularly in our Northern climate. The organization must be skeletonized during the winter months, but at the same time lend itself readily to rapid expansion when the construction season opens. This makes the problem of organization a difficult one, especially when it is necessary that the piece of work be done speedily.

It is a generally recognized principle in all large construction work that the best equipment available is none too good for the job. This applies particularly to the work of constructing tracks. Contractors and engineers are constantly seeking for improved and more efficient machinery, but the fact must not be lost to sight that the equipment may be 100 per cent satisfactory and at the same time the entire operation fall flat because the organization of the personnel was inadequate. The two factors go hand in hand and cannot be considered alone.

No construction job of any size should be undertaken without a reasonable construction schedule being planned in advance. This constitutes a bogey and gives every part of the organization concerned something at which to aim, and a mark to beat if possible. It is equally important that every subdivision of an organization be thoroughly familiar with the part it is to play on every job. This means definite instruction in advance. The smooth working of such an organization is materially

New track ready for surfacing gang

assisted by regular conferences between the department head and the various responsible sub-department heads.

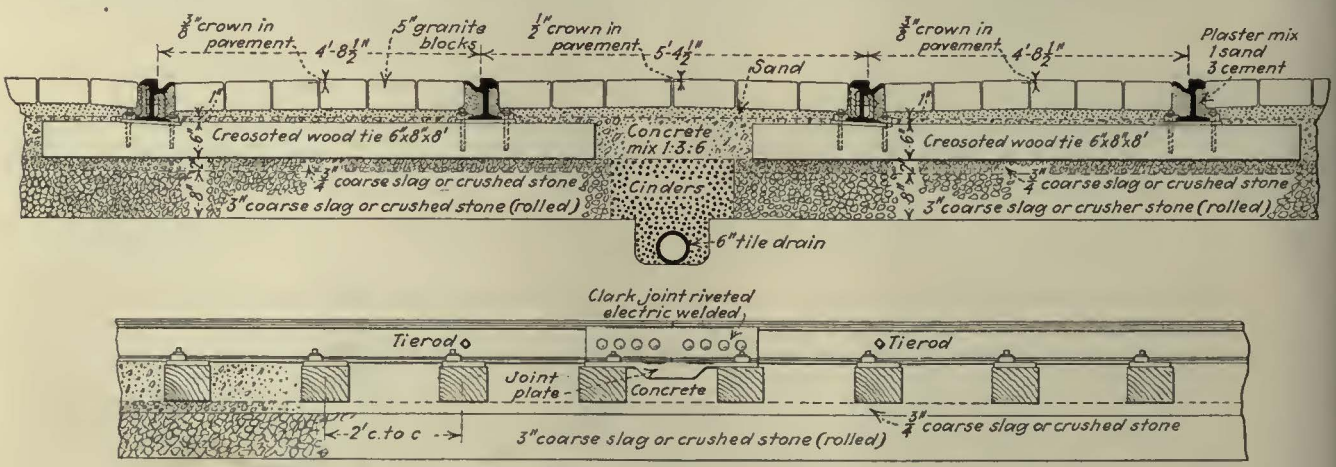
It is frequently the case that as long as an organization is called on to perform only the ordinary routine work everything goes quite smoothly, but that it fails to stand up under the strain of emergency demands. This should not be true, and in order to be prepared for the unusual demands a construction organization should be so planned as to be readily susceptible to expansion. In addition, a certain amount of extra equipment should be kept in reserve or else a definite source of supply should be assured from outside. This means that every man in the organization who acts in a supervisory or executive capacity must have at least one man whom he has trained for the job higher up, so that, when the time for expansion comes, there are already in the organization men ready to take on the work of running the necessary additional construction crews and other incidental work.

There seems to be, in many cases, a disinclination among heads of departments to train assistants to handle every phase of their jobs, or to delegate any authority to them or divide responsibility with them. This may, in some cases, be because the individual concerned has under him subordinates who are not fully qualified to take over his work but where, for reasons beyond his control, he is obliged to retain the services of such individuals. Generally, however, where a department head insists upon shouldering the entire responsibility himself, it is due to an exaggerated sense of egotism and not to any inability on the part of his subordinates to measure up to any responsibility which may be put up to him. As a matter of fact, the successful direction of any departmental organization or business enterprise depends largely upon the ability of the head to devote all of his time and attention to studying the functioning of his organization in perspective, in comparing the work it is doing with that which is being done by others, and in working out plans for simplifying and improving his own practices.

Because the organization of the Cleveland Railway Company's way department was prepared for emergencies, it was possible to meet the unusual demand imposed upon it in the reconstruction during the past year of the double track on Euclid Avenue from East 55th Street to East 105th Street, necessitating the reconstruction of 3.41 miles of single track. The street is one of the main east and west thoroughfares of Cleveland. In addition, it is one of the principal business streets, being devoted for a considerable part to the automobile sales houses. As it had been necessary to tear it up and interfere with business and traffic for extensive trackwork less than four years before, it was the decision of the management that the work should be expedited in every way possible and that the total time for the completion of the necessary replacement should be reduced to the absolute minimum.

The general design selected for the new track in Euclid Avenue is shown in the accompanying cross-section. Although T-rail was used on this job, the cross-section was subsequently modified for other jobs using the A.E.R.E.A. standard grooved-girder rail and screw spikes and clips. The old steel ties and concrete base were completely removed and a creosoted wood-tie construction laid on crushed slag ballast was substituted.

The work was started on May 11 and, with the excep-



Standard track section with 102-lb. girder rail. Tee rail was used on Euclid Avenue

tion of a short stretch at East 79th Street which was left pending a decision by the city relative to street widening details at this point, it was practically completed by the middle of July. The exception noted could easily have been completed by the same date had there been no question at issue regarding the track location at the time the adjoining track was under reconstruction.

In order to make this speed possible, the work was carried on practically without interruption day and night. The first operation was the placing of the temporary track and crossovers which were used during the day for regular car operation in connection with the track not under reconstruction. During the night the second main track was turned over for work trains, and passenger car operation made a two-way affair over the temporary side track by means of block signals. This temporary side track is permanently assembled in sections brought to the job on flat cars and laid on boards set closely together on top of the street pavement as near to the curb as practical, the track being shimmed to a sufficiently accurate grade to permit safe operation. Runoffs were set at various points on this track to take care of expansion and contraction. About 7,500 ft. of temporary track was necessary, this being shifted from section to section as required. The actual work of bringing this material to the job and shifting from one section to the other and as much of the connection work as possible was done at night, the day crew completing it the next morning.

During construction, temporary crossings were provided over the side track and open trench, old ties, broken concrete, and slag screenings being used for this purpose. Loading platforms of fine slag screenings were provided at all car stops for the benefit of passengers boarding cars on the temporary track, or alighting therefrom.

As soon as operation had been diverted to the temporary track, the old Amiesite pavement surface was removed, air compressors and air-operated cutting tools being used. It was then shoveled by hand to one side and later thrown back in the trench to be loaded by the power shovels along with the rest of the excavated material.

The next operation was the breaking up of the concrete. Two Clark concrete breakers were used for this purpose, one breaking up the top layer of concrete forming the pavement base. A gang of laborers shoveled this out of the trench and the second breaker then passed over the track and broke the foundation concrete.

The rail was then burned at the joints with acetylene torches. The nuts holding the rail to the ties were also burned and knocked off by a track gang, which also overturned the loosened rail. At night, the derrick picked up the old rail and loaded it on flat cars for removal to the material yard.

Tearing up old track without interference to car service which continued uninterrupted in both directions

Shovels started working at 8:30 p.m., which was the earliest the second main track could be released. Work stopped at 4:45 a.m., so as to permit resumption of double-track operation. The only exception to this was in the case of the westbound track between East 77th Street and East 79th Street, where work of the shovels did not start until midnight and stopped at 4:45 a.m.

Most of the new track material was handled at night in order to reduce to a minimum the delays to operation of passenger cars through the day. The coarse slag for ballast was dumped directly into the track trench, the fine slag being deposited in the space between the trench and the temporary side track. Concrete aggregate was landed in the same way as the fine slag. Ties were unloaded and placed in the trench at night as far as the foundation had been rolled. Otherwise, they were piled along the sidewalk at convenient locations to be placed in the trench by the day crew. All rail was unloaded by derrick at night and laid on the ties in the track trench as far as the ties could be placed, the balance of the rail being distributed on the street pavement just outside the trench.

One track was completed and placed in operation, before work was begun on the other track

The foundation consists of 8 in. of coarse slag, thoroughly rolled with a 10-ton tandem type roller, this base being covered with fine slag which was washed down and rolled into the coarse slag base. On this base the track was then laid and spiked to the ties. Fine slag for tamping was thrown in the trench, 2 in. being allowed for tamping under the ties on the rolled base. The tamping was in this instance mostly done with electric tie-tamping machines. As soon as the track had been tamped to surface and lined, all surplus tamping material was removed from between the ties.

Riveting and welding crews then completed the assembly of the rail joints, followed immediately by the concreting machine. Care was taken in the joint assembly to obtain as complete a closure between rail ends as possible. The rail and splice-bar drillings were arranged so as to provide $\frac{1}{16}$-in. draw at the two center holes, a drift pin being used to pull the rail ends tightly together. Heat-treated rivets were used to secure the plates, and the seams then welded. A baseplate was used under each joint, the rail base being welded to this plate.

Concreting Was Done Carefully and Lumnite Cement Used as Needed

In concreting the track, care was taken to see that the concrete was of uniform quality and that it was carefully tamped around the ends of the ties and under the rail base between ties and under the joint baseplates. As soon as the concrete had set, the fine slag screenings were distributed over the concrete for a paving cushion. The paving-gang laborers arrived on the job at 3 a.m. to unload the granite paving block and fine slag cushion. The pavers started at 7 a.m., the entire space between rails, including the devilstrip, being paved with new granite block. The space outside the outer rails was paved with asphalt for an average width of 2.3 ft., this work being done by the Cleveland Trinidad Paving Company under contract. The grouting of the pavement consisted of two parts sand and one part Portland cement. Paving pitch was used at street intersections which had to be turned over to traffic at once. In certain short stretches where it was desired to turn traffic over the tracks in a much shorter time than would otherwise have been practical, Lumnite cement was used for the grout. After the pavers had completed their work, the track grinders went over every rail joint to remove any imperfections in the rail surface.

Clean-up Work at Night

Most of the work of cleaning up was done at night. During the day labor gangs would collect the débris in piles and it would then be loaded on the work trains by the night gangs.

During the period covered by this job it rained on sixteen days and 24 nights. It was necessary partly to suspend operations for this reason on fourteen different days. This fact makes the time record that much more interesting.

The following figures indicate the amount of work involved in this job.

Dirt and concrete excavation	10,434 cu.yd.
Slag used for track base	13,392,000 lb.
Fine slag used for tamping	1,730,000 lb.
Fine slag for paving cushion	3,420,000 lb.
Granite paving block	411,829 block
Sand for grouting pavement	358,000 lb.
Cement for concrete base and grouting	18,783 sacks
Gravel for concrete	5,190 tons
Oak ties	8,702
102-lb. rail	34,397 lin.ft.
Splice bars	583 pair
Joint baseplates	553
Standard tie plates	16,308
Track spikes	111 kegs
Rivets for joints	4,400

The job required a total of 102,030 man-hours and 8,116 equipment-hours for its completion. The various day and night gangs were organized as follows:

Average day track gang—for 56 days	50 Laborers
1 Foreman	2 Watchmen
5 Sub-foremen	7 Temporary track maint'nce men.
77 Laborers	—
7 Watchmen	63 Total
7 Temporary track maint'nce men	Average day paving gang—for 31 days
2 Temporary crossing men	2 Foremen
1 Water boy	22 Pavers
—	25 Laborers
100 Total	1 Watchman
Average night track gang—for 54 nights	2 Truck drivers
1 Foreman	—
3 Sub-foremen	52 Total

The equipment used in the operation was as follows:

2 Portable burners	1 Concrete mixer and conveyor
4 Schramm air compressors	1 Riveter
1 Ingersoll-Rand air compressor	3 Welding machines
2 Clark concrete breakers	2 Grinding machines
2 Electric shovels	11 Work trains
1 Gasoline shovel	3 Derrick cars
2 Steam rollers	40 Work cars
1 Gasoline roller	

This equipment was operated for the following periods:

	Days	Nights
Portable burners	32	8
Air compressors	38	23
Clark concrete breakers	32	8
*Electric shovels	..	38
*Gas shovel (started May 26)	..	23
Steam rollers	16	..
Gasoline roller (started June 2)	28	2
Concrete mixer and conveyor	33	3
†Riveter	23	1
‡Welding machines	25	1
Grinders	13	..

* Shovels required three men each.
† Riveted 550 joints.
‡ Welded 553 joints.

The cost of the material entering into the work was approximately $150,000 and that of the labor approximately $85,000, a total of approximately $235,000, or about $13 per lineal foot, this including every item of expense in connection with the operation.

REDUCING NOISE of Car Operation

By

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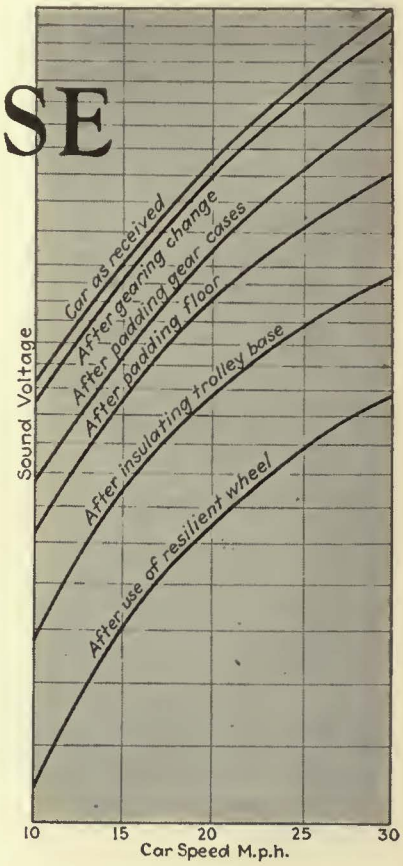
A noisy car has actually been made quiet. Tests show efficiency of various schemes for wheel silencing and results from consistent use of high standards of maintenance. Wheel noise can be reduced considerably by use of grooves filled with lead



Results in eliminating noise plotted to logarithmic scale

TO DETERMINE the efficiency of various methods of wheel silencing numerous tests have been made with the noise-measuring apparatus of the committee on noise reduction of the American Electric Railway Engineering Association. The set-up for the wheel test is shown in an accompanying sketch (Fig. 1). The essential feature of this test consists of striking a uniform blow on the tread of the wheel while it is mounted in the customary manner upon its axle. The wheel under test is blocked up to free it from contact with the rail.

Tests were made of four different wheel conditions as follows: (1) Conventional forged steel wheel without any quieting device, (2) same wheel with four 3-in. wooden blocks bolted to the web near the rim, (3) same wheel with lead ring insert as shown in accompanying sketch (Fig. 2), and (4) resilient wheel as shown in another sketch (Fig. 3).

A sufficient number of tests were made in each case to obtain reliable results. Four typical curves made by the noise evaluating apparatus are reproduced in Fig. 4. From this the silencing value of the various schemes is readily apparent, their ratio being: (1) Conventional forged steel wheel, sound value, 100 per cent; (2) conventional wheel with wood blocks added, 85.9 per cent; (3) conventional wheel with lead insert, 49.7 per cent, and (4) resilient wheel, 16.4 per cent.

Since these tests were made another scheme has been proposed for accomplishing the same purpose. It consists of the use of a ring of iron welded in four spots to the under side of the wheel tread. This plan has been used successfully on gears. Tests are under way to fix a definite value to this scheme. It is believed that its effectiveness will equal that of the lead ring and will have the added advantage of more economical installation.

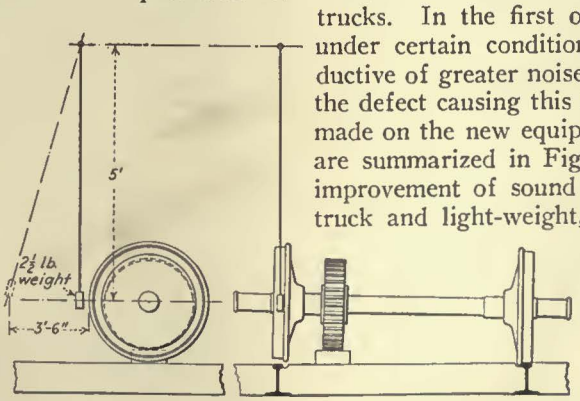


Fig. 1—Set-up for testing various sound muffling methods for car wheels

It must be remembered that the above tests refer to the damping of the ringing or high pitch sounds emanating from the wheels themselves. It must not be inferred that the total noise of the car can be reduced in the proportion shown, but only the sound from the wheels themselves. In other words, all of the car wheels may be arranged with the lead ring and yet it may be difficult to determine by ear that any improvement had been made because the noise due to this particular source is so small a part of the whole that the difference cannot be recognized without instruments.

Tests have been made also on the new worm-drive trucks. In the first of these tests it was shown that under certain conditions the new equipment was productive of greater noise than the standard apparatus, but the defect causing this has now been corrected and tests made on the new equipment. The results of these tests are summarized in Fig. 5, which shows a very definite improvement of sound with the use of the worm-drive truck and light-weight, high-speed motors. With this truck, gear noise is nearly zero and the balance of the improvement is largely due to decreased weight and closer fitting parts.

The question has been raised as to the effect of composition flooring as compared with ordinary wood flooring on noise

within the car. To secure information on this point tests were made on a car with wood floor as shown in Fig. 6. After this test was made the car floor was changed to composition floor as shown in Fig. 7, and this

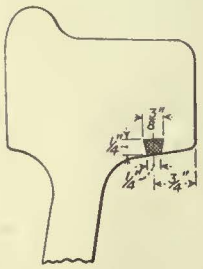


Fig. 2 — Wheel silencing by use of lead ring method

test was repeated under the same conditions. The result of the several tests is shown in the graph which is reproduced as Fig. 8, which shows that the composition flooring has a slightly beneficial effect upon noise within the car.

There is need for greater accuracy in the manufacture of gears and pinions in the interest of noise reduction. Changes in construction of gearing, such as muffling, to produce quiet operation are entirely nullified if accuracy is lacking. Gear defects consist chiefly of warpage and eccentricity due to heat-treatment.

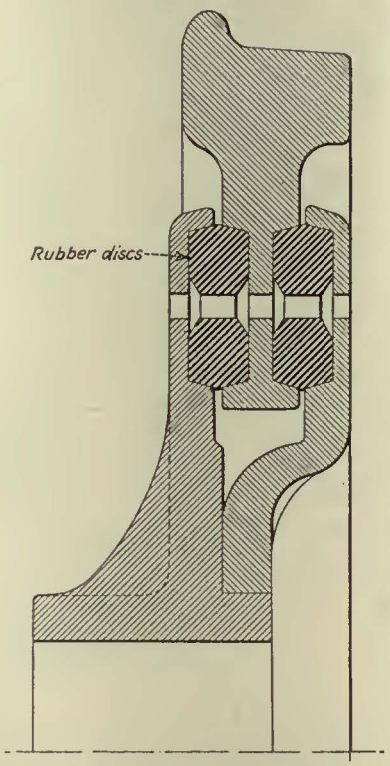


Fig. 3—Type of resilient car wheel on which tests were made

In checking over gear discard gages approved by the association in 1926 it appears that too great wear is allowed by the use of these gages. A layout to enlarged scale made of a section of a four-pitch gear and pinion

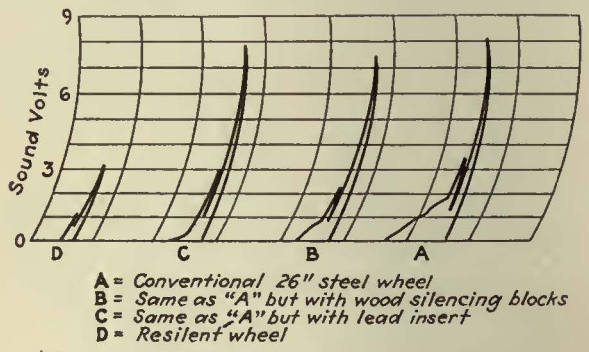


Fig. 4—Graphical results of wheel silencing tests

is presented herewith as Fig. 9. This shows new teeth and the same teeth when worn to the limit allowable by the discard gage. The amount of back lash under this condition is $\frac{1}{4}$ in., which is too great. Moreover, by the use of the present recommended design for gear discard gage, gearing which just fails of condemnation by the gage would be kept in service for a considerable period, with the result that by the time the motor is again taken down the wear of the teeth will be much greater than allowable. Noise values mount rapidly when the gear centers are spread. With a spread of gear centers amounting to $\frac{5}{32}$ in., the noise value more than doubles. A spread of this amount means a back lash of approximately $\frac{5}{64}$ in., or about one-fourth of the amount allowable by the discard gage. In view of this, it appears that the gear defect gage should be altered and limits of warpage and eccentricity established to cover the inspection of new gears.

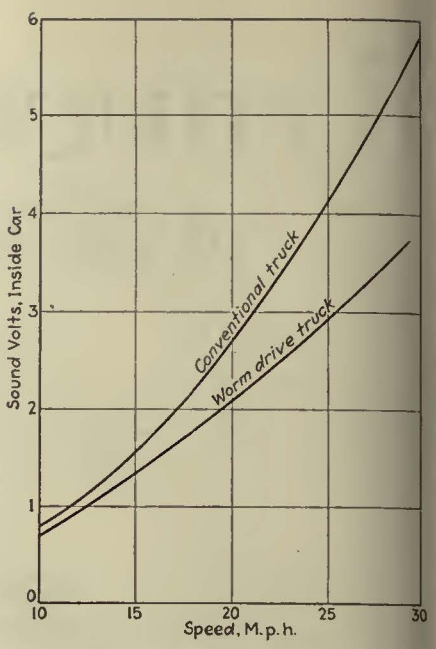


Fig. 5—Comparison of noise of standard and worm-drive trucks

Gear noise is caused by vibration in the material of the gear. The reasons for this may be summarized as follows:

1. Unequal loading of individual teeth, i.e., the load is borne by more teeth at one period than at another, and the increased compressive strains produce vibration.
2. Actual concussion caused by one tooth disengaging before another takes up the load. This allows the following tooth to strike a hammer-like blow with resultant noise and is apt to occur with gearing of low pitch or with spread gear centers. It may also occur during idling.
3. Inaccurate cutting or distortion due to heat treatment may cause the load to be borne by one tooth at a time whereas two or more should always be in engagement
4. Faulty alignment, causing the load to be carried on part of the tooth instead of being distributed over the whole width of the tooth.
5. Bottoming or actual interference of gear teeth.
6. Damaged gearing.

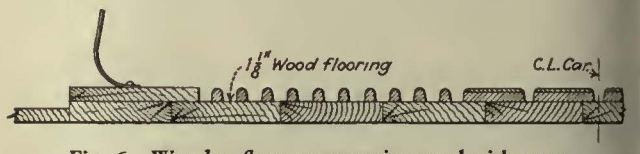


Fig. 6—Wooden floor construction used with tests

As a further step toward the manufacture of quieter spur gearing, it is suggested that attention be given to the use of gears of greater diametral pitch and consequently smaller teeth.

Tests were made on two stretches of track of differing construction but with identical car operation. One type of track was built with steel ties and compressed concrete, as shown in Fig. 10, while the other had granite nose block and compressed concrete pavement with rails

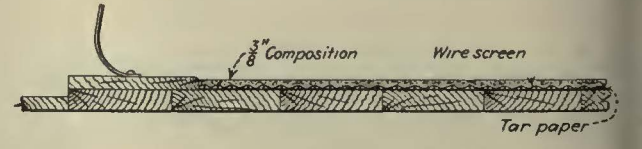


Fig. 7—Type of composition car floor used in tests

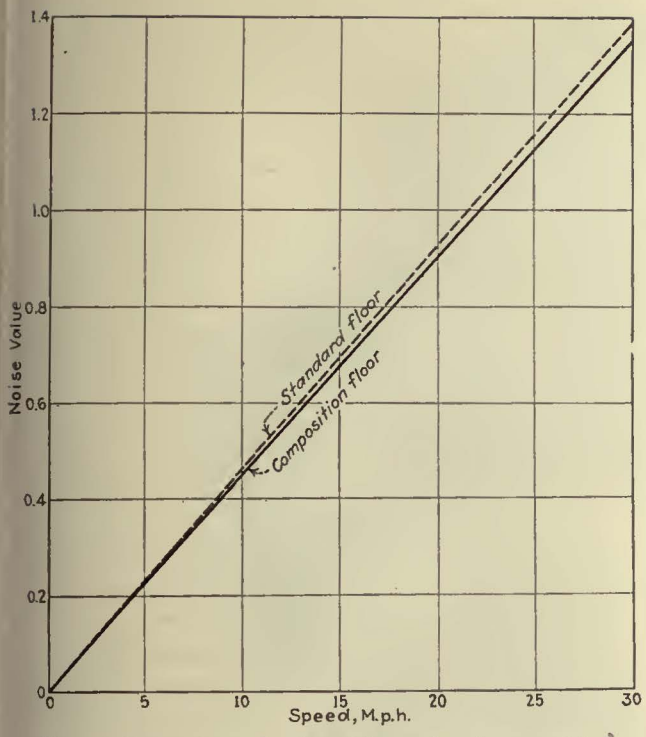


Fig. 8—Comparison of noise with wood and composition floor cars

on wooden ties, as shown in Fig. 11. The sound was measured inside and outside the car, and typical curves showing the results are given in Figs. 12 and 13. These tests indicate that the wooden tie construction is materially quieter than the monolithic concrete type. It is hoped that additional tests on track noise can be made during the coming year, as it is felt that this is important and has been inadequately studied.

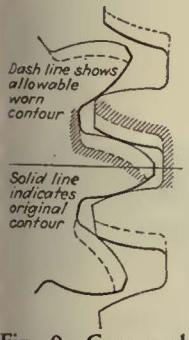


Fig. 9—Gear and pinion, showing original outline and worn condition allowable with present standard gear discard gage

Much has been done through tests to show what can be accomplished in the way of making present car equipment quiet. A modern type car seating 52 passengers and equipped with four 35-hp. motors was selected, it being at the time a noisy car. Progressive changes were made in the car to make it quiet, and by measurements taken the noise value of each step was determined.

Tests were first made with the car as found, to measure the amount of noise which it was creating. It was apparent to the ear that the gearing was very noisy so the car had its gears and pinions changed and the test repeated. In changing the gearing no special gears were used, merely new stock gearing without special selection. This change showed much improvement.

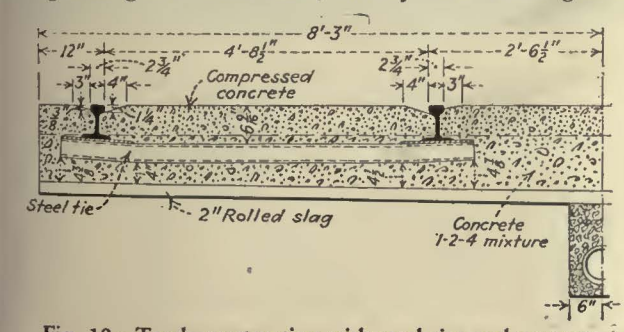


Fig. 10—Track construction with steel ties and concrete

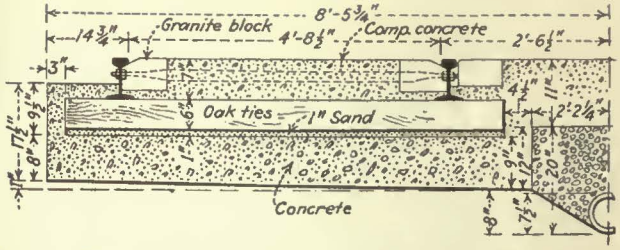


Fig. 11—Granite nose block and compressed concrete pavement with rails on wooden ties

Following this test the gear cases were covered all over with $\frac{3}{4}$-in. felt and a third set of tests made. This was found to have resulted in still further reducing the noise. Next, the underside of the car floor was covered with $\frac{3}{4}$-in. soft felt and tests under this condition again showed material betterment.

The next step was to equip the trolley base with a resilient mounting. Rubber was used for this purpose, the type of support being identical with that used by the noise reduction committee in its air compressor tests of 1927. The entire weight of the base was carried on four rubber supports, one of which is shown in detail in Fig. 14. This mounting effectively absorbs the trolley vibration.

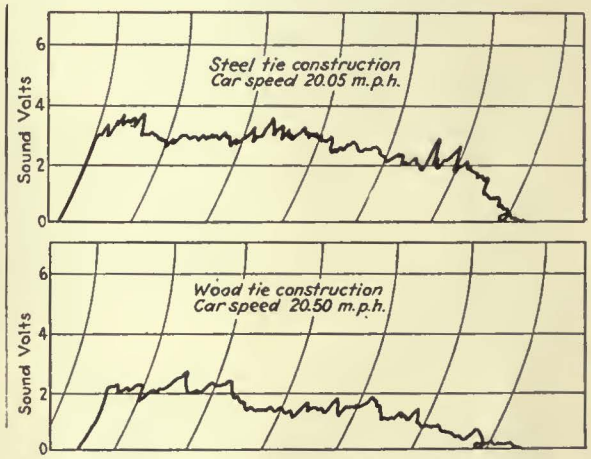


Fig. 12—Comparison of noise measured inside car while operating over track with wood and steel ties.

The final experiment included changing the car wheels

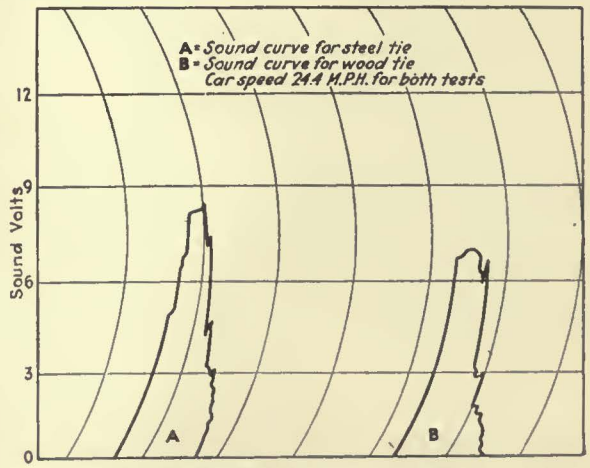


Fig. 13—Comparison of noise measured at the curb line while car was operating over track with steel and wood ties

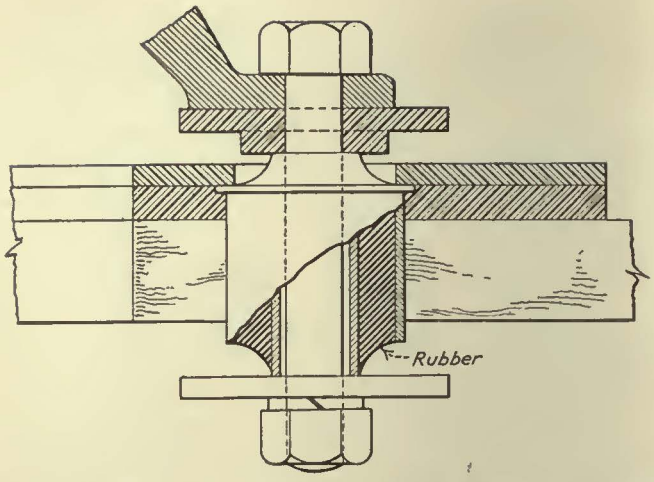


Fig. 14—Method of mounting trolley base to eliminate noise

and equipping with resilient wheels as shown in Fig. 3. One pair of these wheels uses heat-treated aluminum for the central section. Moreover, the construction of this wheel permits not only vertical motion but radial motion as well. Consequently, in starting the sudden jar on the gear is cushioned. In addition, this type of wheel improves the riding qualities of the car very materially.

Results of these progressive tests are shown in Fig. 15, from which it will be seen at a glance that each step has been productive of definite results. It must be remembered that these curves represent definite scientific measurements made with all possible care and the personal element is eliminated. Sound vibration amplitude measurements are made with a recording meter while speed measurements are taken from an indicating tachometer. The same car was used throughout the tests and they were made over the same track with as nearly identical weather conditions as possible.

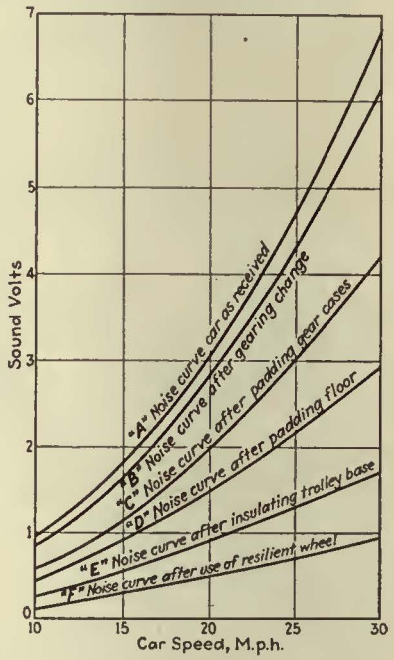


Fig. 15—Progressive results obtained in eliminating noise

In Fig. 15 the results are plotted exactly as taken from the instruments. However, we are chiefly concerned with the effect of this sound upon the ear. The ear does not interpret sound in a direct ratio to the amplitude of the wave which produces it. The ear is affected in a nearly logarithmic ratio. So, in order to get a correct picture of the situation it is necessary to change Fig. 15 to a logarithmic scale, which has been done in the cha appearing at the beginning of this article, which show the true view of the situation.

As a result of this investigation, it has been demon strated that with moderate expense the noise inside th car—that is, the noise which is heard by the passenger— can be reduced by 31 per cent. This refers to th progressive changes mentioned up to the last step, whic is the use of the resilient wheel. The last step is much more expensive item, but with it included the tota noise within the car can be reduced 47 per cent. Th noise as measured at the curb is reduced 18 per cent b the whole procedure mentioned in this article.

As so much effort is being expended upon noise reduc tion, special attention is called to one of the basic prin ciples involved in making sound insulation of maximum effect. This principle is to treat sound insulation exactly as if it were electrical insulation. Resilient padding is effective to damp the noise, but so long as there is meta contact between the parts a large amount of vibration will be transmitted. For example, with the resilient wheel the rim is entirely carried on rubber and no rigid metallic contact of any kind is permitted between the rim and the hub. If the bolts which assemble the parts of the wheel permitted metallic contact between the parts the effectiveness of the wheel would be reduced. The same is true of the trolley base mounting.

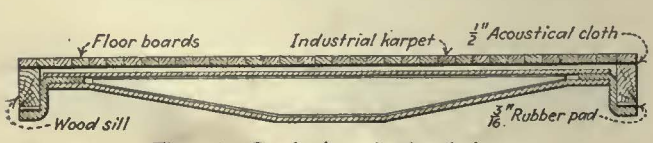


Fig. 16—Car body noise insulation

Newspapers Sold on Cars

MORNING newspapers are now sold on the cars of the New Brunswick Power Company, which operates the street railway in St. John, N. B. Every car on the system has been equipped with a box of the type shown in the illustration, which has a rack for holding the papers and a cash box which forms a receptacle for

the coins. Payment is made on the honor system. Results of this service have been very gratifying, both to the publishing company and to the railway. It has been of value to those who do not have delivery of papers at their homes. There has been no conflict with the local distributors or the newsboys, and it is stated that sales from these sources have not fallen off. Many remarks of commendation have been received from passengers. The honor system is respected and the loss from theft of papers is quite small.

Type of tank used in chromium plating, showing apparatus for the control of current strength

Life of Mechanical Parts

Prolonged by Chromium Plating

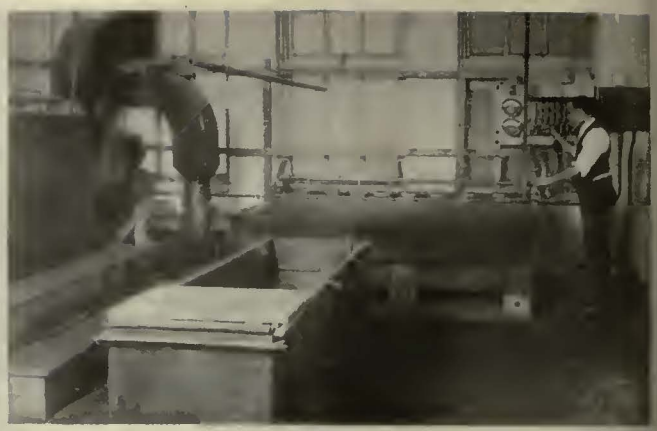
Simple and comparatively inexpensive process offers opportunities for substantial savings in electric railway field

CHROMIUM as a finish on exposed metal has become relatively commonplace of late and its application for wear resistance is rapidly receiving wide recognition. In the electric railway industry it is used considerably for car accessories requiring a non-tarnishable finish and its use has recently been extended to car side and center bearings. Its possibilities for other parts exposed to excessive wear, however, have received comparatively little consideration. Nevertheless it seems likely that the application of chromium to trolley wheels, journal and armature bearings, other wearing surfaces, and even car wheels, may offer many advantages.

Electro-deposited chromium is extremely hard, non-corrosive, immune to alkalies and to most organic acids. It is resistant to atmospheric conditions and is affected by fewer known abrasives than any other metal. Chromium can be applied directly to most metals, and when properly applied produces a product that will wear many times longer than the same base without a coating of chromium. It is not attacked by concentrated nitric acid, aqua regia and cold oil of vitriol. Chromium will also resist weather, sulphur compounds and food acids. Molten tin, one of the most corrosive fluids known, is without effect on chromium.

Considering the diamond as the hardest of any known material and assigning it a value of ten on the Moh hardness scale, chromium is given a value of nine by the same rating, a hardness greater than that of glass. In

Arrangement of tanks for cleaning and deposition of copper and nickel prior to chromium plating. The cleaning tank is in the center. After cleaning, a splash of copper is applied in the tank at the left and then nickel is deposited in the tank in the right background



Removal of fumes is an important part of the process. Fumes from the plating solution in this tank are removed by a suction draft through a series of ports located at the surface of the liquid and drawn through ducts along the sides of the tank to the exhaust fan

fact, the usual methods and instruments for determining the hardness of metals, the Brinell test and the scleroscope, do not give satisfactory results in measuring the hardness of chromium. The scratch hardness method gives a better idea. The Bierbaum apparatus and the micro-character have been used for this purpose and results indicate that even a soft deposit of chromium plate is harder than case-hardened steel. Chromium also resists oxidation at high temperatures. A temperature of 2,192 deg. F. must be obtained before metallic chromium oxidizes, and its melting point is 2,760 deg. F.

Electro-deposited chromium has been used in several industries to a considerable extent in reducing the wear of mechanical parts. In the automobile industry it is used extensively for coating piston pins so as to increase their life. In this instance the pins are hardened, ground and lapped before plating. This is done automatically, giving a coating of about 0.0001 in. thick on each side. The reason for the pin being prehardened is that it is necessary to support the thin wall of chromium by a strong metal if the part is to stand up in service.

Another use for chromium is in plating brake cams. These are made of drum forged nickel-steel machined all over, carbonized and hardened. Approximately 0.0003 in. of plating is deposited on each side. In a number of instances, chromium plated gears have proved satisfactory and chromium has been used on milling cutters to a considerable extent. The life of gear cutters has been extended from three to five times over the life of flame cutters by chromium plating.

Undoubtedly chromium plating has a wide range of possibilities in its application on electric railway cars. Probably it could be used to advantage to increase the life of journal and armature bearings. Its use is particularly worthy of consideration in building up worn bearings to their original dimensions. As already mentioned, side bearings are now being produced with a deposit of chromium to increase their life. Even the chromium plating of car wheels seems worthy of consideration, although in this instance, the tremendous strain and pounding might limit its use.

In connection with its possible use for trolley wheels, its conductivity must be considered as well as its extreme hardness and tendency to reduce friction. The resistivity of chromium is 2.6×10^{-6} ohm.-cm. This value is practically the same as that for aluminum, and is less than that of other metals except silver, copper and gold. However, that does not necessarily mean that the resistance of a contact between chromium and other metals will be low. In fact, the extreme hardness of chromium might tend to hinder intimate contact, and so reduce its usefulness for trolley wheels.

At left, buffing unit on which objects are polished prior to chromium plating. At right, motor-generator set employed to supply the heavy current required in chromium plating

The methods of procedure in the application of chromium are similar to those attended in the depositions of nickel or copper. If the base metal is iron or steel or die-cast, it is scaled or cleaned, a splash of copper is applied, and it is then immersed in a nickel bath. In some instances the nickel is applied directly to the base metal without first striking the object in the copper. Striking an object is done by placing the object in a bath and then passing the current through for a flash. Great care must be taken that upon entering the nickel bath the object should be chemically clean. An alkaline solution is used to accomplish this. Caustic soda dissolved in hot water makes a good cleaner. The caustic removes whatever grease there may be on the object. Rinsing is also very important. The object should be rinsed in clean water several times after each bath. If it goes into the nickel tank with any particles of dirt or grease clinging to it, the deposit of nickel will peel.

For protection against corrosion a piece of iron or steel is plated in a nickel tank for a duration of from 30 minutes to one hour, depending on the thickness of the coating desired. After the object is taken from the bath completely covered with nickel, it is rinsed and dried. As a bright deposit of chromium usually is desired, the article next enters the polishing room. Here the deposited metal is polished to a degree of smoothness and buffed to a finish. Then it is again cleaned and is ready for the chromium tank.

The object may be left in the chromium tank for a period of from three minutes to three hours, depending on the thickness of the deposit required. Under proper conditions, a three-minute deposit will measure 0.00002 in. This deposit, though very thin and shell-like, will be found to be an impervious metal coating, bright in appearance and hard in substance.

Chromium has been evenly plated by a commercial process up to 0.015 in. in thickness, according to W. N. Phillips of the General Motors Corporation. This deposit was on a ring gage and was very evenly plated. On plug gages about 0.0005 in. of chromium has been found to be a satisfactory thickness.

Friction Between Chromium and Other Metals Usually Very Low

Oil seems to adhere to the surface of chromium in a satisfactory way, and the coefficient of friction between chromium and other metals is usually very low. In testing an automobile fan with a cast-iron bearing and carburized shafting with no lubrication, with a chromium-plated shaft the bearing operated fairly successfully for two hours with very little scuffing, whereas a carburized shaft almost cut out the cast-iron bearing in less than two hours.

Occasionally electroplated chromium has failed to adhere to the base metal under severe conditions of service. According to W. Blum, chemist of the United States Bureau of Standards, its adherence depends on the conditions of deposition, the composition of the base metal, the method of cleaning or preparing the base metal, and the conditions of service. Although the hardness of chromium is said to be produced at relatively high current densities, it has been observed that these chromium deposits may have, on the surface, a network of hairline cracks. It is probable, therefore, that with severe conditions of service, deposits with less than maximum hardness but with slightly greater ductility will be more satisfactory. As a rule, it is more difficult to plate certain of the alloy steels such as those for tools and dies, than to plate carbon steel.

It is the belief of J. M. Braunstein that a thorough and complete knowledge of the process is necessary in order to apply it successfully. The ordinary elements—current density and thermal control—are important factors that require careful study. The concentration of the bath is as important as the temperature at which the bath is used. This knowledge, however, is easily acquired and will enable the inexperienced to apply chromium successfully.

Two convenient methods exist for chromium plating parts used by electric railways. For the larger companies, the most economical plan probably will be to install the necessary equipment in their own shops. For the smaller companies, however, it probably will be cheaper to send out the parts to some commercial chromium plating plant.

Oil in Barrels Should Be Protected from the Weather

By Harold L. Kauffman
Petroleum Consultant, Denver, Col.

RAILWAY maintenance men complain frequently to oil refiners or jobbers who furnish lubricating oils in barrels, that an appreciable quantity of water is found mixed with the lubricant. Precautions taken by oil refiners make it certain that the oil is free from contamination when shipped. How, then, does the water get inside the barrel?

During the past ten years the writer has had occasion to adjust a number of such complaints, and it was found in almost all cases that the barrel of oil had been allowed to stand exposed to the weather. Variations in temperature, together with extremely humid atmospheric conditions, may cause a tightly sealed barrel to "breathe in" water.

As an example, if a closed barrel containing 50 gal. of oil has a certain volume at 65 deg. F., the volume will be greater at 95 deg. F. Hence, as the temperature and volume increase the air above the oil is forced out through the vent plug or bung. If the barrel is stored outside, a rainstorm may result in several quarts of water collecting on the barrel head. When the temperature of the oil decreases a vacuum is created, which draws in some of the water from the head. Under extremely humid atmospheric conditions water may be drawn from the air into the barrel.

This shows the necessity for keeping barrels of oil safely protected from weather conditions. Railway maintenance engineers or others in charge of storage of lubricants for electric railways should make certain that adequate protection is given, and then troubles from the accumulation of water will decrease.

"Quick Transportation for Everyone"

IN a recent advertisement, captioned "What Makes a Public Utility?" the Buffalo *Evening News*, Buffalo, N. Y., compared the service rendered by its classified section to public utility services. The advertisement pays a tribute to the electric railways with the following words: "Street railways mean quick transportation for everyone."

Excellent natural illumination is a feature in this garage of the Worcester Consolidated Street Railway

Large side windows admit plenty of light into the bus repair shop of the Twin City Rapid Transit Company

Bus Maintenance WELL

Survey of garage facilities and practices on 41 electric railway properties emphasizes importance of frequent and regular bus inspection. Structures specially built for garage purposes are favored over remodeled car houses. Careful attention paid to training of personnel

INFORMATION disclosed by a survey made by ELECTRIC RAILWAY JOURNAL covering 41 of the largest bus operating companies in the United States and Canada shows that bus maintenance practices are well standardized. These companies, which operate in all some 6,200 buses, have a total of 141 garages. While many of these garages are remodeled carhouses, the trend of late has been strongly toward the use of buildings specially designed and equipped for bus operation and maintenance. The survey shows that in most instances an ample and well-trained personnel is employed in this work.

From data collected on the size of the garages it appears that an average of 300 to 350 sq.ft. per bus answers the needs on most properties. Although a smaller area would probably be sufficient for mere storage, this amount of space is needed for inspection, cleaning and making minor adjustments while the buses are out of service. Good lighting, which is essential to proper maintenance, has received special attention in the recent design of garages.

A number of railways have garages capable of accommodating from 100 to 200 buses, but the majority appear to favor a capacity of about 40 to 60 buses. The largest garage included in the survey is one belonging to the Department of Street Railways, city of Detroit, where 190 buses can be accommodated in a space 139x498 ft.

The survey shows that a considerable number of companies have remodeled former carhouses to serve as bus garages. Although this procedure undoubtedly possesses certain advantages from the standpoint of economy, the results are not always entirely satisfactory from an operating standpoint. It was pointed out by one large railway bus operator that the ordinary carhouse is too narrow to serve efficiently as a bus garage. There is a marked tendency nowadays to build bus garages more nearly square. Storage of buses over long, continuous pits, such as are found in carhouses, is not considered to be the best practice. On account of their being free-wheel vehicles, great care must be exercised under these conditions in moving them in and out. Moreover, their

construction is such that many heavy parts can be removed only by being lifted upward instead of being lowered into the pit, as is customary with street cars. Despite these advantages possessed by buildings specially designed for bus maintenance, the layout and location of various departments in garages continue to reflect strongly the influence of carhouse layout and design.

No general rule is followed with regard to the location of garages in relation to the routes on which the buses operate although the desire to reduce dead mileage to a minimum seems more than anything else to be the determining factor. The majority of operators prefer to have their garages at or near the outer end of the routes, but there are also many who believe that by having the garages in the center of the area served, the buses can be operated with a smaller amount of dead mileage.

AVERAGE MACHINE TOOL EQUIPMENT OF ELECTRIC RAILWAY GARAGES

One	electric drill	for	every	17	buses
"	lathe	"	"	38	"
"	grindstone	"	"	28	"
"	welding set	"	"	38	"
"	grease pump	"	"	18	"
"	jack	"	"	4	"
"	hoist	"	"	27	"
"	gas pump	"	"	23	"
"	oil pump	"	"	15	"

Frequent Inspection Necessary

Bus maintenance usually is classified under the four general headings of inspection, adjustment and minor repairs, unit changes, and general overhaul. In most instances the first two are taken care of in the garage, while the last two are performed in some central repair shop which often forms a part of the railway's general car repair shop.

It is generally conceded that inspection is the most important of these four items, because it is the pivot upon which the whole process of maintenance turns. It was shown by the survey that the average inspection period of a bus is about 1,900 miles. The lowest reported was 500 miles on the property of the San Antonio Public Service Company, and the highest was 5,000 miles at St. Louis. With this company, however, the inspection period is the same as the overhaul period. In other words, the company makes no distinction between inspection and overhaul.

It was emphasized by several operators that this inspection is not merely a casual examination to see that everything is all right, but that it consists of a thorough examination of engine, chassis and body, as well as tightening up of all bolts and general greasing. Many companies believe that the oil in the crankcase should be drained at this time, although others think it bad practice to wait for general inspections and they advocate oil renewal after every 1,000 miles of service.

Practice varies concerning night work in garages. Most operators hold the opinion that no heavy repair work should be done at night, but it is thought that minor repairs which are reported by the drivers as being necessary can be performed by the night force, so as to have the bus ready for the morning rush-hour service.

With mechanically-driven buses it appears that the most satisfactory results are obtained when buses are taken off the road for their annual overhaul after about 60,000 miles of service. Most of the maintenance officials consider that after this amount of

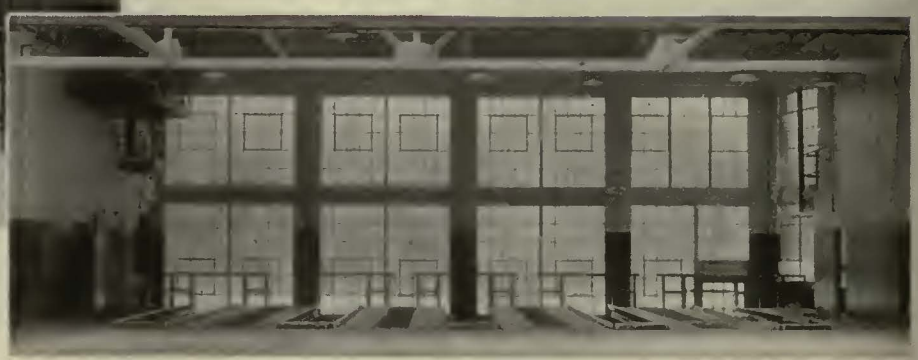
STANDARDIZED

Gas and oil filling station is located just inside the door of this garage of the Twin City Rapid Transit Company

Inspection Facilities of Various Kinds Used in Electric Railway Garages

Convenient pit arrangement in bus garage of the New Orleans Public Service, Inc.

Pit construction in the Dorchester garage of the Boston Elevated Railway is of unusual design with exceptionally good ventilation and light



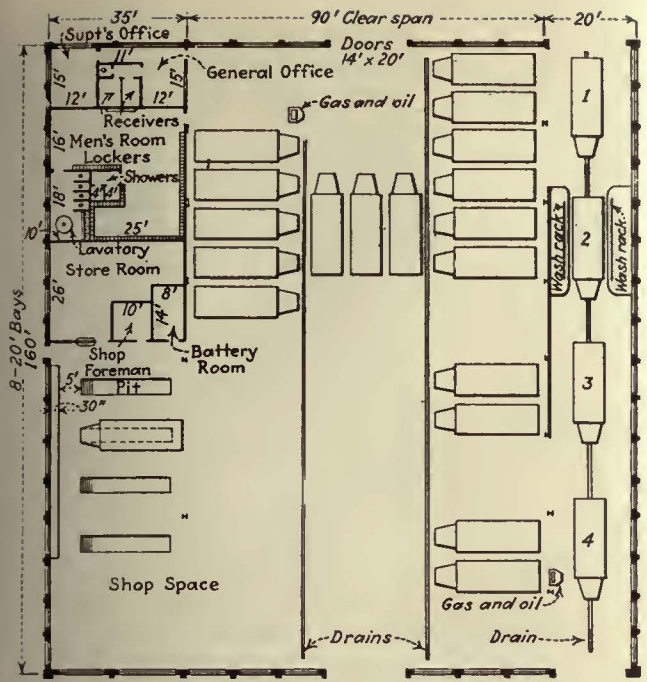
Top view of inspection pit in Dorchester garage of Boston Elevated Railway

Pits in the new Frankford garage of the Philadelphia Rapid Transit Company are arranged at an angle of 45 deg. with the side walls

Brake tester and pit in the Charles Street garage of the United Railways & Electric Company of Baltimore

Ramps used instead of pits in one of the Public Service Co-ordinated Transport garages

Ingenious method of raising hood for inspection at Milwaukee



Typical layout for garage to accommodate 45 buses

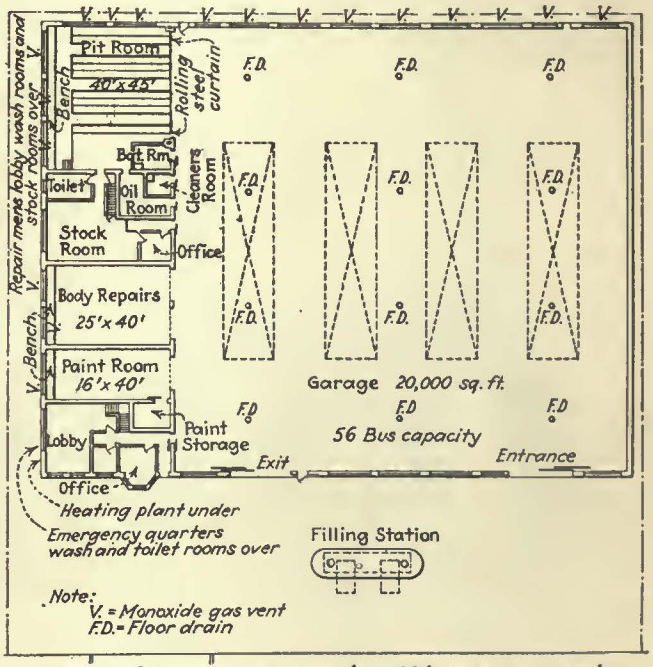
service the vehicle will be badly in need of a fresh coat of paint, and usually the body also needs many repairs for which the garage repair shops are not fully equipped. The maximum overhaul period used by any company included in the survey was 105,000 miles at Springfield, Mass.

It was found that most companies maintain their mechanical-drive buses according to the unit system. In other words, when a unit needs major repairs it is taken out and another unit substituted. After removal the old unit is sent to a central repair shop where experts on that particular kind of work make the necessary repairs. Such replacements usually can be made during the hours that the bus is out of service, thus keeping a maximum number of vehicles on the road for the morning and evening rush hours.

With regard to gas-electric buses, it seems that many operators have not yet ascertained the most satisfactory basis of inspection. Some companies operating gas-electrics are of the opinion that they can be maintained according to the same schedules which govern the upkeep of the mechanically-driven equipment. Kilowatt-hour

Bus shower bath in the garage of the Northern Ohio Power & Light Company at Akron

meters are used frequently as a guide to determine the overhaul period for street cars, however, and this method of determining inspection dates appears to have possibilities for buses also.



Design of garage to accommodate 56 buses as proposed by A.E.R.E.A. committee

Recently built garage of the Virginia Electric & Power Company at Richmond

Summary of Garage Capacities and Personnel

Name of Company	Number of Garages	Names of Garages	Number of Buses	Number of Mechanics	Number of Helpers	Number of Pits
Boston Elevated Railway	5	.....	306	66	1	8
Capital Traction Company, Washington	2	Main	37	6	4	2
		Takoma	1	..	..	..
Cincinnati Street Railway	1	.....	75	23	17	6
Community Traction Co., Toledo	1	.....	125	21	3	5
Connecticut Company	9	.....	138	..	..	..
Delaware Electric Power Company	2	No. 1	18	5	..	1
		No. 2	36	12	..	2
Dept. of Street Railways, Detroit	5	Coolidge	104	36	2	5
		Clark	29	9	1	1
		Hercheval	109	45	3	2
		Gary	33	19	1	4
		Second Ave.	190	85	3	2
Eastern Massachusetts Street Railway	6	.....	82	..	..	2
Georgia Power Company, Atlanta	1	.....	29	4	3	1
Houston Electric Company	1	.....	67	15	13	7
Interstate Public Service Company	3	Greenwood	15	8	4	1
		Greenwood	9	..	..	..
		Louisville	6	1	..	1
Kansas City Public Service Co	1	.....	70	..	6	5
Louisville Railway	1	.....	40	6	6	2
Miami Beach Railway	1	.....	50	7	2	4
Middlesex & Boston St. Ry	5	Waltham	41	12	6	..
		Auburndale	17	2	3	..
		Natick	13	2	1	..
		Lexington	7	3	..	..
		Hopkinton	4	1	..	..
Milwaukee Electric Railway & Light Co	2	No. 1	60	21	30	9
		No. 2	52	4	2	4
Montreal Tramways	1	.....	98	14	..	3
New Orleans Public Service, Inc	1	.....	37	7	6	5
New York State Railways	6	Rochester	27	8	7	3
		Pittsford	3	1	..	..
		Syracuse	19	6	6	2
		Utica	11	3	4	1
		Rome	4	1	..	..
		Dodgeville	5	1	..	..
Northern Ohio Power & Light Co	5	Kenmore	103	43	5	..
		Central	90	33	10	..
		Brittain	19	7	2	..
		Canton	39	11	5	..
		Dover	4	1	1	..
Penn-Ohio System	4	Youngstown	85	21	14	8
		Cleveland	8	4	1	1
		Warren	14	1	3	..
		New Castle	5	1	1	..
Philadelphia Rapid Transit Co	8	No. 1	175	..	..	14
		No. 2	125	..	..	10
		No. 3	106	..	..	9
		No. 4	140	..	..	12
		No. 5	75	..	..	6
		No. 6	27	..	..	2
		No. 7	12	..	..	1
		No. 8	9	..	..	1
Pittsburgh Railways	2	Lexington	50	27	6	..
		Northside	20	6	3	..
Potomac Edison Company, Hagerstown, Md.	2	No. 1	20	8	4	1
		No. 2	10	3	2	..
Portland Electric Power Company	1	.....	40	15	..	For 10 buses
Pub. Serv. Co-Ordinated Transport (New Jersey)	33	.....	1,781	..	..	..
St. Louis Public Service Co	2	No. 1	27	5	3	2
		No. 2	25	15	6	3
San Antonio Public Service Co	1	.....	75	18	..	5
Seattle Municipal Railway	2	No. 1	22	4	3	1
		No. 2	21	5	1	2
Springfield Street Railway (Mass.)	3	Bond Street	34	5	3	..
		Westfield	7	1	1	..
		Palmer	5	1	..	..
Terre Haute, Indianapolis & E. Traction Co.	1	.....	19	6	3	..
Third Ave. Railway, New York	1	.....	125	..	..	11
Toronto Transp. Commission	4	Davenport	90	22	9	3
		Howard Pk.	46	2	2	1
		Sherbourne	13	3	5	1
		Hamilton	6	2	1	..
Twin City Rapid Transit Co., Minneapolis	3	No. 1	69	38	5	3
		No. 2	25	..	..	..
		No. 3	7	..	..	..
United Elec. Ry., Providence	2	Providence	72	44	..	..
		Woonsocket	19	6	..	2
United Railways & Elec. Co., Baltimore	2	Center	58	36	..	4
		Outer End	41	19	..	..
United Traction Co., Albany	2	Troy	30	9	3	4
		Albany	46	24	3	7
Virginia Elec. & Power Co	4	Richmond	80	21	11	3
		Norfolk	80	26	12	1
		Portsmouth	30	5	3	..
		Petersburg	8	1	1	..
Washington Ry. & Elec. Co	2	No. 1	92	12	17	2
		No. 2	4	..	..	1
Winnipeg Electric Co	1	.....	48	8	12	1
Worcester Con. St. Ry	3	Grove Street	42	15	6	4
		S. Bridge	14	3	2	..
		Uxbridge	8	2	..	..
Total	141		6,176	...	...	...

The Philadelphia Rapid Transit Company has obtained particularly good results with this system. Although the kilowatt-hour inspection plan was originally instituted for the electrical equipment only, it has been found also to be a good guide for the maintenance of the mechanical parts of gas-electric buses. After a bus has run an equivalent of 2,500 kw.-hr. it receives a general inspection similar to that given to a mechanically-driven bus, and in addition an examination of all connections of the electrical equipment. These inspections are repeated every 2,500 kw.-hr., until a total of 35,000 kw.-hr. has been reached, when the electrical units are removed from the vehicle and subjected to a thorough inspection to see that all insulated parts, commutator and field coils, etc., are in perfect running condition. This process is repeated until the meter records 105,000 kw.-hr., when the bus is given a general overhaul and a new coat of paint is applied. The same cycle then begins anew and continues until the bus has been in service amounting to a total of 210,000 kw.-hr., when it is considered that major improvements should be made in order to avoid approaching obsolescence.

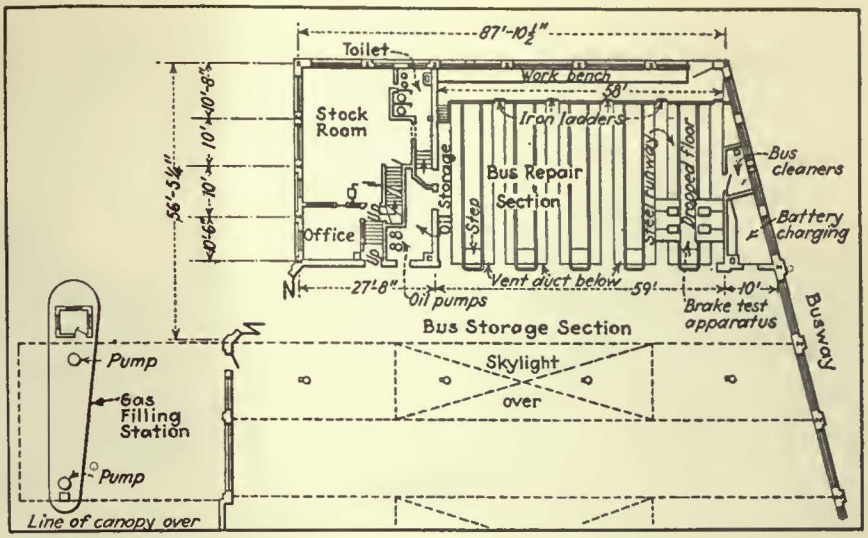
Machine Tool Equipment

From the figures of the companies included in this survey it is evident that the machine tool equipment of the garages is ample, particularly with respect to the smaller apparatus such as jacks, grease pumps, grinding stones and hoists. The larger tools, such as lathes, electric drills, and welding sets, are usually confined to those garages which do heavy repair work and, of course, to the central repair shops. The average number of buses served by each tool is shown in an accompanying table.

With regard to the number of pits required in a garage there seems to be a wide variety of opinion. The survey indicates, however, that on an average one pit for every sixteen buses will be adequate for the ordinary run of maintenance work. Although the latest design of pits is well arranged with respect to ventilation, many maintenance men believe that ramps provide greater safety from carbon monoxide poisoning as well as better lighting. On the other hand, pits can be more easily provided with shelves for small tools. The construction of ramps is usually cheaper than that of pits. It is necessary, however, to have a somewhat larger

space available where ramps are used, as inclined approaches are necessary.

The survey shows that there is a marked preference for separating the repair shop for buses from the car shop. The majority of railways also have separate maintenance personnel for buses and cars even where they operate gas-electric vehicles. A type of organization frequently found is that where one foreman is in charge of bus maintenance and a second foreman in charge of car maintenance, both reporting to a general foreman.



Arrangement of new Dorchester garage of Boston Elevated Railway

Training of Personnel Important

The personnel engaged in bus maintenance work at the garages covered in this survey averages about four men for every ten buses. Of this number three are mechanics and one is a mechanic's helper. Some companies, however, say that they do not differentiate between mechanics and helpers.

Training of mechanics for bus maintenance work is considered to be a very serious problem. The natural training school for these men seems to be in factory work in allied trades. Formerly this was the source from which most of the bus mechanics came, but in recent years the demand has become greater than the available supply and many railways now train their own mechanics. This has been found advantageous due to the fact that with mass production methods in the larger factories the mechanics do not receive the all-around training which they used to get, and hence come to the garages familiar with only one or two parts of the vehicle. The survey shows that a majority of railways prefer to train their own mechanics, due partly, perhaps, to the fact that necessity compels them to follow this course but influenced also by the fact that a mechanic who has been trained elsewhere often is hard to change to the standards required in railway bus maintenance.

Not the least important among the facilities for maintenance and repair of buses is the garage storeroom. In 48 garages on the 41 railway properties included in the survey the average size of storeroom was found to be slightly under 1,000 sq.ft. A total of some 3,000 buses are housed in these 48 garages, making the average amount of storeroom space provided about 16 sq.ft. per bus. In a few instances the companies use the railway storeroom for holding bus material and supplies also, although most companies prefer to have separate storerooms. The largest storeroom in any garage included in the survey is that of the Second Avenue garage of the Department of Street Railways, Detroit, which has an area of 4,400 sq.ft., or about 22 sq.ft. per bus.

Outside filling station of the Virginia Electric & Power Company at Richmond

Recently built Lake Street garage of Public Service Co-ordinated Transport

Report Forms Used by New Orleans Public Service, Inc., for Track Inspection and Maintenance Work

Form 742-0558 — DAILY TRACK REPORT—LABOR JOB SHEET — 9-28—12M

Stretch No. 242 Job No. Date 2-14-29

Location Villere, Elysian Fields - Almonaster W. O. No. 854

LABOR

No. of Men	CLASSIFICATION	Hrs.	Rate	Amount
1	Foreman	9		5.40
5	Laborers	47	30	14.10
	TOTAL			19.50

MAINTENANCE

DESCRIPTION	Acct. No.	No. of Men	Hrs.	Amount	TOTAL
Foreman	7-1	1	9	5.40	
Repair Sp. Work	6-2				
Excavating	7-1				
Renew Ties	7-1				
Renew Rail	7-1				
Gauge Track	7-1				
Surface Track	7-1				
Repair Joints	7-1	5	47	14.10	
Concreting					19.50
Repair Paving	5				
" Bond Planks	8				
" Paving Sp. Wk.	8-1				
" Cross Walks	12-4				
" Foot Landings	12-4				
" Bridges	11				
Watching					
Miscellaneous					

Weather Cloudy - light rain Foreman George Bunch

1

FUTURE MAINTENANCE SCHEDULE

JOB NO.	W. O. NO.	FOREMAN	LOCATION	WORK TO BE DONE	MEN REQUIRED	DATE ASSIGNED	TIME REQUIRED	DATE COMPLETED	STRETCH NO.
	1744	Verbeck	Jefferson Ave. and Magazine Street.	Raise and tighten low and loose switch tongue in heel of S-2	2	1/19/29	1 Hour	JAN 25 1929	686
	1743	Verbeck	Jefferson Ave. and Constance Street.	Reset loose switch shell	3	12/7/28	2 Hours	DEC 13 1928	685
	1871		Jackson Ave. and St. Charles	Tighten and surface loose joints	4		6 Hours		661
	1877	Bunch	Jefferson Ave. bet. Laurel & Annunciation	Surface and tighten up 8 joints where car derailed on outbound track. Replace necessary ties to keep joints to gage. Replace necessary bolts in joints.	4	12/21/28	3 Hours	JAN - 2 1929	236
	1886	Verbeck	Jefferson Ave. and Prytania Street	Raise and tighten low and loose switch points in heel	2	1/10/29	1 Hour	JAN 25 1929	687
	2122	Bunch	Jefferson Ave.	Tighten, surface and set up loose joint with base plate for welding	2	2/6/29	1 Hour	FEB 15 1929	234
	2119								
				...ghten, surface and set up loose joi... ...se plate r welding	4	2/6/29	2 Hours	FEB 15 1929	234
				...hten, surface and set up loose j... ...welding			...Hour	FEB 15 1929	234
				...lace worn switch point with a ...					690
				...hten, surface and set up joint... ...welding.					691
				...ace every 4th tie with a ... ...old tie plates on new ties... ...s in worst places. Use c...					235
				...n, and raise tongue of ...				1929	686

2

Form 31c — NEW ORLEANS PUBLIC SERVICE INC. — MAINTENANCE INSTRUCTIONS — ROADWAY DEPT. — 854 — 2/6/29 — 19

CNCM

Mr.

Work to be Done

VILLERE ST. ELYSIAN FIELDS AND ALMONASTER.

Rail Section: 203

1. In front of 2265 - in track - outside rail
2. In front of 2201 - in track - inside rail
3. In front of 2120 - out track - outside rail.

Replace existing joint plates with new joint plates with new bolts. Put tie plates on ties. Use slag for needed ballast in surfacing.

Material: 3 - prs. 203 Joint plates
36 - 1" x 3 3/4" track bolts
36 - 1" nut locks
20 - good 2rd tie plates
2 - Cu. yds. slag
2 - Cu. yds. shells for paving.

D. E. Delph Ass't. Roadmaster.

Charge to 242

Work Completed By J. Bunch Date 2-14 1929

MOVING TIME ½ hr. WORKING TIME 3½ hrs.

3

Form 742-0558 — NEW ORLEANS PUBLIC SERVICE INC. — ROADWAY INSPECTOR'S REPORT — 8-28-10m

Inspector M. Kaack Date 2-7-29 Time 9.00 A.M.

Charge to 242

Location Villere bet Elysian Fields & Almonaster

House No. 2265

Report—

1. On track - Outside Rail
Two loose joints working and pounding badly. Gage ½" open at each joint. Joints are very low and will require approx. 20ft of surfacing at each.

2. In track - Inside Rail
In front of 2201.
One loose and pounding joint with ¼" lip on receiving rail. Inside joint plate partly broken.

3. Out track - Outside Rail
In front of 2120.
One loose joint with ½" opening between rails. 3 bolts missing. Joint very low and will require surfacing.

(SEE OTHER SIDE)

4

Form 742-0574-1 — MAINTENANCE EXPENDITURES ROADWAY DEPARTMENT — 12-10 2m

Month of December 1928

	SYMBOL NUMBER	LOCATION	ESTIMATED YEARLY EXPENDITURE	Expenditure Month of December	EXPENDITURE TO-DATE THIS YEAR	EXPENDITURE SINCE 1-1-26
	234	Jefferson, Tchoupitoulas - Dryades	2496.	40.55	2385.94	5618.38
	317	St. Charles, Jefferson - Broadway	1200.	38.78	1175.56	2342.03
	141	Carondelet, Canal - Erato	600.	125.22	359.18	4260.61
	112	Baronne, Canal - Howard	6000.	1372.66	5651.73	13810.04
5	226	Hurst, Joseph - Audubon	1008.	61.68	974.74	1788.57

Field paving maintenance unit at work. Truck carries paving materials and hauls oil-burning combined tar kettle and sand drier

Detailed Analysis of TRACK COSTS *Promotes Economy*

Street railway trackage in New Orleans is classified according to type and age of construction and accurate records are kept of all expenditures. These figures permit determination of most economical designs and methods

By

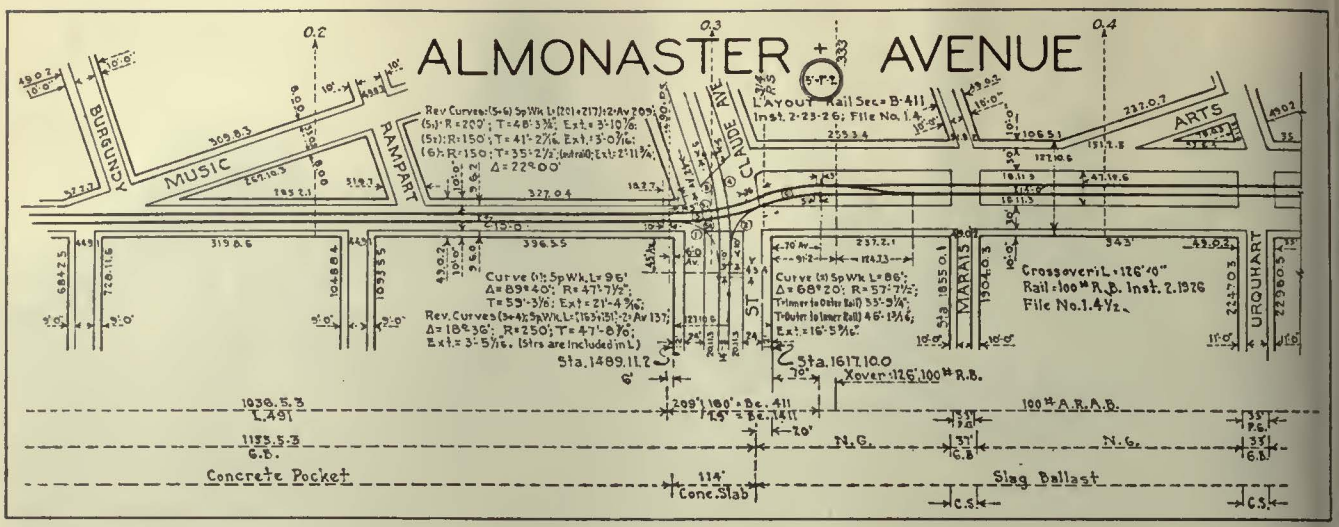
I. O. MALL

Assistant Superintendent of Roadway
New Orleans Public Service, Inc.

EXPENDITURES for the construction and maintenance of tracks are a factor of prime importance in electric railway operation, as analysis shows that the investment in permanent roadbeds, in general, comprises one-half or more of the entire property investment. Intelligent analysis of track maintenance costs is dependent upon a record of such nature that a detailed study can be made of the expenditures. Track costs, when recorded under the usual classification of accounts established by the I.C.C., are merely a group of figures that permit of balanced bookkeeping. This system does not permit of analysis and affords a convenient means for covering up expensive mistakes.

Due to the absence of recognized standards of track design in the past the average operating company has acquired numerous types of construction through its period of development. When the total maintenance cost is spread over the net mileage of such a variable track system it is impossible to analyze performance. Unless maintenance methods and cost records are given detailed attention and kept under complete control, it is inevitable that large sums of money will be wasted that might otherwise be made productive. Efficient operation requires that the roadbed be designed, built and maintained in a manner that assures an economic life commensurate with the investment. It is imperative, therefore, that a co-ordinated system of maintenance methods and cost records be utilized.

With this thought in view there have been developed in the roadway department of the New Orleans Public Service, Inc., methods and records that furnish a basis for investigating the economical aspects of track construction and maintenance. The track system is divided into track stretches. The limits of the stretches are variable, being governed by type and age of construction, and terminated at points where service is duplicated.



Alignment drawing gives complete picture of physical features of track structure

This latter feature allows the maintenance cost to be properly proportioned to each of the car lines on tracks where service is duplicated. Each track stretch is designated by a symbol location number, which appears on all orders and records pertaining thereto.

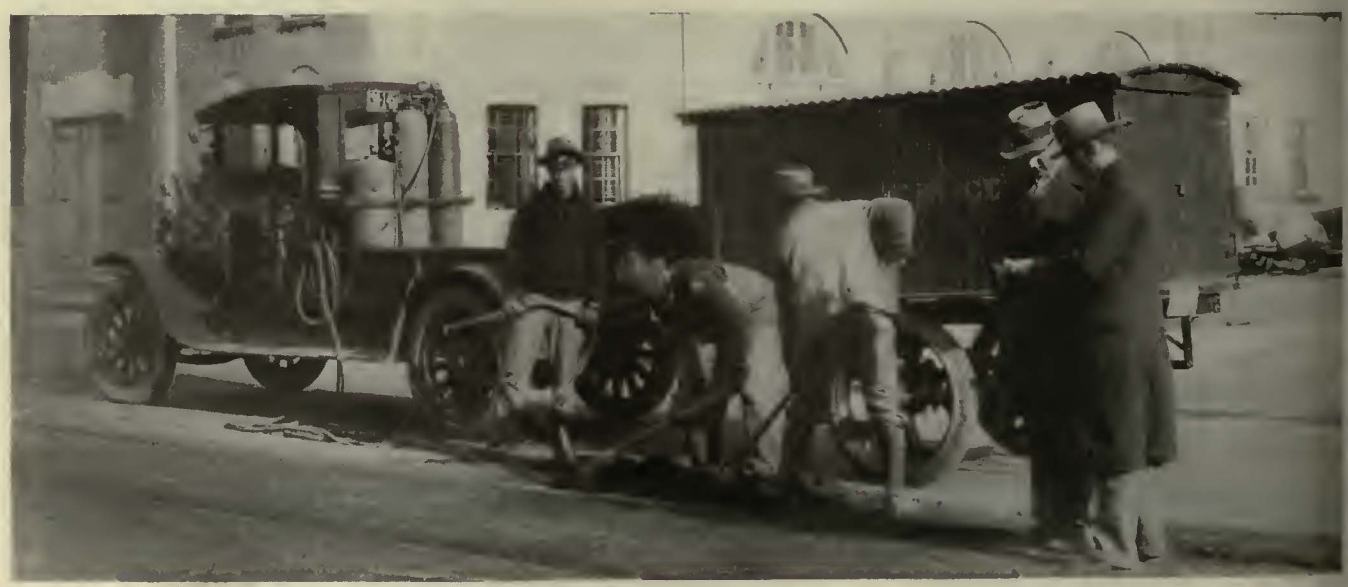
A plan record of construction, commonly known as an "alignment drawing," showing a complete picture of the physical track structure in the street, is available for reference in studying stretch maintenance costs. This drawing defines and locates intersecting streets, lineal distances, cross-sectional street dimensions, types of construction, materials of construction, all represented in such a manner as to afford a basis for analysis.

Assignment of repair work is based upon a system of thorough track inspection. Tangent track mileage is segregated into divisions and a track inspector is responsible for reporting the condition of the track in each division. The inspector makes his observations while riding the cars and supplements his notes with a careful examination made while walking along the track and watching conditions under car operation. A written report is made of all track defects and conditions. These inspection reports are forwarded to the assistant roadmaster in charge of maintenance operations.

The assistant roadmaster conducts tri-weekly meetings with the track inspectors, at which time the inspection reports are thoroughly discussed. The repair jobs are separated and classified in accordance with the urgent need of repairs. The consecutive order in which the jobs are to be executed is recorded on the "Future Maintenance Schedule." Sufficient work is outlined in advance to keep each maintenance unit busy for at least two weeks.

Every maintenance job, whether of minor or major proportions, is performed with a "Maintenance Work Order." This work order gives a complete description of the work to be done and specific directions and instructions for doing the work. It shows the track stretch symbol location that the work is to be charged to. In the assignment of jobs an effort is made to group work of a similar nature, in order that the maintenance units may become specialized. Each maintenance unit consists of an automobile truck and a trailer tool cart, properly equipped to do the required work. When a job is completed the maintenance work order is checked and the job removed from the future maintenance schedule.

The foreman of each maintenance unit makes a daily "Lahor Distribution Report." This report indicates the



Field track maintenance unit at work. Foreman discussing features of work with supervisor

total charge against the particular track stretch, as designated by the track stretch symbol number. The labor charges are distributed in accordance with the conventional classification of accounts, which enables the accounting department to keep books on this basis. Material and supply issues also carry the track stretch symbol. which completes the total charge accumulated on a given job.

Track expenditures are budgeted yearly in advance. The probable amount of money required is determined after a thorough study of the physical condition of the track. The assistant roadmaster in charge of maintenance operations, with the aid of the track inspectors, develops an intimate knowledge of track conditions. This information enables him to specify within very close limits the amount of money necessary to meet standard maintenance requirements. A cumulative statement of "Monthly Maintenance Expenditures" is prepared which shows the budget performance. At the end of each month a general meeting of the supervising personnel and maintenance unit foremen is held, at which the track stretch cost record is analyzed in detail. Variable or excessive costs, as brought out by this statement, are given special attention, together with a complete analysis of all work performed on the track stretch in question. This discussion also provides the basis for an efficient study of maintenance methods and measures the relative efficiency of different types of track construction.

Maintenance procedure, that detects failures or defects in the track structure and completes the necessary repairs while these defects are of a minor nature, minimizes the net maintenance cost. Such a procedure is possible and practical when based upon a system of regular and thorough inspection.

Advance scheduling and assignment of work eliminates delays and lost time that usually occur when work is assigned without planning. The information furnished by track inspection forms a specific basis for planning a schedule of maintenance work, so outlined as to employ the minimum of maintenance forces efficiently.

The most careful scheduling and planning of work may be of no avail unless a very rigid follow-up system of checking is employed. Adherence to instructions, quality of workmanship and efficiency of performance can be gained only by applying a systematic follow-up check on each and every assigned job.

Improvement of maintenance methods and practices can only be gained by comparative study and application. These methods and practices are an important factor in track costs. Obsolete or old-fashioned methods will soon be abandoned when competing with modern practices developed through the analysis of proper cost records.

Track inspector using straight edge gage on frog to determine extent of wear or cupping and alignment and condition of center insert

Track inspector observing effect on track of passing car watching for track movement and listening for impact noises

In making minor repairs developed practices give very little consideration to the quality of workmanship required. It is a difficult problem to educate foremen and laborers to the fact that the success of minor repairs is dependent upon high standards of workmanship. A system that provides a record of job performance creates an atmosphere of respect for the work performed and is, therefore, a conducive factor in developing the best standards of workmanship.

The written and filed record of track maintenance costs, in conjunction with a description of the work done, is of particular value in the study of track performance. This record shows when operating costs reach an amount that justifies reconstruction of the track. Comparative studies of maintenance costs, as related to types of track design, afford a basic guide for the selection of the type of track design that should be used in future construction work.

Co-operation

between departments is an important factor in bus maintenance at Toronto

No. 1. Upper floor of Davenport garage, which has a clear space 66 ft. wide.

No. 2. Overhauling chassis at Davenport garage.

No. 3. Bus engines are removed and taken to this room for repairs.

No. 4. Hydraulic refueling system is used at the Davenport garage.

No. 5. Checking up water, signs, seats, etc., before bus leaves garage.

No. 6. Driver opening air-operated garage door without leaving his seat in the bus.

No. 7. Typical bus inspection pit in T.T.C. garage.

Overhauling bus bodies at the Hillcrest general shops of the Toronto Transportation Commission

Accurate Garage Records

Insure Reliable Bus Performance

By
A. S. McARTHUR
General Superintendent Toronto Transportation Commission

VARIOUS departments co-operate in the maintenance work for the 81 buses, 90 coaches and 63 trucks and service vehicles operated by the Toronto Transportation Commission. Body repairs and painting for these 234 vehicles are carried out at the Hillcrest general shops by the rolling stock department. Chassis and engine repairs are made by the garage department at Davenport garage. This department also looks after the inspections and overhaul schedules, and all preparation of vehicles for service at four garages in Toronto and one in Hamilton. All battery repairs are done by the electrical department at the Yonge Street substation, but batteries are charged at three garages. In all of this work the keeping of accurate records plays an important part.

For the operation and maintenance of its large fleet of automotive vehicles the T.T.C. owns four garages and rents one. Howard Park garage was built in 1921, and will accommodate twelve large vehicles. It is located on the west side of the city and is equipped with facilities for all regular maintenance work but not for major repairs. The Hillcrest emergency garage was completed in 1923, primarily for overhead tower, emergency and service trucks. It is located almost in the center of Toronto and accommodates eighteen trucks. Davenport garage on the northwest corner of the Hillcrest yards property was opened in 1925 and accommodates 100 vehicles on two floors. The upper floor is at street level and the lower at the yard level, to which a ramp leads down from Davenport Road at the west end outside the

Spray painting at Hillcrest shops. "Bus" bodies are painted red, while "coaches" are painted in two-tone gray


TORONTO TRANSPORTATION COMMISSION

TIRE ON

T.T.C. TIRE NO.

COACH NO.

DATE

HOUR

RIGHT FRONT

LEFT FRONT

RIGHT INSIDE REAR

RIGHT OUTSIDE REAR

LEFT INSIDE REAR

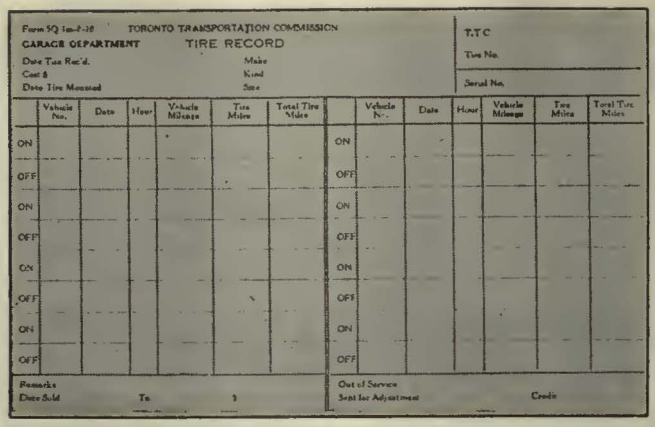
LEFT OUTSIDE REAR

MARK-X

SIGH HERE

Tire Card

When a tire is removed from service or placed in service this card is filled in by the tire staff and entered on tire records by office staff.


TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT TIRE RECORD

T.T.C

Date Tire Rec'd. Make

Cost $ Kind

Date Tire Mounted Size

Tire No.

Serial No.

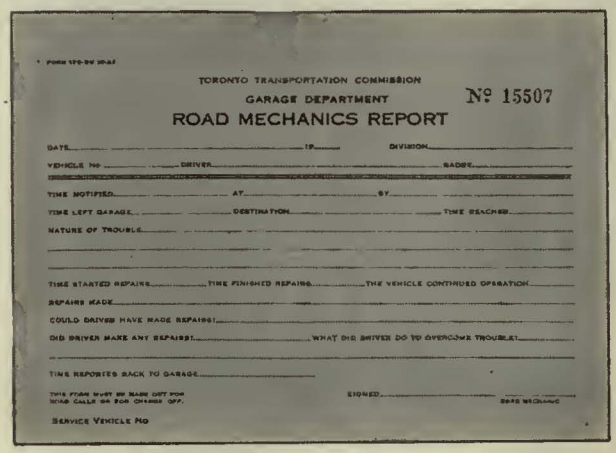
	Vehicle No.	Date	Hour	Vehicle Mileage	Tire Miles	Total Tire Miles		Vehicle No.	Date	Hour	Vehicle Mileage	Tire Miles	Total Tire Miles
ON							ON						
OFF							OFF						
ON							ON						
OFF							OFF						
ON							ON						
OFF							OFF						
ON							ON						
OFF							OFF						

Remarks Date Sold To

Out of Service Sent for Adjustment Credit

Tire Record

When a tire is placed in service or any change made to it, a record is transferred to this card from the "Tire On" and "Tire Off" card, and the mileage entered from the mileage book.


TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT Nº 15507

ROAD MECHANICS REPORT

DATE 19 DIVISION

VEHICLE NO DRIVER BADGE

TIME NOTIFIED AT BY

TIME LEFT GARAGE DESTINATION TIME REACHED

NATURE OF TROUBLE

TIME STARTED REPAIRS TIME FINISHED REPAIRS THE VEHICLE CONTINUED OPERATION

REPAIRS MADE

COULD DRIVER HAVE MADE REPAIRS?

DID DRIVER MAKE ANY REPAIRS? WHAT DID DRIVER DO TO OVERCOME TROUBLE?

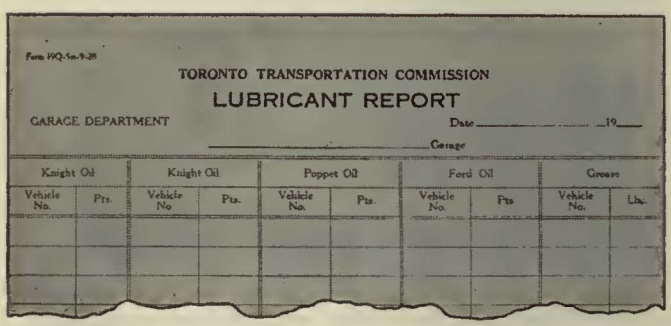
TIME REPORTED BACK TO GARAGE

THIS FORM MUST BE MADE OUT FOR ROAD CALLS OR FOR CHANGE OFF. SIGNED ROAD MECHANIC

SERVICE VEHICLE NO

Road Mechanic's Report

When a "trouble" call is received at the garage, the person taking the call enters on this report the time and destination of the bus and the nature of the trouble. The mechanic making the repairs fills in the rest of the form and turns in the completed report to the garage foreman.

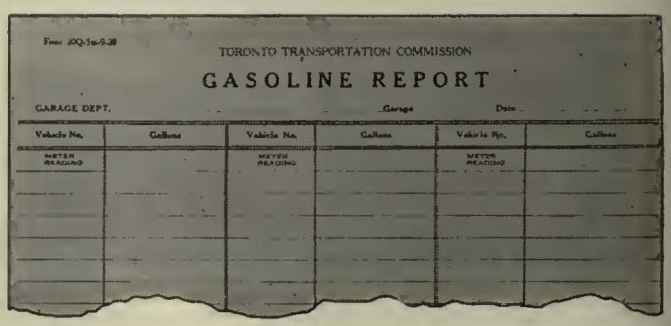

TORONTO TRANSPORTATION COMMISSION

LUBRICANT REPORT

GARAGE DEPARTMENT Date 19

Garage

Knight Oil		Knight Oil		Poppet Oil		Ford Oil		Grease	
Vehicle No.	Pts.	Vehicle No.	Pts.	Vehicle No.	Pts.	Vehicle No.	Pts	Vehicle No.	Lbs.


TORONTO TRANSPORTATION COMMISSION

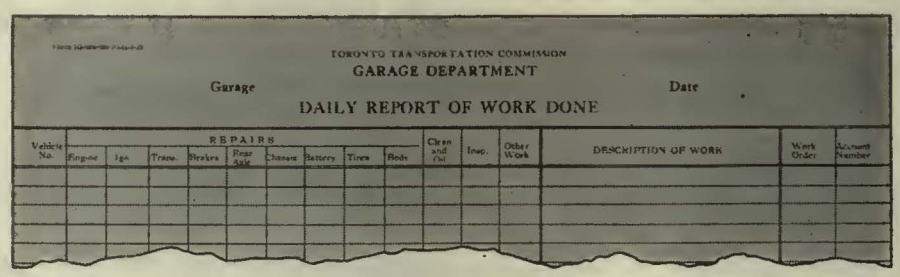
GASOLINE REPORT

GARAGE DEPT. Garage Date

Vehicle No.	Gallons	Vehicle No.	Gallons	Vehicle No.	Gallons
METER READING		METER READING		METER READING	

Lubricant and Gasoline Reports

These are made up by the floorman on each shift, checked and entered in records in the office.


TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT

Garage Date

DAILY REPORT OF WORK DONE

Vehicle No.	REPAIRS									Clean and Oil	Insp.	Other Work	DESCRIPTION OF WORK	Work Order	Account Number
	Engine	Ign.	Trans.	Brakes	Rear Axle	Chassis	Battery	Tires	Body						

Daily Report of Work Done

These are made out by mechanic, turned in to timekeeper, who sorts them and gives them to garage foreman, who in turn gives them to the gang foremen for their O.K. After this they are turned over to the timekeeper to be allotted account numbers and time distribution. Garage foreman finally checks the time sheets with the repair cards.

TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT GENERAL INSPECTION SHEET

GARAGE ____ TYPE ____ VEHICLE NO. ____

DATE OF INSPECTION ____

ROUTINE OF INSPECTION	WORK DONE BY	DATE	REPORTS COPIED FROM REPORT CARDS AND SIGNING IN SHEETS SHOW ROAD CALLS IN RED INK	REPAIRED BY
1200 MILES	1200 MILES / 2400 MILES			
a. Examine radiator for leaks. b. Examine bonnet catches. c. Examine radiator tie rod and radiator bolts. d. Examine engine for oil leaks. e. Examine fan belt and grease fan pulley. f. Oil accelerator cross shaft. g. Grease clutch spindle. h. Grease clutch thrust race. i. Examine universal discs and bolts. j. Examine transmission for oil and leaks. k. Examine clutch pedal for clearance. l. Lubricate control shafts. m. Jack up rear wheels test for brake clearance. n. Examine rear system for lubricant. o. Lubricate king pins and tie rod connections. p. Lubricate spring leaves. q. Check tires.				
2400 MILES				
1. ENGINE a. Run engine and examine for knocks. b. Examine radiator connections. c. Examine engine holding down bolts. d. Test compression. e. Clean purolator. f. Lubricate air pump. g. Examine breaker points. h. Examine leak wires. i. Examine and clean spark plugs. j. Drain oil tank. k. Test oil pressure. l. Wash engine.				
2. CARBURETOR a. Remove jet caps and clean wells. b. Tighten exhaust and intake manifolds. c. Examine gasoline filter. d. Examine choke. e. Clean air strainer. f. Clean out gas lines and vacuum.				
3. ELECTRICAL a. Clean and adjust generator. b. Check output. c. Check bearings and connections on generator. d. Examine battery and connections. e. Examine starting motor and connections. f. Examine all lights. g. Test all fuses and breakers. h. Test and adjust horn. i. Examine ignition and lighting switches.				
4. CLUTCH AND TRANSMISSION a. Examine clutch fingers. b. Examine hand brake lever and rod. c. Test gear change. d. Tighten transmission holding bolts.				
5. PROPELLOR SHAFT a. Examine all universal joints. b. Examine flange nuts. c. Lubricate gear case.				
6. REAR SYSTEM a. Test for lift and end play in wheel bearings. b. Examine brake linings for wear. c. See that wheels are tight on the tapers. d. Examine brake drums for wear. e. See that flanges are tight on drive units. f. Tighten rear spring clips. g. Examine rear springs for broken leaves. h. Lubricate rear springs. i. Lubricate brake cylinders. j. Wash grease off brake linings and drums.				
7. FRONT AXLE AND STEERING a. See that front spring clips are tight. b. Jack up front wheels and test for wear and adjustment. c. Grease front wheel bearings. d. Test for wheel alignment. e. Examine tie rod arms. f. Examine front springs for broken leaves. g. Examine tie rod connections. h. Examine drag link. i. Examine steering for looseness or play. j. Lubricate spring leaves.				
8. BODY a. See that interior of vehicle is clean. b. Examine for loose and worn seats. c. Examine for noisy windows. d. Examine heater pipes and coverings. e. Examine heater valves. f. Tighten all body and fender bolts. g. Examine fenders for rattles or damage. h. Examine fire extinguisher bracket.				
3200 MILES a. Clean exhaust ports. b. Examine manifold gaskets. c. Examine exhaust and intake valves on air pump. d. Examine valves in brake control. e. Change magneto. f. Examine carburetor floats. g. Clean carbon from stove pots. h. See that throttle is in good order. i. Change generator. j. Focus head lights. k. Clean and examine destination and route signs. l. Drain and refill grease cups.				
Should any irregularities of either oil or grease be noted, Foreman's attention should be called to same immediately.				

Inspection Sheet— The driver's reports of defects found in the vehicle and also road mechanic's reports are entered on this sheet daily.

TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT Month ____

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL
CHASSIS																																
ENGINE																																
GASOLINE SYSTEM																																
COOLING SYSTEM																																
IGNITION SYSTEM																																
OIL SYSTEM																																
CLUTCH																																
TRANSMISSION																																
BRAKES																																
DIFFERENTIALS																																
REAR AXLES																																
FRONT AXLES																																
SPRINGS																																
TIRES																																
BATTERIES																																
MISCELLANEOUS																																
BODY																																
BUMPERS																																
FENDERS																																
DOORS AND CONTROLS																																
WINDOWS																																
WINDSHIELD WIPERS																																
LIGHTS																																
HEATERS																																
MISCELLANEOUS																																
ACCIDENTS																																
POLLINS																																
TOTAL																																

Report Form for Change-offs and Road Calls

GARAGE DEPARTMENT — TORONTO TRANSPORTATION COMMISSION

UNIT CHANGE

THE FOLLOWING UNIT HAS BEEN CHANGED THIS DATE:

GIVE UNIT NUMBER AND NAME	GIVE UNIT NUMBER AND NAME
UNIT OFF	UNIT ON
REMOVED BY	REPLACED BY
DISPOSITION OF UNIT REMOVED	
CAUSE OF REMOVAL	
VEHICLE NO.	SIGNED ____ FOREMAN

Unit Change

A mechanic making a unit change fills in this slip and the change is then recorded on a card index system—each type of unit having a card of its own.

TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT DAY ____ DATE ____

Daily Record of Buses Removed From Service

VEHICLE GROUPS	Vehicles Owned	Accidents	Tires	Bodies	Chassis	Brakes	Clutch	Elec. trical	Vehicles Found O.K.	%	VEHICLE MILES	Total Defects	Total Vehicles	Defects Per M. Miles	Vehicles Per M. Miles	Miles Per Defect	Miles Per Vehicle	REMARKS
Y																		
Z																		
XC																		
XB																		
YW																		
AB																		
ALB																		
ALC																		
W																		
J																		
MS																		
Total																		

CORRECT ____

Daily Record of Buses Removed From Service

This is compiled from change-off sheets and mileage books

TORONTO TRANSPORTATION COMMISSION

GARAGE DEPARTMENT

№ 14378 **REPAIR CARD**

Vehicle No. ____ Date. ____

Please Repair:

Signature ____

Date	WORK DONE	Repair Man	Hours	Rate	Amount

Repair Card

This form is made out for every repair made to a vehicle—the senior foreman filing in the items to be repaired and the men filling in the time and work done and material used. The record as to prices and quantity is completed in the office.

garage building. All regular maintenance work is done here in connection with the vehicles operating from this point, as well as the major repairs and overhauls for all vehicles. All tire repairs are made here.

At the Sherbourne terminal for radial express and freight service downtown, part of the old street car shops were rearranged to give garage accommodation for 57 vehicles. All interurban and sightseeing coaches operate from here, as well as several bus routes operating in the east end of the city. Garage space is rented at Hamilton, Ontario, for cleaning and running repairs only and accommodation is furnished for whatever coaches are at this terminal overnight. The motor coach department, in charge of operation, has divisional offices in Davenport and Sherbourne garages and the garage department has its office at the Davenport garage.

Buses and coaches are allocated for their runs according to the schedules and requirements of the motor coach department. Assignments are posted on blackboards at the various garages. The buses are placed in readiness for the drivers with the appropriate run numbers and signs showing, and are booked out of the garage on leaving. On its return each vehicle is inspected, filled with gasoline and water, oiled and classified as for service, general inspection or repair. If it is classified for service, it is cleaned inside and out and placed in position for the next booking. Then the tires and battery are checked and minor adjustments made. A typical exit is shown in an accompanying illustration. Water is checked there. An air hose for tires is provided also. Extra seats are readily available, and the demountable side signs are racked near by, as well as the run number signs.

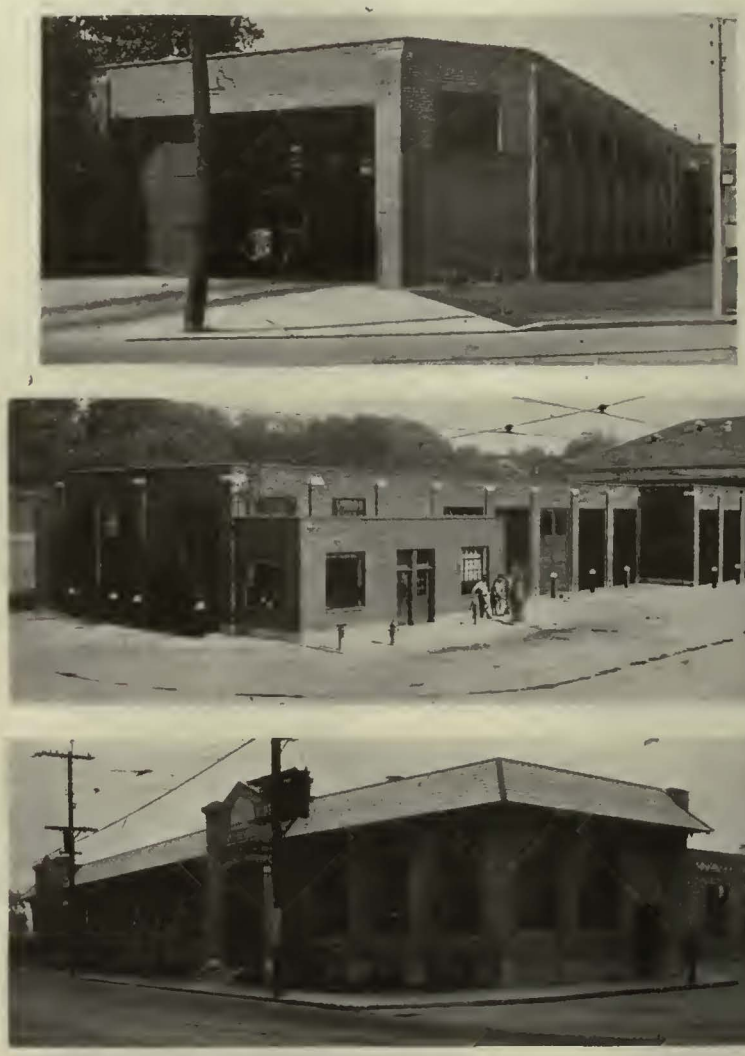
Greasing is done thoroughly every 1,250 miles and a general inspection is made every 2,500 miles. The vehicles are "called" the day previous to inspection. Of great value at this time is the record which has been kept of every defect of that particular vehicle since the last inspection. The work done at this time consists of thorough lubrication and a check over of all working parts and the body. The brakes are examined and tested. The engine is cleaned and tuned. Tires are carefully gone over for minor cuts and are replaced if necessary. Every effort is made here to insure uninterrupted service for the next 2,500 miles. Every 5,000 miles a more complete inspection is made.

Vehicles requiring major repairs on account of accident or breakdown, or on being due for general overhaul, are placed in special bays in readiness for the repair staff the following day. The overhaul period is about 65,000 miles, or every second year. At this time the engine and chassis are gone over thoroughly and all necessary replacements made to run a second period. However, as the equipment gets older the general overhaul process will gradually be changed to replacement of the major units at inspections.

The whole maintenance program is based on the mileage operated, which is tabulated daily for every vehicle. From this individual record the usefulness of any unit may be determined.

Garage equipment is not elaborate. Machine and blacksmith work is sent to the general shops. The four repair pits are adjacent to the toolroom and stores. Brake relining is done on a machine here and all air-brake equipment is rebuilt and tested in one department. The motor overhaul shop is alongside the tire shop. On the completion of the chassis work the vehicle is tested and then moved to the general shops for the body overhaul and painting. At this time improvements or additions are made as desired. With the finish of the painting the vehicle is then ready for the road.

The commission has found that best results are obtained when repair work on bus chassis is performed by a separate force than engaged in car repair work. Experience, however, has shown that the repair work on bus bodies can be more economically performed by the same staff which does the repair work on car bodies. This results in economy and keeps the bus maintenance staff down to a minimum.



Architectural simplicity gives pleasing appearance to garages of the Toronto Transportation Commission

At top, Howard Avenue—the first bus garage—built in 1921.
In center, garage for service trucks adjacent to Hillcrest general shops.
At bottom, Davenport garage, showing entrance drive at the right and exit door at left.

Light Oils for

CAR BEARINGS

Have Possibilities

Experiments on Chicago Surface Lines and Chicago, North Shore & Milwaukee Railroad indicate that better lubrication with smaller temperature rises can be obtained by use of one grade of light oil for all season

By

E. H. HILLMAN

Technical Division, Standard Oil Company of Indiana, Chicago, Ill.

OILS which have a light body more like kerosene than like ordinary car lubricants, are now being used by some electric railways. They possess such a high degree of adhesion to metals that even after the journal has been at rest a long time sufficient oil remains to provide adequate lubrication and prevent overheating. Such oils have been used both on high-speed interurbans and on city street cars, with marked reductions in bearing temperatures as well as savings in energy consumption. Tests made on equipment of the Chicago Surface Lines and Chicago, North Shore & Milwaukee Railroad show many advantages for low viscosity oils.

Besides forming an oil layer between the brass and the journal, a good car oil must adhere strongly to the surfaces. Small amounts must remain even under the very high pressures and severe rubbing encountered when cars are accelerated or braked rapidly. This second requirement has been given the lesser consideration, but is really the more important. According to Karelitz[1] in the Westinghouse laboratories, the amount of oil supplied by capillary feed through waste is frequently negligible compared to the oil pumping capacity of the bearing. This indicates that oils which will feed rapidly and adhere tenaciously to the bearing surfaces can be used with advantage. Various car oils differ in this respect to a considerable extent.

In a typical journal box the waste must lift the oil several inches, at the same time retaining sufficient resiliency to maintain good contact with the journal in spite of a tendency to settle because of the jarring action of the truck.

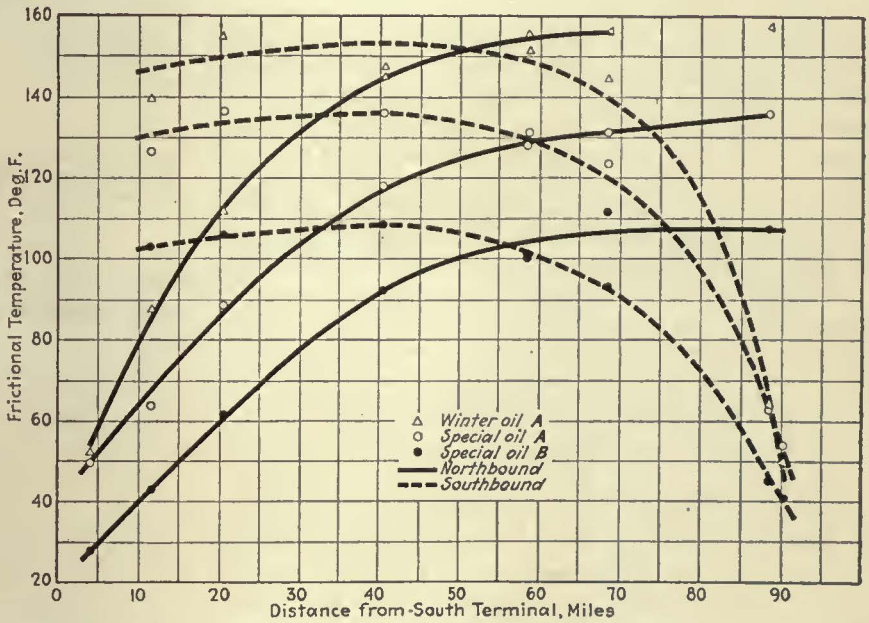


Fig. 1—Journal bearing temperature rise on high-speed interurban runs averaging 39 m.p.h. schedule speed between terminals. Five round trips were averaged for winter and special oil "A" and three for special oil "B"

Lubricants differ widely in their tendency to make a specified grade of waste become soggy and fall away from the journal. Oils differ also in their rate of feed through waste. To complicate matters further, various grades of waste possess different degrees of resiliency and capillarity—ability to maintain journal contact and draw up oil. Other things being equal, the lower the oil viscosity the faster it will feed and the more positive the resulting lubrication. The lighter oils usually have much less tendency to make the waste soggy or heavy. Soap fillers tend to reduce the rate of oil feed.

Adequate bearing lubrication requires an oil with suffi-

[1] *Valuable discussion of journal lubrication theories will be found in the works of the following authors: A. Kingsbury, W. H. Herschel, S. A. McKee, D. P. Barnard IV., W. J. Harrison, H. A. S. Howarth, Petroff, G. B. Karelitz.*

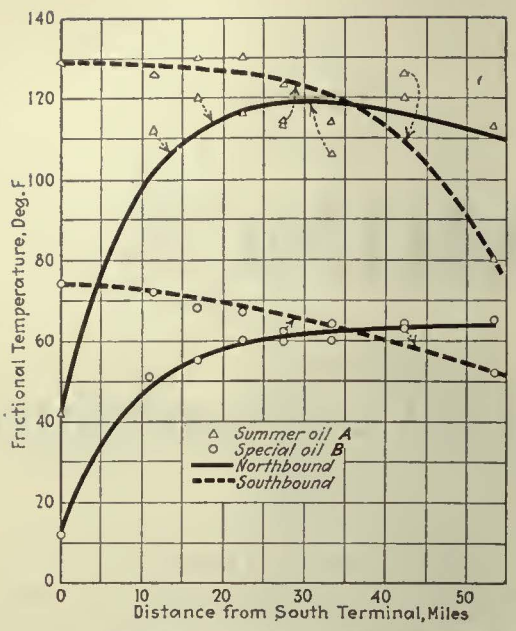


Fig. 2—Journal bearing temperature rise on moderate speed interurban runs averaging 25.6 m.p.h. schedule speed between terminals

cient body to form a fluid layer separating the journal and the bearing. This layer of oil is constantly being forced out at the edges of the bearing and as constantly being replenished by a new supply from the waste in contact with the oil. The usual practice has been to secure an oil film of the necessary thickness by making the oil so heavy that it could not readily be forced out of the bearing. Such an oil necessarily feeds more slowly through the waste, especially in cold weather. The rate of feed is reduced even more when soaps are compounded with car oils. The net result is that with a viscous oil there may be less oil on the bearing surface than with a thin oil. Heavy lubricants require more force to move the bearing surfaces over each other. This appreciable energy loss can, to a large extent, be avoided.

Light Car Oils Coming Into Use

Car oils have ordinarily been characterized by their high viscosity, running from about 200 seconds Saybolt at 100 deg. F. for a low viscosity winter oil to 1,000 seconds for a heavy summer grade. Light oils are not entirely new in railroad experience, however. Some years ago oils of about 57-66 viscosity at 100 deg. F. were in use on a French railroad.[2] More recently, Dr. W. B. D. Penniman of Baltimore[3] has done much to demonstrate the advantages of lubricants having low viscosity and high adhesiveness.

[2] *Proceedings International R.R. Assn., Vol. 7, No. 4, April, 1925.*

[3] Electric Railway Journal, *October 13, 1928.*

The tests described in this article were made jointly by the Standard Oil Company of Indiana, the Chicago Surface Lines and the Chicago, North Shore & Milwaukee Railroad to study further the possible merits and advantages of such low viscosity car oils. Tests were made in warm and cold weather, on both light and heavy cars under a variety of speed and service conditions. Of seven oils undergoing the test the first four were typical car oils of well-known brands, while the last three were made according to the principles previously outlined.

The boxes were packed by the regular oilers in the usual manner. No attempt was made to measure either oil or waste, but comparable conditions in lubrication were sought by having some free oil in the bottom of the boxes at all times. With heavy oils the waste holds

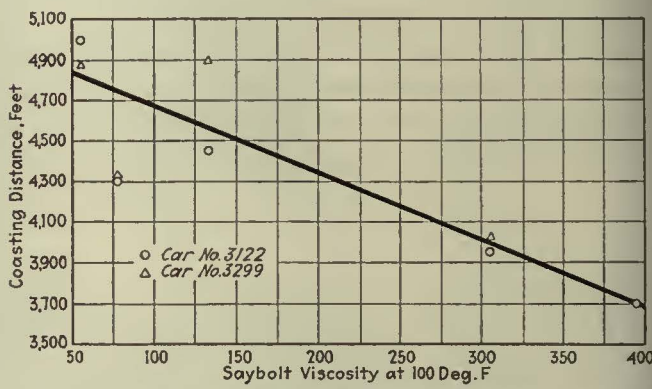


Fig. 3—Street car coasting tests conducted in La Salle Street tunnel, Chicago Surface Lines. Oil was changed in journal bearings only

much oil which will be forced out as it is pressed into the box. On the other hand, light oils drain very completely from the waste but feed rapidly due to their high capillarity.

During runs with the test cars bearing temperatures were taken by means of thermocouples inserted in holes drilled to the center of the brass, the end of the hole being as near the bearing surface as possible.

In regular service it was found impossible to standardize runs so that reliable data on relative energy consumption could be obtained. Therefore simulated service tests were arranged to show the differences in energy consumption between the various oils. For convenience, these are expressed in kilowatt-hours per car-mile.

These tests consisted of runs back and forth on a level track 1.781 miles long. On each run four starts at predetermined points were made, followed by running with maximum acceleration and full power for a fixed distance, then coasting to the next starting point. When bearing temperatures reached equilibrium, test runs (usually twenty) were made. Thus service operation was

TABLE I—STREET CAR RUNS—SIMULATED SERVICE CONDITIONS

Oil	Number of Tests	Number of Runs	Temperature, Deg. F. Journal	Air	Rise	Corrected Rise, Deg. F. Air*	Air and Speed†	Speeds, M.P.H. Schedule	Running	Kw.-Hr. per C.M.	Relative Energy Used	Viscosity at Journal Bearing Temperature Saybolt	Absolute
Special oil "B"	9	170	100.5	51.0	49.5	37.5	37	13.49	20.53	1.670	0.973	77	0.132
Winter oil "B"	7	130	129.0	57.5	71.5	59.0	60	13.49	19.80	1.716	1.00	148	0.282
Special oil "B"	5	100	111.5	67.5	44.0	39.5	37	13.49	21.33	1.662	0.968	68	0.104
Summer oil "B"	2	40	145.0	69.5	75.5	68.0	72	13.50	19.28	1.754	1.022	137	0.248
Special oil "A"	8	160	121.0	76.5	44.0	42.0	39	13.48	21.51	1.674	0.976	89	0.155
Special oil "C"	4	80	116.0	84.0	31.5	36.0	34	13.49	21.73	1.638	0.954	48	0.063

* Temperature rise (frictional temperature) corrected to an air temperature of 80 deg. F. was taken as standard since the data were not sufficient to estimate the rise for special oil "C" at lower temperature.

† Temperature rise corrected to an air temperature of 80 deg. F and a speed of 20 m.p.h.

These groups of runs are listed in the order in which the work was done. Each test represents a group made on the same day. Oils were changed in all bearings.

simulated closely but the running speed of about 20 m.p.h. was higher than that ordinarily maintained. The same motorman operated the test car throughout.

In every instance journal bearing temperatures represent the average for the eight journals. In the street car tests armature and axle bearing temperatures were also taken. They show the same general trend but the temperature rises are lower and the average figures more erratic. Results of these tests are summarized in Table I.

Results of tests on regular suburban runs on different roads, at high and low schedule speeds, are shown in accompanying charts 1 and 2. The temperature rises are shown, as this eliminates variations due to differences in air temperature. Frictional heat represents lost energy; excessive heat represents inefficient lubrication and frequently excessive wear. These runs show the improved lubrication obtained with special oil "B." That energy which can be saved by improved oiling is limited, of course, as bearing friction is only one of the various energy losses which occur in moving a car.

Table II gives results of higher speed runs with the same street car used in the simulated service tests. The car made ten runs back and forth on a track 3.653 miles long, averaging 27.33 m.p.h. running and 23.49 m.p.h. schedule speed, after all bearings had reached an equilibrium temperature. As could have been predicted from the relation that fluid friction losses vary as the square of the speed, the actual savings with light oils are greater than in the low-speed runs. The proportional savings are also greater because relatively less energy is used in accelerating.

It was found that considerable variations in speed and energy consumption were caused by track and weather conditions, changes in line voltage, and sometimes by traffic interruptions. It was not possible to standardize these runs as carefully as those shown in Table I. This undoubtedly accounts for the advantage observed with special oil "A" as compared with "B" and for the difference between Winter "B" and Special "A," which is larger than would have been expected from their viscosities. The general trend is the same as in the other tests.

Street Car Coasting Tests

Relative friction with the various oils was further shown by coasting tests on a track between two grades, forming a valley with approximately equal slopes (La Salle Street tunnel, Chicago Surface Lines). The set cars were allowed to coast with trolley pole down and brakes released from slope to slope until they came to rest. The motion thus consisted of a series of oscillations. Before each test the car was run in service for a day or so to make sure that equilibrium conditions were obtained and was then taken directly from service to the test so that the bearings could not cool. The sum of these oscillations, averaging at least five tests for each oil, is shown graphically in Fig. 3. The accuracy is shown by the close agreement obtained with different cars at different times.

Tables I and II show the corrected temperature rise. Where other factors are kept uniform the temperature of the bearing does not remain at a constant difference above air temperature, the difference between air and bearing temperatures tending to decrease as the air temperature goes up.

The bearing temperature rises until the oil thins down to a point where the rate of heat generation is equal to

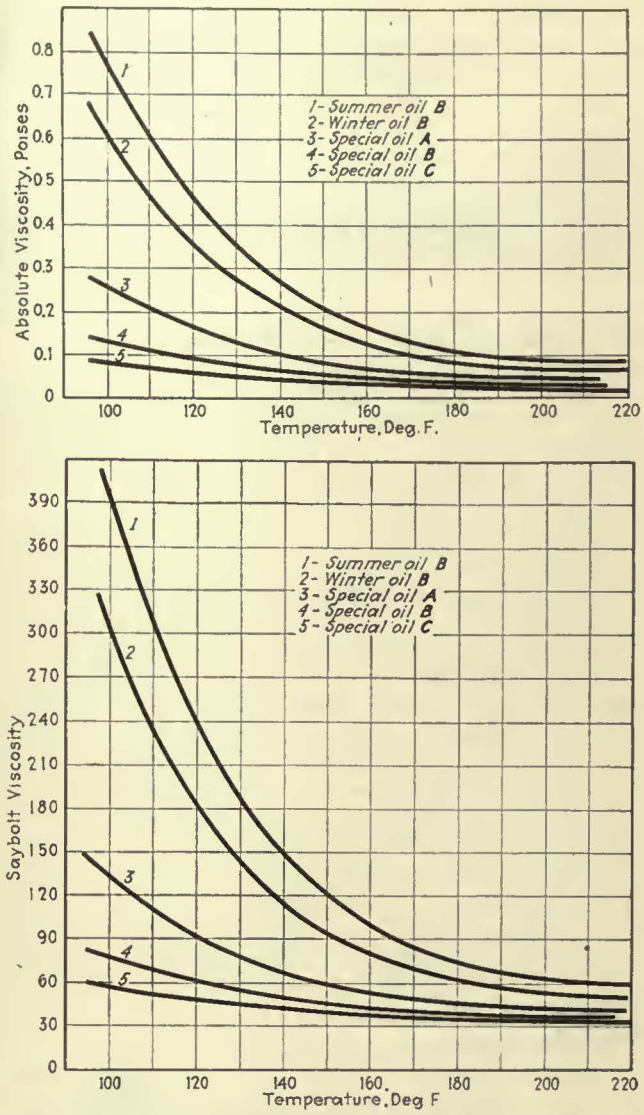


Fig. 4—Viscosity-temperature chart of oils used in street car tests. Absolute viscosities were used in all calculations since they are proportional to power loss in the oils. Special oils "B" and "C" possess a much more uniform viscosity at all temperatures

the rate of dissipation. The rate of dissipation is dependent on the difference between air and bearing temperatures, but the rate of generation is dependent principally on oil viscosity at the operating temperatures. The higher the air temperature the lower the viscosity and the less the temperature rise. When air temperature is plotted against average journal bearing temperature for each oil, a family of curves is obtained which are almost straight lines at ordinary temperatures and are roughly parallel.

Such curves were drawn for each oil in the test and each point was moved parallel to it to a position opposite an arbitrarily selected standard air temperature from which the corresponding temperature rise was found. The resulting figures are only approximate since often there were not enough data to locate the curves accurately, but they more nearly represent true comparisons than do the uncorrected temperature readings.

In all the tests no special precautions were taken in the preparation or packing of bearings. The street car bearings were not machined or scraped. The interurban bearings were machined to $\frac{1}{32}$ in. oversize diameter.

The conclusion that no change in shop practice is necessary with the new oils was confirmed by large scale tests

TABLE 11—STREET CAR RUNS—HIGH SPEED. OIL CHANGED IN JOURNAL BEARINGS ONLY

Oil	Number of Tests	Number of Runs	Temperature, Deg. F. Journal	Temperature, Deg. F. Air	Temperature, Deg. F. Rise	Corrected Rise, Deg. F.*	Speed, M.P.H. Schedule	Speed, M.P.H. Running	Kw.-Hr. per C.M. (27.33 M.P.H.)	Relative Energy Used†	Viscosity at Journal Bearing Temperatur Saybolt	Viscosity at Journal Bearing Temperatur Absolute
Winter oil "B"	3	30	173.0	28.0	145	91.0	23.52	27.33	2.113	.....	67	0.105
Special oil "A"	5	50	151.0	17.0	134.5	70.5	22.96	26.94	1.875	0.91	57	0.090
Special oil "B"	6	60	127.5	33.5	94.0	45.5	23.79	27.79	1.899	0.92	57	0.078
Winter oil "B"	4	40	158.0	25.5	132.5	75.0	23.88	27.22	2.052	.....	90	0.140

*Temperature rise corrected to an air temperature of 80 deg. F. and a running speed of 27.33 m.p.h.

†Based on average of two groups of runs with Winter "B" as 100 per cent.

Each test represents a group of ten runs made on the same day, in each instance bringing the bearing temperatures to equilibrium with air temperature before taking these data. The oils were changed in the eight journal bearings only. Since slower runs frequently were alternated with faster runs, there was no time for bearing temperatures to adjust themselves; hence temperatures shown here are averages without correction for running speed.

on hundreds of street cars with special oil "B" and other oils of similar viscosity. The cars were lubricated with these oils without special instructions. No overheating was found except where a few cars with new bearings were sent on long trips without stops at the beginning of their runs. Even then hot boxes did not develop.

Axle and motor bearings carry lighter loads than car journals and hence are easier to lubricate. The street car tests confirmed this, showing lower temperatures on these bearings.

There was no trouble with the oils working out of motor bearings and into the windings. This will not occur in modern rolling stock equipped with overflow pockets, but it may cause some trouble on old equipment. No exact data were secured on oil consumption, but on all types of bearings observed it was only a little more with the lightest than with the most viscous oil.

The journal bearings on the street car were 4¼x8 in., giving a projected area of 34 sq.in. Since there were eight journals the total projected area was 272 sq.in. The car weighed 47,000 lb. The weight on the bearings was this, less the weight of the axles, wheels and half the motors, or 38,600 lb., making a bearing pressure of 142 lb. per square inch on the projected area.

The revolutionary nature of these experiments will be appreciated when it is remembered that such bearings have been lubricated at low speed, using waste, with an oil of 56 seconds Saybolt viscosity at 100 deg F. Others have lubricated similar bearings with an oil of 35 viscosity at 100 deg. F.

Summer and Winter Oils Not Needed

Heretofore car oils have been made in two grades—summer and winter. For instance, where the average summer and winter air temperatures are 80 and 25 deg. F., typical oils having viscosities of 100 and 46 at 210 deg. F. will both have a viscosity of 3,500 at the summer and winter temperatures respectively. This method of oil selection is faulty, as in summer or winter after a few minutes due to frictional heat the temperature rises above summer temperatures. As the frictional heat is less in summer than in winter, and as it was found that oils much lighter than those customary for winter lubrication could be used in hot weather, the theoretical advantage of two oils was largely removed.

Car oils are seldom changed in accordance with the seasons. Where boxes are repacked at intervals of three months or more, it is obvious that frequently summer oil will remain in use during the coldest weather, while the winter oil must lubricate on many a hot day. On steam roads, where boxes are repacked twice a year at most the use of two oils has even less justification.

Oils such as special oil "B" or "C" can be used in hot weather and at the same time are more fluid at low temperatures than the old winter car oils.

Several distinct advantages result from the use of light car oils. These include (a) saving in energy consumption, (b) lower bearing temperatures resulting in fewer hot boxes, (c) less bearing wear, (d) longer life of waste, (e) same oil summer and winter, and (f) fewer pull-ins.

The results obtained on typical properties under (a) and (b) above have already been shown. Less bearing wear has not been proved experimentally but must follow from the power and temperature effects.

Waste will last longer with these oils on account of the entire absence of heavy ingredients which clog the waste, making it soggy. The dirty waste can be reclaimed with surprising ease and with a minimum loss. On some roads waste consumption was reduced greatly, while the time between reclaiming was much longer than with ordinary oils.

By reducing bearing friction greatly the use of an oil such as special "B" will reduce the need for roller bearings. Mechanical lubricators designed to replace waste will be of less advantage due to the increased life of the waste.

TABLE III—OILS USED IN TESTS

Oil	Viscosity at 100 Deg. F.	Calculated Viscosity at 0 Deg. F.
Summer "A"	629	150,000
Summer "B"	396	30,000
Winter "A"	272	15,000
Winter "B"	305	32,000
Special "A"	133	8,000
Special "B"	78	1,550
Special "C"	56	650

Car Oil Specifications

Future experience will show just how low in viscosity modern car oils can be made. Oils lighter than special "B" were not tried in the interurban tests, nor have they been given extensive street car service tests. For the present the following safe limits can be set for electric railway car journal oils:

Viscosity at 100 deg. F.—75 to 80.

Viscosity at 0 deg. F.—As low as possible consistent with the above.

Pour test—10 deg. below 0 deg. F.

The viscosity at 0 deg. F. is an important property which heretofore has been given little consideration. High fluidity at low temperatures is just as important as proper viscosity at ordinary temperatures. If the oil becomes too viscous when the car is at rest in the winter, proper feed through the waste may be interrupted and bearing friction increased. The maximum demand load will be decreased materially by the use of oils having low viscosity at low temperatures. This property of low viscosity at low temperatures has no relation to pour or solid point. The pour should be as low as the lowest probable winter temperature. Even a very light oil may have a high pour point due to the formation of wax crystals. The wax before solidifying is a very thin liquid.

Attention to Fundamentals Reduces

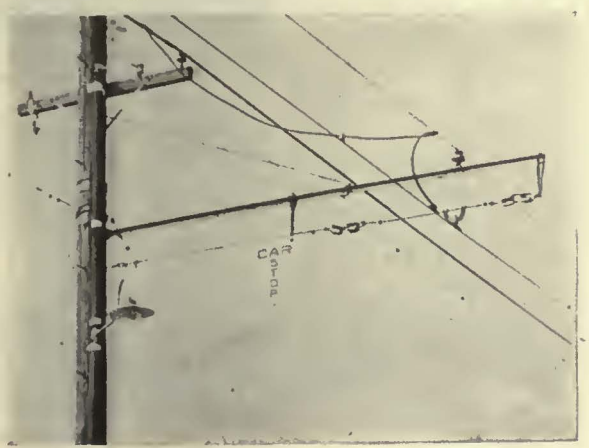
Overhead Maintenance

By
L. W. BIRCH
Assistant Manager Railway Division
Ohio Brass Company

Use of high-grade materials and proper construction methods results in longer life and less need for repairs. Insulation is of the utmost importance

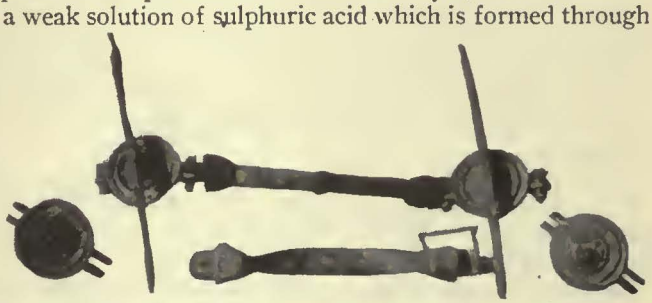
REDUCTION in maintenance costs usually is based on one fundamental principle. This is, "Build to stand." This principle obtains particularly in overhead work. The class A pole outlasts the second grade, the galvanized steel fitting resists corrosion better than the painted one, and double insulation in a span wire prevents an attempt to heat all outdoors through current leakage. Following this principle is far better than skimping and deferring needed repairs. The following discussion considers some of the recognized good practices, and some which are worthy of greater use than is found today. Every one of them is based on the principle of building to stand.

In some of the larger cities, particularly where the atmosphere is smoke laden, there is corrosion of the span wires. The same is true along the sea coast where salt fogs prevail. Corrosion of steel span wires, even though galvanized, may take place quickly in the presence of salt or smoke. It is produced by a number of conditions.



Leakage currents over the surface of insulators cause a plating action that deposits metal on the face of the porcelain, rendering it useless as a non-conductor

To begin with, the lineman, in serving a span wire at an insulator or fitting, strips a certain portion of the zinc coating off the wire by permitting the strands to slide between the cutting edges of his pliers. While this is a recognized method, it exposes the steel strand to the atmosphere, and rusting or corrosion immediately starts. When the span wire is attached to an insulator, particularly a span insulator, that is coated or dirty, leakage of current is likely to take place. This in turn sets up a plating action which not only tends to destroy the strand but also deposits a metallic conducting layer on the surface of the insulator. This plating action only takes place in the presence of some electrolyte, such as salt or a weak solution of sulphuric acid which is formed through



An example of burning due to leakage of current in a salt fog vicinity. Flat spans did not permit the drip water to avoid the insulator. Greater slope to the span wire and drip points in the fittings would have decreased this trouble

Double insulation is good practice, especially in a coast district. Note that the porcelain strain insulators are connected in series on each side of the contact wire under the mast arm. Connections are made with clips which serve as drip points

the presence of sulphur in a smoke-laden atmosphere. Again, if the strand and the part to which it is connected are made of dissimilar metals the well-known battery or cell action is set up where an acid solution is present. Current leakage if of sufficient severity will burn the strand. This, of course, is not helped out materially by the choice of strand except in so far as a metallic deposit

A contact wire does not have long life when only a few pull-overs are placed to support a curve. Excessive wear develops at the ear joints

on a span insulator might be averted, providing the plating action referred to has been stopped through the proper choice of materials.

To obviate such troubles as this, spans of non-ferrous material have been installed on a number of the larger properties. The practice was started along the seacoast where salt fogs prevail, but later several of the larger operators in the interior of the country began the use of non-ferrous span wires to reduce maintenance cost by safeguarding against corrosion. As an example of the difference, in Havana it formerly was necessary to replace ½-in. steel span wires at twelve-month intervals as they disintegrated through salt water corrosion. Now with non-ferrous wire a number of spans have been in use four years and the life of the span has not yet been determined.

Copper feed-in spans have been in use for many years. The life of these spans is usually much greater than that of a steel span in the same district, providing the copper span is not overworked mechanically. Of course, the non-ferrous span is more expensive in first cost, but if it lasts twice as long as a steel span it is a good investment when the cost of labor for replacing is included. It is not the purpose of the writer to advocate non-ferrous span wire universally instead of steel span wire. But there are many locations where the steel span wire has short life and must be constantly replaced. These locations warrant study and usually maintenance costs are decreased through the use of non-ferrous materials.

The use of non-ferrous strand must necessarily call for some study of fittings. A combination of bronze or copper strand with iron fittings tends to produce cell or battery action through the presence of the dissimilar metals. With a bronze or copper span wire, bronze fittings must necessarily be used in order to get full life out of the strand.

Span-Wire Tensions Vary Over a Wide Range

While there is no standard definition of tightness or looseness of a trolley wire span wire, a tight span wire is usually considered as one which is pulled up to the point where it is being worked close to its elastic limit at minimum temperatures. It is then working at its maximum allowable load under the most severe conditions. The loose span wire is permitted to sag deeply and is working at a reduced load with consequent reducti in side pull to the supporting pole. The tight span wi has an advantage for city work in that a shorter pole c be used. However, the side pull is of sufficient magnitu to require a fairly husky pole. While there is very lit difference in the cushioning effect, the loose span wi will permit equalization of tension in successive spa For instance, the "cutting-in" of a splicer may elimina a few inches of trolley wire. This necessarily increas the tension which exists in this span but it can equalized throughout a number of adjacent spans fairly slack span wires are used. With very tight sp wire, the span wires adjacent to the point where t splicer was inserted tend to act as anchors and pick an additional load, thus imposing a greater side pull the pole.

In the February *Aera* the subject of span-wire tensi was discussed in the "Question Box." In the answe all types of city and interurban properties have been re resented. It is interesting to note that one large pro erty reports the tight span wire as correct, while equally large property asserts the loose span wire to satisfactory.

For city work where the number of car passengers high and where the contact wire has a very short li the equalization of tension in the span wire is of l

This curve is supported with the proper number of insulat Note the double insulation in the pull-over wires

importance. The length of contact wire between tu outs and street intersections is comparatively short, c sequently excessive trolley wire sags do not exist. systems where the contact wire lasts for many years question of slack in the contact wire is always a probl Slack may be taken out of the wire at the splicer poi and at special work. However, it often is necessary cut the wire, pull out slack and insert a new splicer. it is necessary to eliminate 1 ft. to 2 ft. of trolley w to secure the proper sag and tension the tight span w is a hindrance. The slack span wire will permit of s pulling without too great a loss of alignment at the In brief, the ear need not be stripped from the wire w this pull is made.

There seems to be no difference in the pounding cars under a tight or a loose span wire, provided trolley wire is maintained at the proper tension.

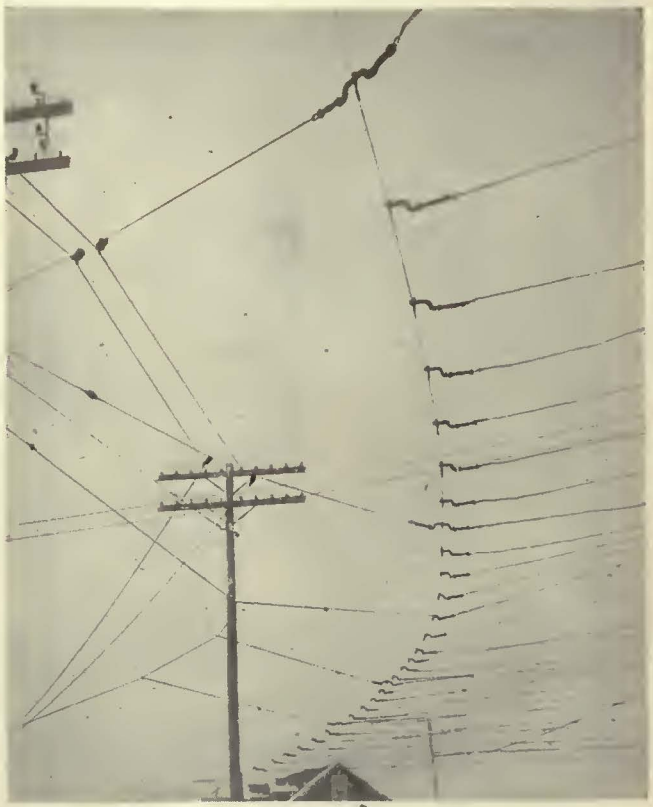
Curves with too few pull-overs invite trolley wire w at the pull-overs due to the change in direction of wheel at these points. At the other extreme, if too m

pull-overs are installed on the contact wire a more rigid system is secured and the side pull is not sufficient to prevent the weight of the pull-over fitting from tilting the ear and causing side-swipe.

The engineering manual of the American Electric Railway Engineering Association gives the following pull-over spacing for various curves:

Radius of Curve, Feet	Spacing of Pull-overs, Feet
40	7
50	8
60	9
70	10
80	11
90	12
100	13

This spacing is sufficient to maintain uniform curvature of contact wire and at the same time permit single curve pull-over fittings to hold their alignment and not permit the trolley wheel to strike the side of the trolley ear. The A.E.R.E.A. tabulation has worked out satisfactorily both from the standpoint of maintenance and from the standpoint of the theoretical number of pull-overs which should be used. Accompanying illustrations show the results of too few pull-overs as well as too many.

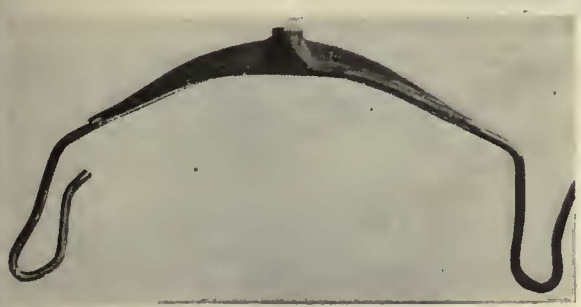


Too many pull-overs form a rigid overhead system. Usually it is impossible to maintain sufficient tension in the pull-over wires to prevent tilting of the fittings and side-swiping of the ears

Secondary Span Insulation Should Be Near Poles

Three types of span insulation are recognized as good practice: The wood stick insulator, the composition insulator, and the porcelain insulator. The present-day tendency is to use as much porcelain insulation in the overhead system as is consistent. Ordinarily, a porcelain strain insulator is inserted as a secondary insulation where an insulated hanger is used for supporting the trolley ear. Often the secondary insulation is placed within a few feet of the pole, while sometimes the insulation is carried farther into the span. As mentioned previously, corrosion of the span wire may occur through the leakage or plating action at the strain insulator. This leakage is greatest during rain, or when there is the most fluid or electrolyte on the insulator. Naturally the straight current leakage due to smoke or dirt deposit is greatest in the presence of water. Its slope forces the drops of water to run down the span wire to the first insulator or attachment in it. The water usually drops off where the attachment or the insulator forms drip points. These drops of water carry particles of dirt which further tend to increase leakage during a rain, although a dashing rain sometimes cleans the span wire and insulators, thus diminishing the leakage. For the above reason the secondary insulation in the span wire should be placed as near the supporting pole as the law will permit and should be so attached in the span that water drips from the span or attachment rather than from the insulator. Most span insulator attachments are shaped to permit this drip on the attachment rather than on the insulator.

There is a greater drip at the insulation nearest the contact wire whether it be a separate insulator or an insulated hanger. Usually the length of clear wire between contact wire and secondary insulation is greater than the length between secondary insulation and pole. Thus there is more opportunity for the collection of water and dirt and the insulation at or near the contact wire must stand more than the secondary insulation.



A new 00 trolley ear, 12 to 15 in. long, usually withstands 1,000 lb. dead load as this one did. Note the central holding section continues to surround the wire, while the approach ends are slightly loose

Long Trolley Ears Are Used Most

Proper length of trolley ears has been the subject of many discussions. There is no "best" length, inasmuch as various ears have their particular operating advantages. In the first place an ear must withstand the dead weight of the trolley wire and other fittings suspended from it, which in the 100-ft. span rarely exceeds 100 lb. A very short length of ear will hold a 100-lb. weight providing there is nothing to burn the ear or reduce the section through wear. The average clinch ear has sufficient length and section to support approximately 1,000 lb. This requires a middle section in the ear of approximately 6 in. Depending on the thickness of the lips, the approach section which is added to the holding section varies in length from 3 in. to 4½ in., making a total length of from 12 in. to 15 in., depending on the degree of grinding or sloping on the approach ends. The approach of an ear does not clamp the contact wire as tightly as does the center holding section, partly because the approach must permit the wheel to ride over the ear with as little bump as possible. However, the

approach ends of an ear must also partially damp the wave produced in the trolley wire by the trolley pole and wheel. The gradual damping of this wave at the ear decreases the fatigue in the wire and prolongs its life. With the longer ear the trolley wheel approach is gradual and the shock of the wheel falls directly against the ear rather than beyond as it does with the short ear.

The secondary insulation between the positive and negative wires is so low it forms a drip point. The collection of sediment and eventual leakage of current and burning may be expected on the surface of the insulators

For the average 100-ft. span the 12-in. to 15-in. ear is giving the best results. With short pole spacing it is possible to use the short ear successfully inasmuch as the loads are lighter and the trolley wire sag in the short span is not sufficient to injure the wire at the ear point. An example is in catenary construction, where short clips or ears are used at frequent intervals. However, a recent survey of the power distribution committee of the Central Electric Railway Association found that approximately 95 per cent of the ears being used at the present time are 12 in. to 15 in. long.

A survey of the complaints on radio interference in the states of Ohio, Kentucky and West Virginia in 1927 indicated that 5,900 complaints were received by 39 companies. Of the 5,900 complaints 14.4 per cent were due to street railway troubles. The sources of interference from street railways were classified as: (a) Poor rail bonding; (b) commutation of station converters and motor-generator sets; (c) commutation of car motors, and (d) trolley arcs.

Special Cases of Trolley Arcing

A few trolley arcs exist only when a car with the controller on passes a section insulator or an insulated cross-over. These points are carefully watched by the operating company. However, they fall in this classification and react directly on the maintenance of insulated parts and on the cost of radio interference. Besides arcs at section insulators and other insulated points frequent leaks have been found where the feed-in wire was loose in the feed tap, or where the solder had melted out due to a grounded trolley or overloading. Leakage of hangers or insulators will also produce annoyances which are classed as radio interferences. Fortunately the latter are few and only occur in extreme cases of poor maintenance or accidental line trouble.

Another source of radio trouble is the trolley frog. Many of the older trolley frogs with the open pan permit the trolley wheel to jump as the wheel passes over the pan. An arc occurs and is readily picked up on the radio, even at some distance away. The newer types of frogs, such as those which permit the wheel to operate on the runner rather than the pan eliminate much of this jumping and reduce the arcing to a minimum.

New Type Car for Metropolitan Electric Tramways

As a result of experience with two experimental cars, a new vehicle has been designed for the tramways of the London Underground group. Separate entrance and exit are provided. Cross seats have been installed, upholstered in moquette. The cab has a comfortable seat for the motorman. At his side are switches to control the lights. The car has four 35-hp. motors and eight-wheel electric brakes.

Overcoming Controller Finger Trouble*

By H. J. Beadle
Dallas Railway & Terminal Company, Dallas, Tex.

FOR some time past trouble has been experienced on cars of the Dallas Railway due to sagging of the ground fingers on controllers. In many conditions they do not make contact with the ground conductor mounted on the insulation disk. With the original method for supporting the ground finger, shown in Fig. 1, the finger is rather flexible, so that a small bump causes it to sag below the disk, which carries the contact to the ground on the controller shaft.

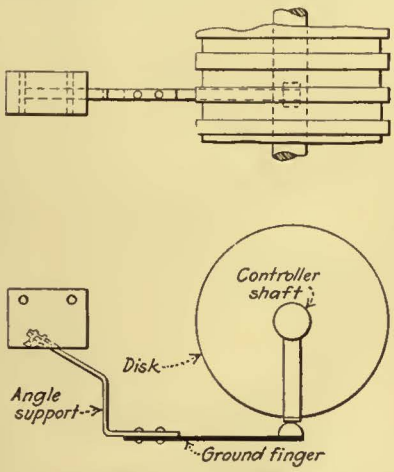


Fig. 1—Old type of construction for supporting ground finger

In Fig. 2 a new method of supporting the ground finger is shown. In this a wooden block is attached to the back of the controller frame and the ground finger is screwed directly to the block. A solid support is thus made for the finger. The position of the conductor to the ground was changed as shown. With this construction we have been able to eliminate the extra angle piece which gave the trouble, and as a result we have avoided many pull-ins. This change has been made on 176 controllers and the ground fingers are kept in alignment with the disks without trouble.

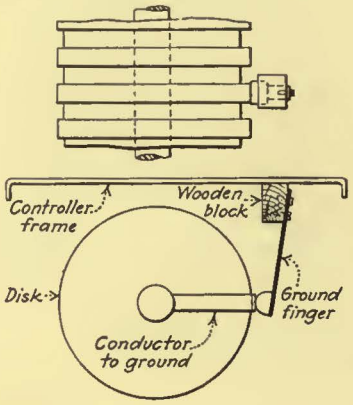


Fig. 2—New type of construction now used for ground fingers

*Submitted in Electric Railway Journal Prize Contest.

Expansion Joint for Girder Grooved Rail*

By C. R. Kinnear
Assistant Engineer of Way
Toronto Transportation Commission,
Toronto, Canada

FOLLOWING the adoption of the A.E.R.E.A. standard 7-in. 122-lb. girder grooved rail in 1921 by the Toronto Transportation Commission, it became necessary to procure an expansion joint primarily for use on bridges. Accordingly, a type of joint was designed and built by the way department, wherein the central or stationary portion is cut from a filled groove girder guard section rail with the guard left high at the center. The two end or traveling parts are of girder grooved rail and slide on the baseplate.

Wheels of cars are carried over the variable gap in the tread by the flange bearing section of the center piece, which has flange bearing risers at each end to lift the wheel to the minimum groove depth of $\frac{9}{16}$ in. The maximum expansion provided for use on lines of the Toronto Transportation Commission is 3 in.

Type of construction used for expansion joint of girder grooved rail

*Submitted in Electric Railway Journal Prize Contest.

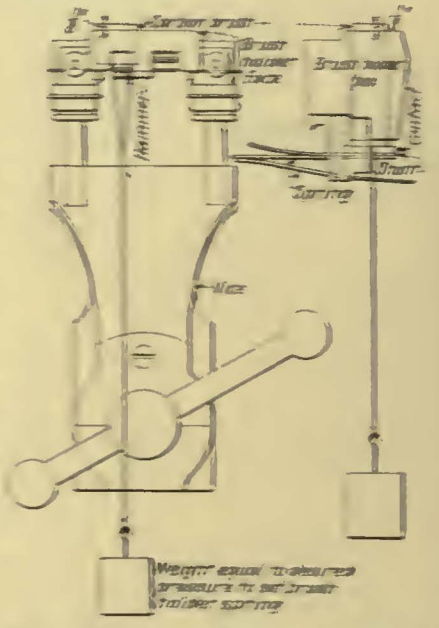
Method of Adjusting Brush Pressure*

By Arthur E. Clegg
Foreman Electrical Department
San Diego Electric Railway,
San Diego, Cal.

WHEN brush-holders are repaired it is the practice of the San Diego Electric Railway to adjust the pressure accurately. After defective parts have been replaced the brush-holder is clamped in a vise, with the hammers at the bottom as shown in the accompanying sketch. A carbon brush with a groove across the top is placed in the brush-holder box and a cord is placed around the hammer at the center of the carbon way. A weight is attached to the other end of the cord. This weight is just sufficient to give the proper amount of pressure.

If the weight does not balance the pressure of the hammer the ratchet is adjusted so as to change the brush pressure. Correct adjustment is obtained with the brush projecting ¼-in. outside the face of the brush-holder.

Proper brush pressure for the different types of motors has been determined and weights are made to be used in adjusting each type of brush-holder. These weights are stamped with the type of motor with which they are to be used. This method of measuring brush pressure provides a quick and accurate means of adjustment.



Method of adjusting brush pressure used by the San Diego Electric Railway

Submitted to Electric Railway Journal *Prize Contest.*

Bumping Rail for Installing Special Track Work*

By E. B. Spencer
Way Department Cleveland Railway,
Cleveland, Ohio

WHEN installing special trackwork, a bumping rail is considered by the foremen of the Cleveland Railway to be an essential tool. A special rail is now used for this purpose; previously, a short length of standard rail was used. This was held by tongs and, in the course of the work, the tongs often slipped off, which was unsatisfactory. Moreover, it was usually hard to find a rail that would answer the purpose satisfactorily. With the use of the special bumping rail accidents and lost time have been cut down considerably.

The special bumping rail is 8 ft. long and weighs 50 lb. It is equipped with four sets of handles, placed 2 ft. apart. A pair of splices is riveted on each end of the rail to give more weight and to provide a broader surface. These bumping rails have fulfilled all expectations. The cost of new is only the cost of assembling.

Bumping rail in position for use

Submitted to Electric Railway Journal *Prize Contest.*

Method for Storing Air-Brake Gaskets

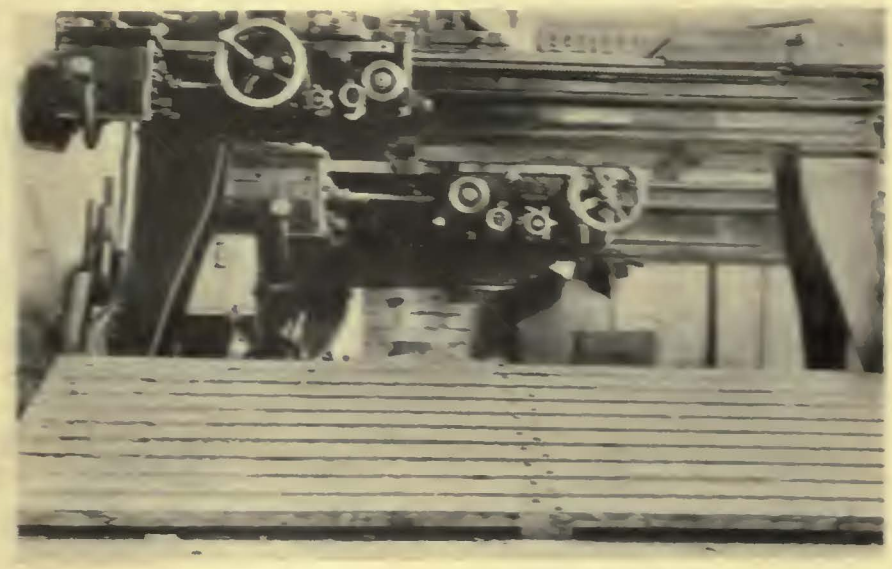
IMPROPER storage of air-brake gaskets in the store room of the Richmond Railways, Inc., Staten Island, N. Y., was the cause of a great deal of destruction until a method was devised as shown in the accompanying illustration. Previously, the gaskets were stored in bins and when a certain style gasket was required it was found necessary to remove practically all of them before the one desired could be found. This often resulted in destruction of some of them. At present they are stored on a common panel and the type is visible and marked plainly. Any gasket can now be picked up readily without disturbing the remaining ones.

This arrangement improves the store room appearance, prevents unnecessary destruction and decreases the time required for the filling of orders.

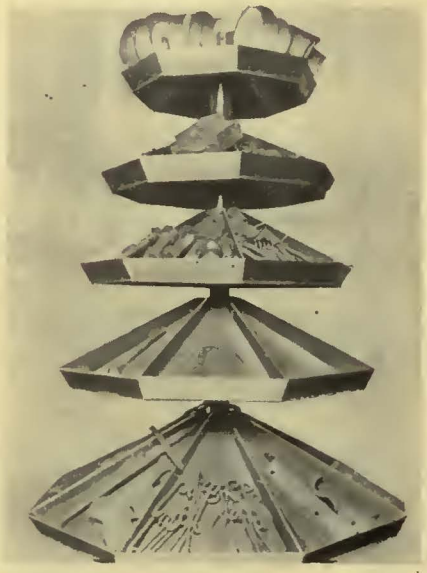
Board for storage of gaskets

Strip Platforms Improve Production

IT WAS noticed in the shop of the Surface Transportation Company, bus subsidiary of the Third Avenue Railway, New York, N. Y., that there was a tendency on the part of the machine workers to slow up in the afternoon. Investigation disclosed the fact that they were standing on the hard concrete floor and that it tired their feet. Wood strip platforms were constructed and installed in front of each machine for the operators to stand upon. These platforms are made in various lengths and widths depending upon their location and the type of the machine they are used with. They are made of 1-in. x 2-in. maple strips, spaced ¾ in. apart. They are screwed to three ⅞-in. x 3-in. maple cross strips. One of these platforms is shown in the accompanying illustration. Since these platforms served that a vast improvement in have been installed, it has been ob- the production has resulted.



Wood strip platform saves workmens' feet from fatigue due to standing all day on concrete



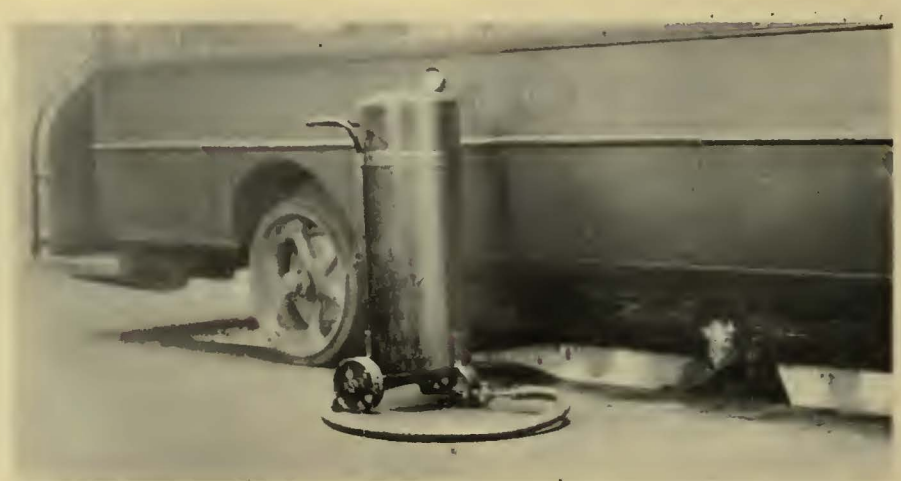
This rack permits of storing a vast quantity of small material and tools in a minimum of floor space

Revolving Tool and Material Rack

ONE of the most useful devices in the shop of the Staten Island Rapid Transit Railway, Staten Island, N. Y., is a revolving tool and material rack. It is conical in shape, 72 in. high, and occupies a floor space of 2,500 sq.in. There are five octagon-shaped conical trays varying in diameter from 24 in. at the top to 50 in. at the bottom. These trays are made from $\frac{1}{8}$-in. sheet iron and all joints are welded. Each tray is partitioned into eight equal sections. They are welded to a $2\frac{1}{2}$-in. solid vertical shaft and arranged so that the three upper trays can be revolved independently of the two lower ones. The bottom of the shaft supporting the three upper trays is provided with a shoulder fitting into a piece of pipe welded to the top of the lower section of the shaft. This arrangement provides a bearing for the rotary movement of the three upper trays. The bottom of the shaft, to which is attached the two lower trays, fits into a special floor flange providing a bearing for revolving these trays.

Air Tank Converted to Portable Grease Reservoir

GREASING of bus transmissions and differentials has been expedited considerably at the Walden garage of the International Bus Company, Buffalo, by the use of a regular street car air reservoir as a grease supply tank. The tank, mounted in a frame on wheels, can be moved directly to the bus to be serviced. No. 600-W grease is forced under 80 lb. air pressure from the tank to transmission or differential through a 12-ft. length of $\frac{3}{4}$-in. flexible hose equipped with the usual grease gun nozzle and control valve.



Originally built as a street car air reservoir, this tank holds 100 lb. of grease for bus lubrication work

Power and Line Maintenance Notes from Cleveland

Cable Rack Leakage Detector*

By F. W. Braund
Superintendent of Power Conversion Cleveland Railway, Cleveland, Ohio

CONNECTION between positive bus bars of conversion plants and the overhead distribution system of the Cleveland Railway is made by use of flameproof, rubber-covered cable installed in vertical iron pipes at the curb line. These pipes, into which additional insulation in the form of fiber duct is installed, are arranged in a group termed a feeder rack. Some method to determine the leakage between cables and the rack is of immense importance because continued leakage would have rather disastrous effects and perhaps cause serious interruption to service, particularly in non-attended stations.

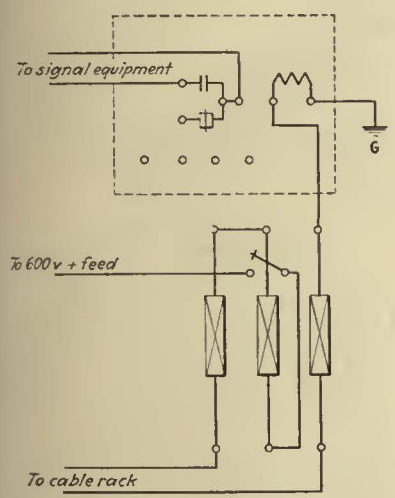


Diagram of connections for cable rack leakage detector

As a solution of this problem a standard voltage regulating relay has been adopted. This is equipped with a coil to operate contacts at approximately 20 volts. The positive lead of the coil is connected to the structural portion of the rack with the negative tied directly to ground. The contacts of the relay are wired so as to operate a signal at the load dispatcher's office in case of automatic plants, and a bell or trouble lamp within manually-operated plants. The accompanying diagram shows the connections.

To facilitate periodical calibrating and testing of the circuits of the rack leakage relay, a test circuit is arranged through resistance tubes from a 600-volt circuit. The amount of resistance is such as to give a feed to the coil of the relay of approximately 20 volts. With this test circuit a simulation of rack leakage potential can be set up on the rack for the purpose of checking the rack leakage detector's functioning.

Submitted in Electric Railway Journal Prize Contest.

Reclaiming Trolley Ears*

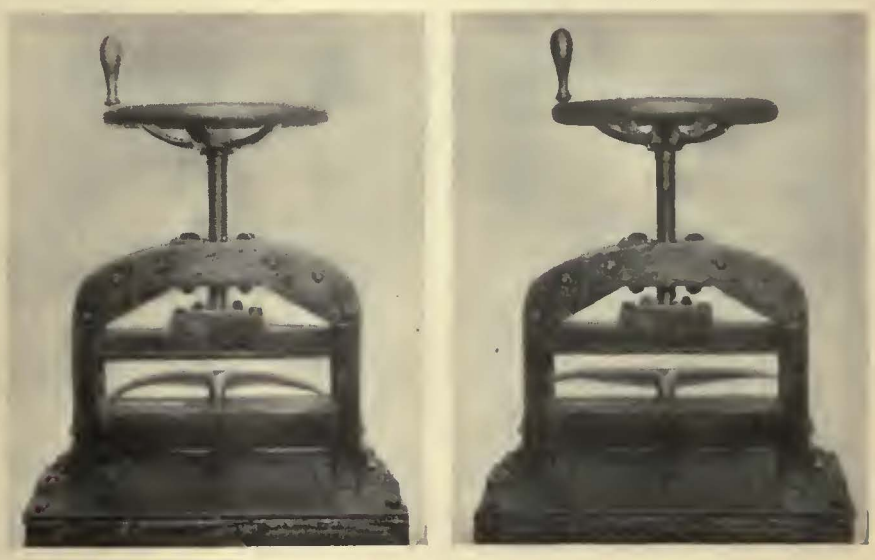
By Angus G. Scott
Assistant Superintendent of Overhead Lines Cleveland Railway, Cleveland, Ohio

BY MEANS of a machine for reclaiming slightly worn trolley ears in the overhead department of the Cleveland Railway, ears removed from the wire before they are worn out can be straightened and rendered fit for further service. Pole relocations, span rearrangements, removal of temporary trolley wires, as well as trolley renewals, require the removal of a surprisingly large number of trolley ears long before they are worn out. These ears are in good condition, except for the half moon bend caused by the stripping iron. It was found by experiment that this bend could not be removed satisfactorily or economically by hand. However, the saving possible warranted the construction of a simple machine to perform this operation.

The machine now in use resembles a letter press in appearance, into the base of which a die is fitted. This is cut to conform with the upper side of a new ear. The upper face of the press is movable and consists of a metal block connected to the top of a ball and socket joint, to a screw passing through the upper frame of the press. The lower face of this block consists of a metal strip which is shaped to correspond with the under side or groove of the ear.

The ear to be straightened is placed in the press, as shown in one of the accompanying illustrations. The boss rests on a coil spring extending up through the center of the lower die. The handwheel is turned to close the press and force the ear into the die. Moderate force applied to the wheel is sufficient to accomplish the desired results. Upon opening the press the spring in the base raises the ear to the position shown in the second illustration, from which it may be removed readily. The entire operation can be completed in less than a minute.

After reclaiming, the ears are used on temporary jobs, such as side-track trolley, temporary crossovers, etc. Each ear reclaimed represents a net saving of 45 cents. The Cleveland Railway used 573 reclaimed ears during the year 1928, which resu'ted in a saving of approximately $257.85.



At right, trolley ear in press for reclaiming. At left, straightened ear after the pressing operation

Submitted in Electric Railway Journal Prize Contest.

LABOR-SAVING PRACTICES from Rolling Stock

Testing Insulation of Armatures During Baking*

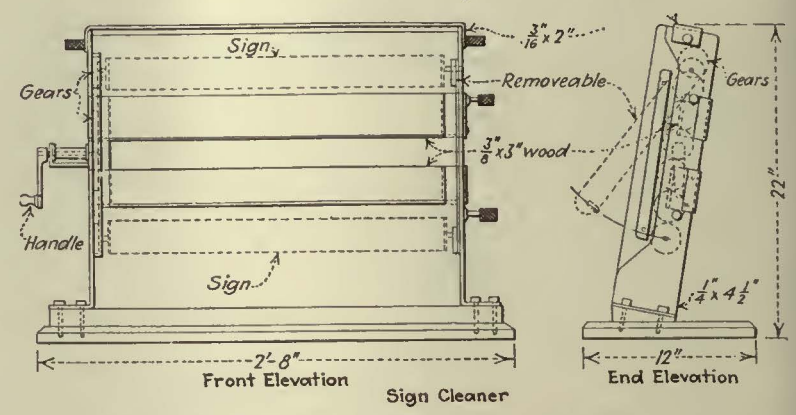
By A. J. NAQUIN
Equipment Engineer
Rolling Stock and Shops Department
New Orleans Public Service, Inc.,
New Orleans, La.

A TESTING set which provides easy and reliable means for checking the condition of armatures which are preheated or baked is used in the shops of the New Orleans Public Service, Inc. The equipment includes a Leeds & Northrup portable insulation testing instrument of the B battery type. This is wired to a special selector switch from which ten pairs of asbestos covered leads are wired permanently into the baking oven. Phosphor bronze spring clamps form the terminals of the leads inside the oven. The selector switch and the wiring must have a very high insulation resistance value of their own, otherwise a false reading may be obtained.

The accompanying illustration shows the connections of the testing set, the selector switch and the method of carrying the leads into the oven. It has now been in use for more than a year and its use soon showed that the length of time required for baking could be reduced safely. Before the testing set was installed armatures were baked a much longer time than was necessary in order to be on the safe side.

At the present time a reading of 600,000 or more ohms at an oven temperature of 210 deg. to 225 deg. F. is the passing limit. During the past year no armatures were lost during the final high potential test. Armatures which are dipped and baked are given a 1,500-volt test. Rewound armatures receive 2,000 volts. As a further check on the effectiveness of the dipping and baking methods employed, a total of 27 armatures were rewound during the year 1928, from a total of 1,100 motors in service. The cost of the testing equipment used in New Orleans is approximately $300.

**Submitted in* ELECTRIC RAILWAY JOURNAL *Prize Contest.*

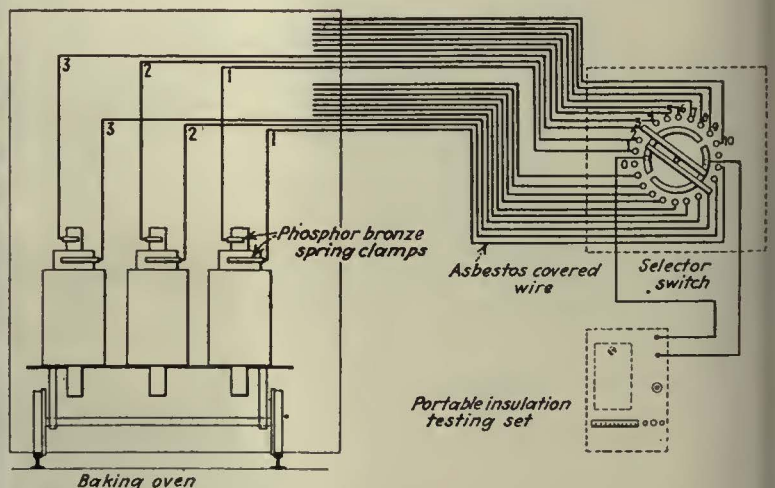


Device used for holding destination signs during cleaning

Roller Sign Holder Assists Cleaning*

By G. H. WATKIN
Foreman Brooklyn City Railroad,
Brooklyn, N. Y.

CLEANING of Hunter roller destination signs in the shops of the Brooklyn City Railroad is facilitated by the use of a machine for rotating the signs. The equipment consists of two rollers held in position by two metal side pieces. A series of gears together with a handle connects the two rollers. Metal side pieces are arranged to be detached quickly for insertion and removal of the sign.



At left, armatures are tested during baking at shop of New Orleans Public Service, Inc. At right, connections for insulation test equipment

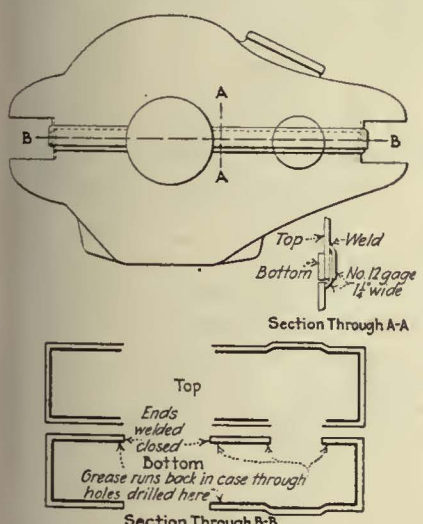
Departments

The framework is mounted on a wooden base. Through the use of this equipment roller type destination signs having 59 destinations, with a width of 22 in., are cleaned in approximately five minutes. Without the machine the cleaning operation would take at least one-half hour.

Making Gear Cases Tight*

By Equipment Department
Georgia Power Company, Atlanta, Ga.

TO PREVENT loss of lubricant and to keep water and dirt from getting in gear cases, the Georgia Power Company welds strips to both the top and bottom halves to form a



Method of welding strips to gear cases to prevent water and dirt from getting in

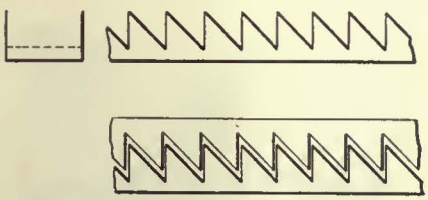
double-tongued joint. Holes of $\frac{3}{16}$-in. diameter are drilled at the bottom of the groove on the lower gear case, so that any grease that might otherwise escape will return into the case. The ends of this groove are welded closed at the axle and armature shaft openings of the case. This prevents any grease from escaping at these points, and reinforces the joint. The outside strip prevents water and dirt that may be thrown up by the wheels from entering the case.

**Submitted in* Electric Railway Journal *Prize Contest.*

Preventing Loose Armature Bands*

By F. A. Marsh
Superintendent of Equipment
St. Petersburg Municipal Railway,
St. Petersburg, Fla.

AFTER an extended trial of methods for banding armatures, the Municipal Railway of St. Petersburg has adopted a design wherein the



Armature band used by the St. Petersburg Municipal Railway is a tin trough with serrated edges

usual type of steel banding wire is used but the clips are omitted and a thin tin metal trough with serrated edges is used in their place. The wire band is wound in the tin trough and then the serrated edges are hammered down and soldered. A solid homogeneous band is thus formed which will not come off in regular service.

With the new type of band the wires are soldered firmly at the top and bottom, thus creating a solid metal band of great strength. These bands cost 35 per cent more than the usual type, but this additional cost is saved many times through the increased mileage that is obtained and through decrease in the number of loose wire bands and consequent destruction of armatures and fields.

Are You Overlooking the

MAINTENANCE CONTEST?

Entries for the Second Group of Prizes Close April 15

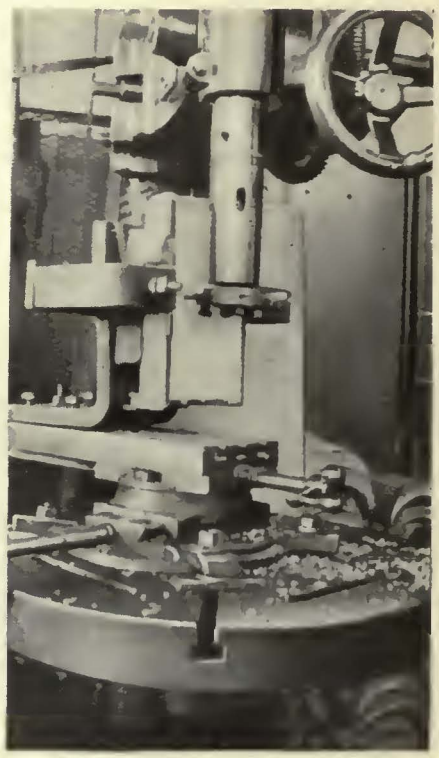
Separate prizes are awarded for items from each of the following departments:

EQUIPMENT	TRACK
BUS	ELECTRICAL

A photograph or sketch together with a letter describing a new maintenance device or method is all that is necessary to enter your ideas.

Journal Bearings Milled in a Drill Press*

By Harvey L. Bullock
Superintendent of Electrical Equipment
Cleveland Union Terminal, Cleveland, Ohio



Drill press attachment for milling journal bearings

AN ATTACHMENT for use with a vertical drill press has been found convenient for facing journal brasses in the White Plains machine shop of the New York Central Railroad. The journal box wedge is attached to an angle plate and the bearing is held in place by two side clamps. A special adjustable milling cutter is used in the drill press spindle. All sizes of journal bearings up to 6¼x11 in. are machined rapidly. Bearings are checked for radius and thickness. This attachment provides a convenient method for doing this work in the absence of a special machine.

**Submitted in* Electric Railway Journal *Prize Contest.*

Four Practical Ways to

Cut Track Mai

One-Man Tie Nipper*

By Joseph Croyle
General Foreman Way Department
Cleveland Railway, Cleveland, Ohio

DESIGNED so that pressure on the lever arm brings the tie up snugly and firmly against the base of the rails during the process of spiking, a one-man tie nipper has been used by the Cleveland Railway during the season of 1928 with marked success. It can be used on any section of rail by changing the hangers as shown in the accompanying sketch. The change is carried out easily and with little work. By use of the nipper the number of men employed in the spiking crew is reduced to three instead of four, as is common practice on most roads. Its use also lessens the hazards of flying spikes and swinging mauls, thus minimizing accidents. The nipper is made easily and cheaply by any blacksmith, and costs little more than the two lining bars generally used for this purpose.

**Submitted in* Electric Railway Journal *Prize Contest.*

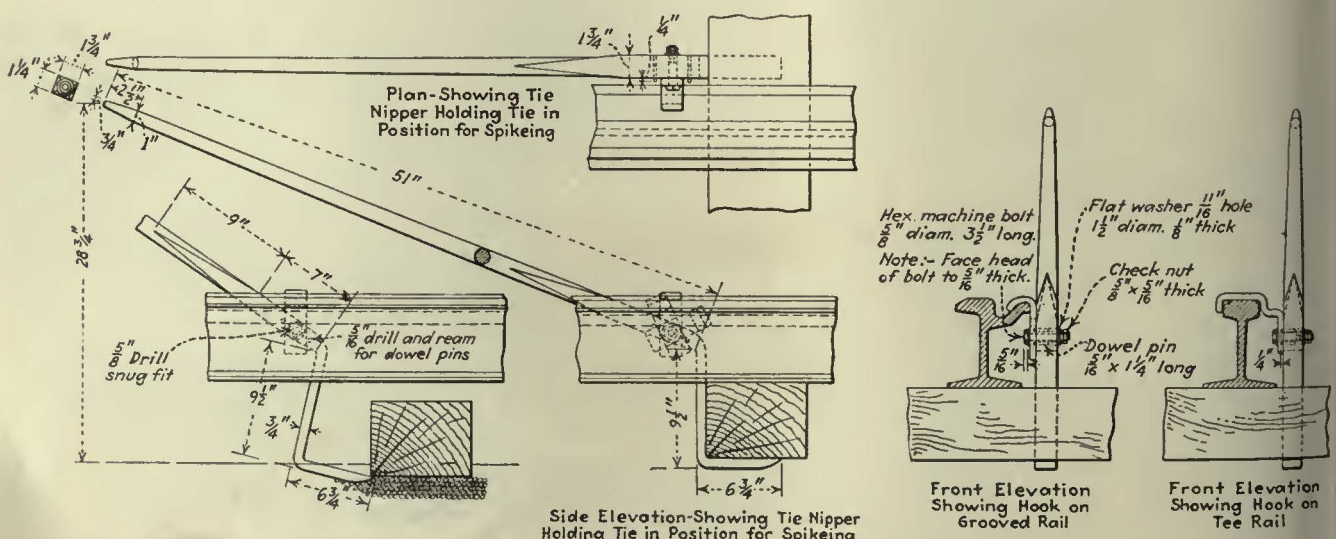
Using the tie nipper while spiking special work in Cleveland. By its use one man out of the crew of four is eliminated

Track Switch Coil Cylinder Vise*

By Charles Herms
General Foreman, San Diego Electric Railway, San Diego, Cal.

CHANGING coils in track switch cylinders was always a two-man job on the San Diego Electric Railway, until a special type of vise was made to hold the cylinder firmly under the heavy strain. A clamp, 8 in. x 16 in., grips the cylinder so rigidly that there is no possibility of slipping. The cylinder is placed in the bottom section of the vise and the top section then placed on. This is hinged on an adjustable eyebolt which is on the opposite side from that shown in the accompanying illustration. With the top in position, the eyebolt *B* is engaged in the slot of the 1-in. x 3-in. plate and the top is screwed down by means of the clamp *A*. The wrench is next placed on the nut and a wedge is inserted in each corner to keep the wrench from slipping off.

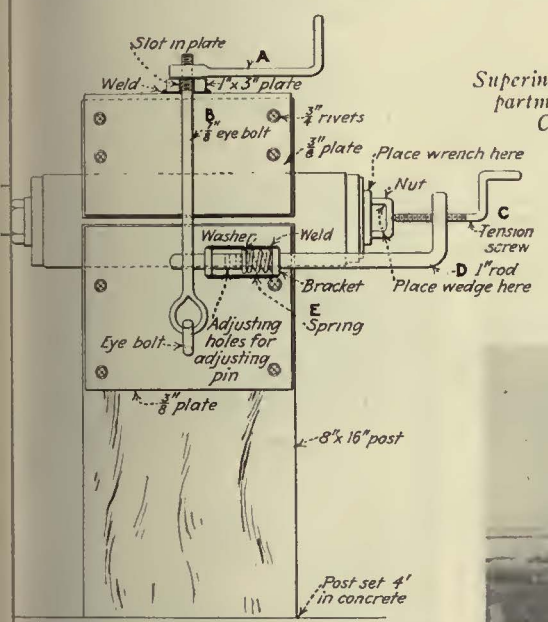
The same procedure is used in installing the nut but it is necessary to compress the spring in the cylinder which formerly required two men, but by means of the compression clamps *C* and *D*, this can now be done



Construction details of the tie nipper and hangers

enance Costs

by one man. The rod *D* is turned up until the tension screw *C* is centered and forced against the cylinder nut. This compresses the spring *E*, so that it acts as a take-up



andy vise used for removing coils in track switch cylinders

until the nut has been screwed on a few threads. Otherwise it would be necessary to screw the crank C in at the same rate as the nut is screwed in. Several holes are drilled in the rod *D* behind the spring *E* so as to give a small range of adjustment should it be desired. When not in service the rod *D* is pushed back to the post, so that it will not occupy too much space.

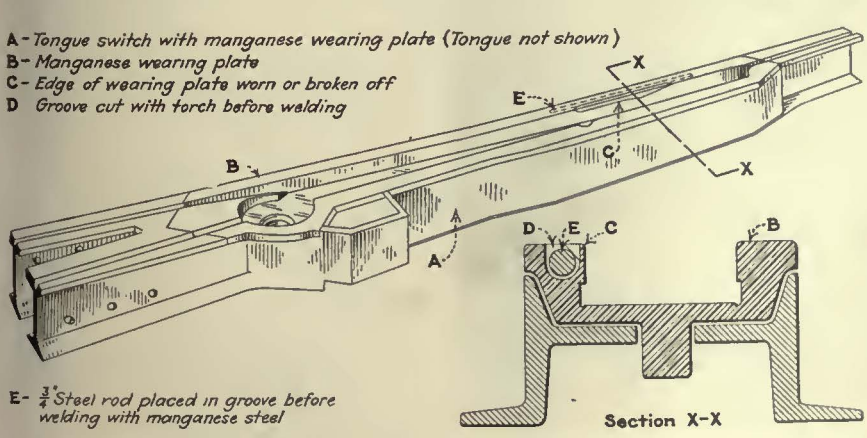
Repairing Manganese Wear Plates

By Louis T. Botto

Superintendent Maintenance of Way Department San Antonio Public Service Company, San Antonio, Tex.

For several years welders of the San Antonio Public Service Company have experienced difficulty in making repairs to manganese wearing plates in switch frames and in building up surfaces. Hair cracks are found across the middle and ends of the work. The switches have been in service from ten to sixteen years, and are worn to a considerable extent. Often they break through the manganese near the center of the switch piece.

An inexpensive method of making repairs which has been found to stand up remarkably well consists of incorporating a piece of ¾-in. round cold rolled tool-steel into the built-up section. The ends of the steel rod project into the sound part of the insert. A trench is cut with a torch and the steel rod fitted into this, after which it is built up.



Method of repairing manganese wear plates at tongue switch

Unloading Trestle Speeds Material Handling*

By C. B. Hall

Chief Clerk Mechanical Department Virginia Electric & Power Company, Norfolk, Va.

Confronted with difficulties in the company's yards due to slow unloading of coal, cinders, ballast, etc., J. C. Newman, engineer maintenance of way Virginia Electric & Power Company, planned and supervised the work of construction of a new trestle, which has resulted in a marked reduction in unloading costs. This trestle is of wood, 96 ft. long and has a concrete base 5 in. thick. Approaches to the trestle are on a 2 per cent grade. Rails are spiked to two 7x14-in. wooden stringers and steel tierods are used to hold the rails to gage. The work of constructing the trestle was completed in ten days at an approximate cost of $750.

Unloading trestle reduces demurrage charges

There is also a considerable saving in time as previously a crew of six men required a ten-hour working day to complete the unloading routine, while now from six to eight cars are unloaded in the same working time.

**Submitted in* Electric Railway Journal *Prize Contest.*

Putting Bus Maintenance Ideas *To Work*

Diagonal Cut in Brake Lining Lessens Glazing

GROOVING the brake lining across the middle for its full depth with a diagonal cut ½ in. wide, at a 60-deg. angle, has been found singularly effective in reducing trouble with the Timken mechanically-operated brakes on the Yellow coaches of the International Bus Company, Buffalo, N. Y. This brake

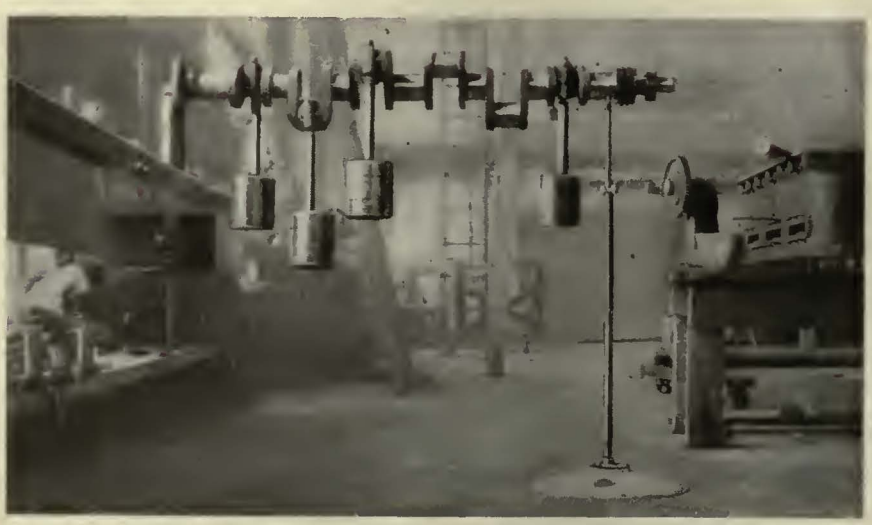
A diagonal groove cut across the face of the brake lining supplies an outlet for dirt particles that ordinarily would be ground into its surface

lining, which is 15½ in. long, 5 in. wide and $\frac{5}{16}$ in. thick, was found to be subject to glazing, which, in turn, produced squeaks and caused irregular wear. The groove apparently has been successful in affording an exit for particles of dirt, gravel, etc., which otherwise would remain inside to be ground into the surface of the brake lining by the shoe and cause trouble.

Crankshaft Supports for Fitting Connecting Rods

FITTING connecting rods to a crankshaft was always a cumbersome job in the shop of the Surface Transportation System, bus subsidiary of the Third Avenue Railway, New York, N. Y., until a method was adopted for supporting the shaft, as shown in the accompanying illustration. The shaft flange is now bolted to a bracket fastened to the upper surface of a work bench near the front edge. This bracket is made of ½x6-in. material. The foot is 4½ in. long and the upright 6½ in. long. The other end of the shaft is supported by a special adjustable stand. The base of this stand is made of sheet iron, is 14 in. in diameter and conical in shape. It is fitted with a ¾-in. pipe flange. A piece of ¾-in. pipe 26 in. long is screwed into this flange and is fitted with a winged cap at the top. This cap is drilled and tapped for a ½-in. bolt thread. A ½-in. rod provided with a jaw 3¼ in. wide and 1½ in. deep and threaded for a distance of 10 in. is screwed into the winged cap. Turning this cap to the right or to the left increases or decreases the height of the stand.

This arrangement permits of accessibility to all parts of the shaft, allows for free circular movement of the rods being fitted and tends to increase the production.



Method of supporting crankshaft while connecting rods are fitted

Heated Chamber Gives Clear Vision for Cars and Buses

TO PREVENT the formation of ice on the windshield of a bus, a heated chamber, 30 in. wide at the top with the bottom shaped in a circular arc slightly shorter than the

Heated chamber installed on the windshield

length of a swinging wiper, has been devised by Joseph O. Marcelais, car mechanic for the Fitchburg & Leominster Street Railway. The back of this chamber is a piece of slightly tinted optical glass fitted into the frame. The front surface is the windshield itself. Three resistance wires are run in the base of the frame. Perforations provide for circulation of air to prevent sweating. A three-way switch connects either one or all three of the wires for use, depending upon the severity of the weather. A cork filler is used to insulate the chamber from outside conditions.

When the air inside the chamber is heated, snow, ice and mist formations disappear and clear vision is obtained. The tinted glass protects the operator from the glare of approaching lights. It is also claimed to ease the strain on the eyes of the operator when glistening snow is on the ground.

NEWS *of the Industry*

Supreme Court to Get Baltimore Case

An opinion just handed down by the Maryland Court of Appeals denies the United Railways & Electric Company, Baltimore, Md., its appeal for a higher rate of return. The opinion concludes the case in the Maryland courts and opens the way to carry the matter to the Supreme Court.

Some months ago the Court of Appeals remanded the case to the Maryland Public Service Commission. At that time the Supreme Court dismissed an appeal on the part of the company, holding that the case was still pending in the Maryland courts.

In the earlier case the company charged that the 6.25 per cent return fixed by the commission was confiscatory. The court remanded the case, however, on the ground that the Public Service Commission had based the depreciation allowance on cost instead of value. When the case was reconsidered by the commission the company was granted an increase in fare from 9 cents or three tokens for 25 cents to 10 cents cash or four tokens for 35 cents. The case again was carried through the courts and the recent opinion of the Court of Appeals brought it to an end in the Maryland tribunals.

Terms of Toronto Agreement Stand

No increase in wages, no vacation with pay as asked for by the men, and the abolition of extra pay for Sunday work, featured the report of D. W. Saunders and D. L. McCarthy, acting as arbitrators between the Toronto Transportation Commission and the local railway men's union.

The report, is not subject to appeal. It provides for overtime pay after the usual eight-hour-day, plus a half-hour leeway for shopmen and an extra half run for trainmen.

James Simpson, who represented the men, dissented. The arbitrators, in effect, rule that the old agreement will stand except for the fact that overtime will not be paid for Sunday.

A new element enters into the situation by reason of the offer of Manager Harvey, backed by the Board of Control, to restore the overtime rate for Sunday work in return for a three-year agreement, instead of the two-year award made by the board. This is a resumption of negotiations on a new line. As the Toronto *Globe* sees it, Mr. Harvey is evidently prepared to protect the public interests in so doing, because under the circumstances he represents the patrons of the system.

In its comment that paper says:

If his proposal involved an increase in fares he would find himself in trouble. Otherwise he is to be commended for making the offer. This overtime rate has been paid for a number of years, and, while the chairman of the board evidently believed that it was out of line with the usual overtime principle, it is doubtful if the people would object to paying the men working Sunday the extra sum for the loss of this universal day of rest.

Franchise Accepted in Jacksonville

John P. Ingle, manager Jacksonville Traction Company, Jacksonville, Fla., filed the company's acceptance to the proposed new franchise passed by the City Council on March 12. The matter is now ready for submission to the electors of Jacksonville, who probably will pass on the franchise after the general city election in June. The action of the Council and Mr. Ingle concluded negotiations between the city government and the company for more than two years.

When Mr. Ingle filed the formal acceptance of the franchise provisions on behalf of the company and Stone & Webster, Boston, Mass., operators of the company, he said in part:

While this franchise does not contain all of the provisions for which the company has contended and believed would be of mutual benefit to the city and the company, it is essential that the negotiations which have extended over a period of three years be ended.

We shall do everything in our power to give the city adequate transportation service, relying on the co-operation of City Council and the public in our efforts to fulfill these obligations.

Mayor John T. Alsop, Jr., expressed satisfaction at the action of the Council and the company, and indicated that he would sign the bill as soon as it was presented to him.

Improvement on Worcester Equipment Follows Editorial

Prompted by an editorial in the Worcester, Mass., *Telegram*, the Worcester Consolidated Street Railway has decided to have the words "emergency door" painted in red letters, 1½ or 2 in. high, on the emergency exit of every bus which the company operates. Work has already started on order of Vice-President Howard R. Whitney. Mr. Whitney investigated and found that the editorial was right in stating that the emergency doors at the rear of the buses are "so integral with the side of the vehicle as to be almost unseen despite signs."

North Jersey Commission for Co-ordination

The North Jersey Transit Commission submitted to the Legislature on March 11 a report presenting in further detail its plans for the development of transit in the metropolitan area of New Jersey with a view to its ultimate co-ordination with the interstate system outlined in the report of 1926.

The report recommends an elective northern New Jersey metropolitan board with power to finance, construct and administer the rapid transit system of the district, with supervision over water supply, sewage disposal, reclamation of salt meadows and subdivision control. The Port of New York Authority, as the most practicable existing agency with power to construct interstate traffic connections, is suggested as most suitable for co-operating with such a board.

The report explains that the commission's studies have been made available to the suburban transit engineering board and that until the task of co-ordinating the views of diverse locality interests affected has been completed, the commission will take no further steps. In the board's opinion Newark, by reason of its population, wealth, area and variety of industrial plants, is today the natural focus about which North Jersey development must center. To regulate and promote this development the commission recommends the creation of an elective North Jersey metropolitan board along lines suggested in a Senate joint resolution now pending in the Legislature.

Preparing for the Operation of New York's New Subways

Indications are that the city of New York will buy its power from the New York Edison and allied companies for the new municipal subways in course of construction. Chairman John H. Delaney, of the Board of Transportation, presiding at a hearing on March 26 said that bids, based on a price per unit of power delivered, would be submitted probably by June 1.

Unless the city builds its own power plant for supplying the new municipal subways, which is not contemplated, the New York Edison Company is practically the only source from which the city can draw. Even now both the Brooklyn-Manhattan Transit Company and the Interborough Rapid Transit Company purchase power. The city will go through the form of advertising bids because of the legal requirements.

The city decided against building its own power plant to supply the new city-

owned subways on the advice of Stevens & Wood. They reported that great changes were taking place in methods of power development and that the city might find it advisable to make a contract for ten years with a private power company. Power requirements are estimated at 18,000 kw. the first year, rising to 209,000 within ten years.

Chairman Delaney asserted that the city would begin operation of the first part of its new subways probably in the spring of 1932. The section to be placed in operation is that of the Eighth Avenue-Washington Heights line from Fulton Street to 207th Street. Within a few months after the opening of that line operations will be extended to Brooklyn. Following the opening of the line to Brooklyn operations to Queens will be begun. The entire municipal system should be in operation by the middle of 1932.

Reduced Fares on Indiana Lines

To stimulate the passenger business during the coming summer and fall, the Evansville, Suburban & Newburgh Railway operating to Newburgh and Boonville, Ind., from Evansville, Ind., and the Evansville & Ohio Valley Railway operating railway lines to Grandview, Ind., and bus lines to Owensboro and Henderson, Ky., and to Mt. Vernon, Ind., will offer reduced half-fare rates on holidays and over the weekends.

Change in Commutation Tickets on Chicago Interurban

The Chicago, Aurora & Elgin Railroad has announced that commutation tickets now used between Chicago and the Fox Valley cities are interchangeable and may be used between Chicago and other points on the line. The 10 and 25-ride tickets, sold at $8 and $19 respectively, are good for one year from date of sale, but the 60-ride ticket, sold for $16, is good only for the calendar month in which it is issued.

Milo R. Maltbie Retained by Philadelphia

Following a conference of city officials of Philadelphia with Milo R. Maltbie, public utilities expert, it was announced that Mr. Maltbie and three of his assistants would return to Philadelphia from New York to work in conjunction with the firm of Haskins & Sells, accountants originally engaged to audit the books of the Philadelphia Rapid Transit Company. Mr. Maltbie's efforts, however, will be directed more specifically toward the engineering phases of the investigation.

Parking Ban in Toledo Suggested

A city traffic commission appointed by Mayor W. T. Jackson, of Toledo, Ohio, has recommended to the City Council an ordinance to bar all parking in a downtown loop area.

Railroading in the Revolutionary Zone

While the average Mexican soldier, regular or irregular, is a notoriously bad shot, he is by the same token, inclined to be prodigal in his expenditure of ammunition, with resulting danger to the innocent bystander. So when the latest disturbances along the border got fairly under way and it began to appear that Juarez was about to change hands again, F. J. Gannon, manager El Paso Electric Company, influenced, possibly, by the slogan "The Street Cars Can't Dodge," and not caring to have his trainmen live the lives of clay pigeons, withdrew his rolling stock to American territory until the unpleasantness was over.

Long experience has taught them to do things well in El Paso. Whereas on the usual railway property it is customary to have weekday, Saturday and Sunday schedules, the El Paso management provides for revolutionary and peace-time schedules, and when the dispatcher learns that another revolt has

Last Car from Mexico Seeks Safety in U. S. A.

broken out across the line he simply says "ho hum," or words to that effect, posts the revolutionary schedule on the bulletin board, and without further instruction the trainmen arrange to turn their cars back at the river. Then follows the regular rush-hour problem of hauling American spectators to points of vantage along the river bank on the United States side from which to view the proceedings. Ordinarily, a good, stiff border battle, in which the principals are well known, will draw a bigger crowd than a bull fight. Attendance at a border battle, however, is not unaccompanied by hazard.

As previously stated, Mr. Gannon, who knows his *vivas*, had been advised that an attack was impending, and had turned off the power and withdrawn his cars to points of safety, with the consequence that the property was damaged only to the extent of a couple of broken span wires and some shattered insulators. On the other hand, the revoltosos displayed their thoughtfulness in cleaning up the damage within a few hours after the fracas so that Americans seeking their week-end stimulants could be accommodated with as little delay as possible. "Their thoughtfulness in this regard," writes Mr. Gannon, "probably prevented a heavy mortality on the American side of the line."

Now the situation is static, but Mr. Gannon expects a return to normalcy when the federalistas attempt a re-take. "My only fear," he writes, "is that the federal forces will use airplanes and bombs, and if they are as poor shots with bombs as they are with rifles El Paso will probably catch fits when they attack Fort Hidalgo, 4 miles away."

Prospects Bright for Chicago Legislation

Representatives of the Chicago electric railways, who during the week ended March 23 were reported to have withdrawn all opposition to the six legislative enabling bills, drafted by the citizens' traction settlement committee, have since notified the committee that they will not assent to any fixed-term franchise.

The six original bills in the settlement program, however, have been approved by the local transportation committee of the City Council.

In a formal statement introduced at a public hearing on the bills on March 25, the companies declared that they would not endorse the recommendation of the citizens' committee that a seventh bill be drawn to empower the city to grant a 40-year term franchise or an indeterminate permit.

The bill approved by the companies and the local transportation committee during the week ended March 23 authorizes the city to grant either a twenty-year franchise or a terminable permit. The statement protested against any change in the bills in their present form and warned the committee that such changes would stir up new issues and cause further delay. The companies have withdrawn their demand that the home-rule proposal should be conditional on the granting of a terminable permit to the new consolidated company.

The local transportation committee, however, is said to favor the terminable permit as the best form of contract with the company but desires the power to grant a 40-year franchise merely for the purpose of stopping opposition to the Council's program in seeking a referendum vote. In discussions on the 40-year amendment, several Aldermen argued that the twenty-year grant would not permit sound financing.

The public hearing sponsored by the local transit subcommittee was marked by a fiery denunciation of the measures by Judge John M. Harlan, representing the F. J. Lisman interests of New York. Mr. Harlan charged that under the proposed legislation the city would surrender to the new company all authority over the use of its streets in return for home rule.

As soon as the City Council passes on the bills, they will be introduced in the General Assembly at Springfield. The entire City Council membership plans to appear before Governor Emerson to ask his support of the program.

Halt in Wage Action in Ontario

As no relief in the way of additional revenue is in sight for the London Street Railway, London, Ont., it appears that no further action will be taken by the employees to enforce the award made by the Railway Board. As a matter of fact, the city has not sufficient power to increase the fares as under the railway act for Ontario municipalities cannot increase railway fares beyond a maximum of 5 cents and the city so far has taken no action to have this clause amended or changed by the Provincial Legislature.

During 1928 many conferences were held with the employees of the company in reference to their application for an adjustment of wages filed with the company on Jan. 30, 1928. Under the wage agreement, notice may be given by the employees under a 60-day clause, asking for a revision of the wage scale, and this notice was served by the employees on Jan. 30. At all of these conferences the employees were advised that the company could not pay any increase in wages under the existing franchise with the city of London. However, during the month of November the employees threatened to go out on strike and the Ontario Railway and Municipal Board of Toronto, Ont., held a session to ascertain if anything could be done to settle the question.

Both the employees and the company agreed to refer the matter to the Ontario Railway and Municipal Board for investigation, and a further meeting was arranged by the Railway Board at Toronto on Dec. 18. The company presented statements of operating costs and information in reference to the additional operating costs on an adjustment of wages on the basis of the scale presented to the company by the employees at the previous conference.

The Ontario Railway and Municipal Board on Dec. 29, 1928, forwarded its award. Briefly, the board favored an increase of 2 cents an hour to motormen and conductors, increasing the general scale from 48 cents to 50 cents an hour and to one-man car operators an increase of 2 cents an hour which would increase the scale from 53 to 55 cents an hour. Bus operators were awarded an increase of 5 cents an hour, raising their pay from 50 to 55 cents an hour. A general increase of 2 cents an hour was awarded to all shopmen, trackmen and linemen. The award was dated from Dec. 1.

The management took the stand that, as no funds were available to pay wages on the basis of the award, it would be impossible to comply with the award. Employees were advised of this fact and at the same time informed that it would be necessary to have the matter referred to the directors of the company for their decision. The directors met on Feb. 6 and decided that it would be impossible to operate the railway and pay the award made by the board and the employees of the company were advised by letter on Feb. 8 that the directors regretted that they could not comply with the award made by the Ontario Railway and Municipal Board without creating a serious deficit in the operation of the railway.

No further action has been taken by the employees, who appear to realize that the company cannot meet the award of the board. In fact, on several occasions pay day has been deferred on account of insufficient funds to meet wages when due.

Paving to Be Done By Sioux Falls Company

The City Commission recently passed a motion requiring the Sioux Falls Traction Company, Sioux Falls, S. D., to pave between the street car rails on Sixth Street between Nesmith and Van Eps Avennes and on Van Eps Avenue from Sixth Street to Tenth Street. In the motion the city attorney was instructed to take steps to compel the company to pave, as it was instructed to do by the Supreme Court following a decision in the case of the city of Sioux Falls vs. the Sioux Falls Traction Company.

Railway Men on Baltimore Safety Council

Thomas A. Cross, a vice-president, and H. B. Potter, vice-president and general manager of the United Railways & Electric Company, Baltimore, Md., have been elected members of the executive committee of the Baltimore Safety Council.

Parking Rules in Chicago Amended

Amendments to the ordinance prohibiting week-day parking on downtown streets of Chicago were adopted recently by the City Council. These shorten the time limitation one-half hour in the late afternoon and correct certain legal errors in the original ordinance. The present no-parking hours on "loop" streets from 7 a.m. to 6.30 p.m. will be shortened to 6 p.m. upon recommendation of the committee on street traffic regulation.

The traffic committee which considered the matter of amendments also recommended that the ordinance be altered to permit trucks to park not more than 30 minutes for loading or unloading. The former ordinance, now under review by the courts, prohibits automobiles from "stopping" anywhere in the "loop," instead of prohibiting "parking." This provision was not worded in accordance with the recommendations of the traffic committee of the Chicago Association of Commerce, which sponsored the ordinance. The amended document corrects this defect and was passed with practically no organized opposition, indicating the success of the no-parking restriction after more than a year's experience.

City Directors Play Small Part in Philadelphia Deliberations

Declaring "no self-respecting citizen could continue on the Philadelphia Rapid Transit board of directors as a representative of the city unless there is change," Ernest T. Trigg caused a stir among City Councilmen on March 21 in a criticism of Philadelphia Rapid Transit business methods.

During the long discussion of the matter in which he contended city directors on the board of the railway company have been reduced to a situation of complete unimportance in formulating its plans and policies, Mr. Trigg contributed an earnest statement calling for action by City Council, but he qualified his remarks by saying he believed the Philadelphia Rapid Transit Company would act to make the city directors play the part in the affairs of the company they should.

Denial Issued on Equitable Coach Application

Transit Commissioner Leon G. Godley denied on March 28 the Equitable Coach Company's application for a certificate of convenience and necessity to operate buses in Manhattan, Brooklyn and Queens, New York, under the franchise voted by the Board of Estimate on July 28, 1927. The franchise itself would be revoked by the board shortly, it was said at City Hall. Commissioner Godley's decision was on the ground that his inspection of a financing plan submitted to him by the company recently disclosed that the Equitable was not only "a financial cripple from the start" but was "suffering from a complete financial paralysis" and was therefore in no position to supply a bus service commensurate with the public need.

Revocation of the franchise will end further investigation by the city of the "slush fund" charge raised in connection with the Equitable's unsuccessful attempt to put through a merger of its Brooklyn and Queens routes with the Brooklyn-Manhattan Transit surface lines.

New York Session Ends

The 152d session of the New York State Legislature adjourned on March 23 with many bills dying in committee, among them the transit unification bill for New York City. Measures that passed of interest to utilities were the two-cent gasoline tax effective May 1 and the investigation by commissions of practical working of the public service law. Measures that failed were the ambulance-chasing legislation and the suburban passenger traffic inquiry by Port Authority. Bills affecting New York City which failed of passage were the creation of a sanitation department and the board of control for unified city operation of subways, to which reference has been made before.

Convention Plans Fast Maturing

Program practically completed. Unusual facilities for the exhibits, with good arrangement for rolling stock display

REPORTS of standing and special committees of the American Electric Railway Association made at a regular meeting of the executive committee held at association headquarters in New York on March 22, 1929, indicate that the association's work for the year has been advanced since the last meeting, and that plans for the annual convention are rapidly taking definite shape. At the same time, reports made by the presidents of the several affiliated associations reflect the progress being made by committees of the Accountants, Claims, Engineering and the Transportation and Traffic Associations.

T. A. Kenny, chairman of the program committee, reported that the convention program has been practically completed, and that the various speakers selected are being invited to participate. Chairman J. H. Hanna, of the exhibit committee, expressed his gratification at the progress made in completing the new exhibit hall at Atlantic City, and was quite confident that the facilities afforded by the new auditorioum would amaze and delight the entire industry.

Chairman Hanna called particular attention to the unusual facilities that will be available for a representative car exhibit. The space for showing cars will be on a decorative plaza which is being built on the ocean side of the boardwalk in front of the new auditorium, with space for fifteen city type cars on curved tracks laid on this plaza and with direct track connections from one of the streets at the side of the auditorium. In this setting, it was the consensus of opinion, this year's car exhibit will be in the finest spot for the purpose to be found anywhere in the country. It was considered important, therefore, that a really representative exhibit of modern cars be staged for the publicity value to the industry which would result from the location that is to be available this year.

Chairman Hanna reported that there have been only two affirmative replies to letters of inquiry sent to car builders regarding their plans for exhibiting modern types of cars, and he requested the co-operation of the executive committee and the special manufacturer's committee in arousing the car builders to an interest in the importance of this exhibit.

Report on Pacific Coast Conference

Reports of other standing and special committees included those on publicity, membership, finance, national relations, publications, hotel arrangements, Coffin Award, education, insurance, research, taxation and street traffic economics.

Managing Director L. S. Storrs reported on the conference of Pacific Coast executives recently held in San Francisco under the auspices of the Advisory Council. He felt that the plan of holding a series of similar conferences in various sections of the country should be pushed. J. N. Shannahan, chairman of the Advisory Council, asked for an expression of opinion from the members of the executive committee as to the value of sectional meetings of this kind. It seemed to be the consensus of opinion of the entire executive committee that such sectional meetings for principal operating executives, with no fixed program, for the frank discussion of the problems and outlook for the industry, are very much worth while. Past-president W. H. Sawyer declared that the justification and need for such meetings was so manifest as not to warrant discussion, the only question being the number of meetings of this kind which the chairman of the Advisory Council, the president of the association and the managing director could find the time to attend.

Managing Director Storrs informed the executive committee of his acceptance of the position of executive chairman of the board of directors of the United Railways & Electric Company, Baltimore, which would necessitate his resignation as managing director, to become effective April 1, 1929. Mr. Shannahan expressed the regret which the industry, the association and the Advisory Council would feel at this loss of the active services of Mr. Storrs, and suggested the appointment of a committee to draw up suitable resolutions regarding the service which Mr. Storrs has performed for the industry during the four years since he undertook the work as managing director.

C. D. Emmons, president United Railways & Electric Company, Baltimore and past president of the association, expressed his gratification of the fact that the Baltimore management had chosen Mr. Storrs, with his broad view of the industry's problems and outlook, to apply this wide experience toward the solution of Baltimore's transportation problem. Mr. Emmons said that the association's loss will be Baltimore's gain and that the entire United Railways organization would welcome Mr. Storrs' leadership.

Those present at the meeting of the executive committee included the following: President J. P. Barnes, presiding; J. H. Hanna, C. E. Morgan, G. A. Richardson, L. S. Storrs, R. P. Stevens, O. H. Bernd, L. F. Wynne, W. H. Boyce, T. W. Casey, Paul E. Wilson, E. P. Waller, W. F. Cutler, J. R. Fitzpatrick, H. B. Potter, Carroll Burton, M. B. Lambert, W. M. Wampler, W. H. Sawyer, F. R. Coates, J. N. Shannahan, C. D. Emmons, F. W. Doolittle, T. A. Kenny, H. L. Geisse, C. S. Hawley, J. W. Welsh, Labert St. Clair, Leslie Vickers, E. J. Murphy, J. A. Miller, Jr., Charles Gordon, Freddie Dell, G. C. Hecker, E. E. Bodine. The tentative date selected for the next meeting is May 2, 1929, at Washington, D. C., at which time the United States Chamber of Commerce will convene in annual meeting.

Indianapolis Employees Press Wage Demand

Oral arguments were heard recently by the Indiana Public Service Commission on the motion of the Indianapolis Street Railway to postpone until next year further consideration of the request of the employees of the company for a wage increase. The case originated several weeks ago when the employees filed a formal petition for a wage boost. A company motion to dismiss the petition was overruled shortly afterward and then the company granted slight increases based on the increase in its net earnings in 1928 over those of 1927.

Attorneys for the employees insisted that the original petition should be considered at once by the commission. They suggested that the company and its employees "might get together and iron out their differences."

David E. Watson, attorney for the company, contended the company's present financial condition will warrant no wage increases. He said that compulsory payment of more than a company is able amounts to confiscation of property.

Ten-Cent Fare Sought in St. Catharines

The Canadian National Electric Railways has applied to the City Council of St. Catharines for a 10-cent fare on its local lines. Under the franchise, the railway has power to charge 8 cents. The present fare is 7 cents.

Equipment Men Urge Early Reservations for Meeting

Selection of the Lafayette Hotel, Lexington, Ky., as headquarters for the July 24-26 meeting of the Electric Railway Association of Equipment Men, Southern Properties, has just been announced by A. Taurman, president. Rates for rooms are $2.50, $3 and $3.50 for a single room and $5 and $6 for a double room. Members are urged to make reservations early. If reservations are not available at the Lafayette, members are referred to the Phoenix Hotel, a short distance from the Lafayette.

Preparation of the program is under way and suggestions on topics for discussion are solicited.

Vancouver "Buzzer" Has New Top

The decoration or heading for the front page of "The Buzzer," official pamphlet of the British Columbia Electric Railway, Vancouver, B. C., was selected by W. G. Murrin, president, out of 158 submitted in the recent contest. A graphic representation shows Mr. Public pressing the button for service, and the trainmen, the bus driver, the mechanic, the office man and the stenographer rushing in the manner of good public utility employees to give him service. The design is the work of F. A. Wilson, who received the $25 prize.

Gas Tax Passes in Illinois

The Illinois 3-cent gasoline tax bill was signed recently by Governor Emerson, after being passed by both houses of the Legislature by a wide majority of votes. It will go into effect on Aug. 1. Provision is made for a tax of 3 cents a gallon on gasoline used in all motor vehicles operating over the public highways of the state. It provides a division of the tax money of 2 cents to the state and 1 cent to the counties. The estimated annual yield of $21,000,000 will be used for completion of the state's hard roads system. Opposition to the measure came chiefly from Chicago members who asked for an equal split of the revenue between the state and the counties and a share to be used on maintenance of city streets in Chicago.

Help in Paying for Paving Sought in Baltimore

The United Railways & Electric Company, Baltimore, Md., has asked the city to finance the company's share of paving on several streets to the amount of $210,000, the United to repay the money in five annual installments without interest. A similar agreement is said to have been entered into under a previous administration. The Board of Estimate has taken the subject under consideration.

COMING MEETINGS OF *Electric Railway and Allied Associations*

April 5 — Metropolitan Section, American Electric Railway Association, 33 W. 39th Street, New York, N. Y.

April 12—Maryland Utilities Association, Annual Meeting, Hotel Emerson, Baltimore, Md.

May 1-3—Indiana Public Utilities Association, Indiana Gas Association and Indiana Electric Light Association, annual joint convention, Hotel Gary, Gary, Ind.

May 13-15 — National Highway Traffic Association, annual meetiog, Stevens Hotel, Chicago, Ill.

May 15—Association of Electric Railway Equipment Men, Middle Atlantic States, semi-annual meeting, Wilmington, Del.

June 3-6—National Association of Purchasing Agents, Annual Convention, Hotel Statler, Buffalo, N. Y.

June 5-7—Canadian Electric Railway Association, annual coovention, Montreal, Quebec.

June 21-22 — New York Electric Railway Association, Bluff Point, N. Y.

June 27-28—Central Electric Railway Association, Michigan City, Ind.

July 24-26—Electric Railway Association of Equipment Men, Southern Properties, Lafayette Hotel, Lexington, Ky.

Aug. 15-16 — Wisconsin Utilities Association, Transportation Section, Hotel Northland, Green Bay, Wis.

Aug. 27—National Association of Railroad and Utilities Commissioners, Glacier National Park, Mont.

***Sept. 28-Oct. 4*—American Electric Railway Association, 48th annual convention and exhibit, Atlantic City Auditorium, Atlantic City, N. J.**

Paving Relief in Alexandria, Va.

A measure relieving the Mount Vernon, Alexandria & Washington Electric Railway of its proportionate cost of permanent improvements, along its right-of-way in Alexandria, was adopted by the City Council on March 22.

This action by the local authorities was taken by them to lighten the burden of the railway in the proposed repaving of seven blocks of King Street, which will necessitate an expenditure of approximately $25,000, of which the railway would have had to pay $11,480.

Gardner L. Boothe, president of the company, assured the Council that new rails and ties would be installed when the repaving work is started by the city. He said this would cost approximately $10,000.

Jurisdiction of Minnesota Commission Supreme

Street railway lines in Minnesota will remain under the jurisdiction of the Minnesota Railroad and Warehouse Commission. Bills introduced in both houses of the present Legislature to repeal the Brooks-Coleman act, which placed fixing of valuation, setting of reasonable rate of return on the properties and making of passenger rates, were killed in the committees, after several hearings, by means of indefinite postponements. The Senate general legislation committee acted first and the House committee took similar action March 14. The stand against the repeal of the Brooks-Coleman act was made on the theory that control of transit lines might better continue where it has rested for several years than be placed in the hands of the governing bodies of the three principal cities, Minneapolis, St. Paul and Duluth.

Public hearings on a bill to create a metropolitan zone with one rate of fare in the Twin Cities will be set. There is much opposition from Minneapolis to this bill. The cities now have the same rates, but a second fare must be paid after crossing the line from one city to the other.

Parking Laws in Effect in Baltimore

After years of effort, Baltimore has put into effect a new ordinance which prohibits parking of automobiles on two of the important downtown streets. Previous efforts to pass such an ordinance always failed when the merchants claimed such action would hurt their business. A recent fire on one of the streets, during which parked automobiles hampered the firemen, aided in passage of the ordinance. The United Railways & Electric Company favored the ordinance on the ground that it would speed up service.

Under the ordinance, parking is prohibited on Lexington Street between Charles and Liberty Streets at all times; from 7:30 a.m. to 6 p.m. between Liberty and Howard Streets and between Aisquith and Caroline Streets; on Fayette Street from 7:30 a.m. to 6 p.m. between Greene and Holliday Streets and at all times between Fallsway and Broadway.

Numbering Car Lines in Spokane

A system of numbering railway lines has been adopted by the Spokane United Railways, Spokane, Wash., and will be put into effect April 1, according to A. J. Schulthess, general superintendent. Under the plan each line will have a number, there being 27 lines in all. North and east lines will have odd numbers and south and west lines even numbers. The numbers are to be painted in black on white dash signs. The illuminated deck signs giving the name of the line will be retained.

Recent Bus Developments

New Lines Established by Northern Ohio

The Northern Ohio Power & Light Company through its subsidiary, the Cleveland-Akron-Canton Bus Company, established two new bus lines March 24, one through line from Cleveland to Dennison and a through line from Massillon to Dennison. The two lines converge at Dover. The Masillon line will supplant the electric line as soon as the Ohio Public Utilities Commission passes upon the application of the company for abandonment. The hearing is set for April 2.

The through service between Cleveland and Dennison will be operated on a two-hour schedule from 7 a.m. until 7 p.m. The Massillon-Dennison line will also be operated on a two-hour schedule from 5 a.m. until 11 p.m. Going north, buses leave Dennison at 5 o'clock in the morning and every hour until midnight. The bus leaving at 5 o'clock goes to Massillon. The one leaving at 6 o'clock goes to Cleveland, thus alternating during the entire period covered by the schedule.

As all of its franchises for the interurban line between Massillon and Uhrichsville have expired with the exception of one in the village of Navarre, the company expects little delay in securing an order for abandonment. When the line is discontinued, a 30-minute local service will be established between Dover and New Philadelphia. Local service will also be established between Massillon and Navarre. The company announces that additional through and local service will be supplied as rapidly as the riding demands.

The company will use Yellow coaches in this service and has purchased additional new 29-passenger White buses to take the place of the Yellows which were transferred from other lines.

From Taunton to Middleboro

The East Taunton Street Railway has petitioned the Massachusetts Department of Public Utilities for permission to run a bus line from Taunton to Middleboro, Mass.

Pennsy, B.&O. and Mitten to Supply Service

Co-ordination of all bus service in the Philadelphia district is planned by the Pennsylvania Railroad, the Baltimore & Ohio Railroad and the Philadelphia Rapid Transit Company in the interest of operating economy on routes connecting Philadelphia with New York, Baltimore and New Jersey seashore points. According to Charles W. Galloway, vice-president Baltimore & Ohio, the proposal would carry a guarantee of responsible operation, submission to fair regulation, provision for bus terminal facilities and the assurance of certain revenue not obtainable under present conditions "which could be applied to public highways." He made it plain that the railroad would insist on the provision of adequate high-speed or surface-car subway facilities to the terminal location before the actual construction was authorized.

Would Prepare for Buses on Massachusetts Line

Selectmen of Wakefield, Stoneham and Winchester recently received petitions from the Eastern Massachusetts Street Railway, seeking permission to discontinue the present service by railway between Wakefield and Winchester by way of Stoneham for the purpose of substituting bus service. The petitions request the change because of the extensive plans in Winchester to widen and straighten Forest Street, through which the railway runs. It will retain the line between Arlington and Winchester.

Bus Revenues Exceed Car Revenues in New Jersey

For the first time in the history of the Public Service Corporation of New Jersey bus revenue during 1928 exceeded car revenue, although the number of car passengers still substantially exceeds the number of bus passengers. Business by bus has grown from 1,952,059 passengers in 1923 to 211,565,713 in 1928, while the number of trolley passengers in 1923 was 354,194,933 contrasted with 331,568,468 in 1928.

An analysis of the traffic statistics shows a decrease of 29,504,597 in the number of street car passengers and an increase of 45,485,765 in the number of bus passengers. This result is accounted for by the substitution, in many instances, of bus for car service and by bus lines taken over or put in service.

Concerning the transportation situation, President McCarter says:

Substantial progress was made during the year in carrying forward the policy of co-ordinating transportation facilities. Our efforts are directed towards the creation of a transportation system in which street cars, buses and other units, as their operation may be undertaken, will be utilized so as to provide a maximum service and effect economy by the elimination of waste and duplicate service and the combination of construction, maintenance and operating activities to reduce overhead expense.

Regarding the initial experiment with the operation of taxicabs, the report of the company says:

Operation of the Yellow and Public Service Cab Companies of Camden, with a combined fleet of 58 cabs, was taken over in May, and results under our management have been encouraging as to future possibilities.

Toronto Expands Its Bus Service

By securing the franchise for the Royal Blue Lines Company, Boston, Mass., for Toronto and all points within Ontario, the Toronto Transportation Commission has made a notable extension to its coverage for tourists and sightseeing parties. As the *Canadian Financial Post* points out, since the commission's subsidiary, Gray Coach Lines, has the franchise for the Gray Line, it enables the commission to furnish exclusive service in the province for the only two large sightseeing and tourist organizations in the United States.

According to D. W. Harvey, general manager Toronto Transportation Commission, operating the railway and bus system owned by the city of Toronto, the Royal Blue Lines agreement is for a period of two years, and is renewable at expiration. There is only a nominal cost attached to this extra service, but the Toronto commission will secure the advantage of the international advertising done by the Royal Blue Lines Company in all the large cities in the United States and Canada.

A number of the commission's coaches will be painted blue and carry the Royal Blue Lines insignia. The number will be small at first, and will be increased as business warrants.

These coaches bearing the insignias of the Gray Lines and the Royal Blue Lines are used for sightseeing purposes only, and are quite separate from the Gray Coach Lines' motor coaches which operate an interurban service from Toronto to points in Canada and the United States.

The Toronto Transportation Commission and its subsidiary, Gray Coach Lines, now have contact with practically every tourist agency on the North American continent.

Railroads Free to Organize Bus Subsidiaries

The Interstate Commerce Commission has ruled it cannot regulate or forbid organization of bus subsidiaries by railroads, or collect excess profits from such subsidiaries. The decision apparently validiates the already extensive activity of railroads in bus operation, and permits them to expand it whenever they feel it necessary to meet competition. The decision also emphasizes the absolute freedom from regulation of interstate bus and truck operation.

A. Jaloff, doing business as "Columbia Stage," operated 40 buses between Portland, Astoria and Seaside, Ore. In 1924 the Spokane, Portland & Seattle Railroad, feeling competition, incorporated the S. P. & S. Transportation Company and installed bus service between Portland and Astoria, paralleling its tracks and also Jaloff's service.

Jaloff appealed to the I. C. C., claiming that organization of the bus subsidiary was in violation of the trans-

portation act, which says that a railroad must, before extending its lines, get a certificate of convenience and necessity from the commission. He also claimed that the articles of incorporation of the railroad did not permit it to organize the bus line.

The commission ruled against Jaloff on both points and decided that the railroad did not have to report its earnings from the bus line under the excess profits clause of the Transportation Act. It ruled, however, that where a railroad offers through rates via a train and bus combination, it must separate the train earnings so they may be reported.

Substitution Proposed in Greenville

Recommendation that the Mississippi Power & Light Company be granted permission to substitute buses for its street cars in Greenville, Miss., was made at a meeting of the street railway committee of the City Council with E. J. Lenz, district manager of the power company. The buses would be operated on the schedule of rates submitted the City Council by L. V. Sutton, vice-president and general manager Mississippi Power & Light Company, at the meeting of the Council held on March 5. That schedule called for a 10-cent cash fare. Tokens would be sold at three for 25 cents. Weekly permits would be sold for 25 cents, and the rate of fare with the permit would be 5 cents for each ride. The proposed substitution will come before the Council for action in April.

Would Extend Line in San Diego

Application made by the San Diego Electric Railway to the city for a franchise to extend its National Avenue bus line a distance of approximately one mile has been granted. Subsequently application was made the California Railroad Commission for a certificate of convenience and necessity to cover the extended operation.

To Test Reduced Bus Fare in Boston Suburb

Public trustees of the Boston Elevated Railway will establish a 6¼-cent bus fare, for a test period, from Mattapan Square to Cleary Square and from Cleary Square to Wolcott Square, Readville, in either direction. At present the unit bus fare is 10 cents for the entire distance from Mattapan Square to Wolcott Square, but the majority of the riders use part of the service either between Mattapan Square and Cleary Square or between Cleary Square and Wolcott Square, and would save the difference in fare. The 10-cent bus fare would remain in effect for those who ride beyond Cleary Square in either direction and for those who transfer.

Receivers Sought for Indiana Company

Suit asking that a receiver be appointed for the South Side Motor Coach Company, of Indianapolis, has been filed in Superior Court by Orville P. Foreman, former attorney for the company. The bus company was sold recently to the Beech Grove Traction Company. Mr. Foreman alleges that he acted as attorney for the defendant during the sale and asks judgment for $2,500 against the company. Gilbert E. McFarland and Frank Stuck, the owners of the company, sold the property to the railway for $22,500, according to the complaint. Charges are made that the bus company is insolvent.

The suit has no connection with the new owners of the coach company property, C. F. Schmidt, president of the Beech Grove Traction Company, declared. He said the coach company still was intact as a partnership and the suit was against the partnership.

Control Bill Before New York Assembly

The New York Senate on March 22 passed and sent to the Assembly the Thayer bill, bringing under control of the Public Service Commission all stages, buses or motor vehicles operating between fixed terminals or over regular routes as common carriers.

Buses Succeed Cars on Wisconsin Line

The Wisconsin Public Service Corporation has recently abandoned interurban lines from Green Bay to Kaukauna and to Duck Creek, as well as two city lines. Service is continued with buses.

No Flat-Rate Cabs in Springfield, Mass.

Flat-rate taxicab service has been practically eliminated from the realm of possibilities as far as Springfield, Mass., is concerned. The transportation board decided on March 4 that such taxicabs "would not be for the best interests of the people or other public carriers of this city." The board was aided in its decision by reports of Worcester's recent experience with flat-rate cabs and it hesitated little in pronouncing this type of service undesirable.

The subject of flat-rate taxicabs was discussed at length at a meeting of the board on Feb. 18. Representatives of concerns seeking to enter the city and establish a business of this sort were heard, as well as officials of the local taxicab companies and President Clark V. Wood, of the Springfield Street Railway.

The board also received communications from the Central Labor Union and from the local branch of the Amalgamated Association protesting against the flat-rate service. Councilman Homer E. Barton, a member of the transportation board, sent a letter to Chairman Henry A. Booth in which he described the confusion caused by flat-rate cabs in Worcester, Mass., and voiced his strong opposition to the proposal. He said:

> The taxicab situation got out of hand at Worcester on account of the flat-rate system. They were everywhere and if they were let loose in Springfield with its limited business district a serious traffic problem would be created. I am opposed to any let-down in the present regulations.

Enthusiasm for Courteous Drivers in St. Louis

In an endeavor to reduce street accidents in St. Louis the St. Louis Public Service Company, the St. Louis Bus Company and the People's Motor Bus Company are co-operating with the Courteous Drivers Club recently formed by the St. Louis Safety Council. Motormen and bus drivers are being urged to join the club and to carry its insignia upon their vehicles. Approximately 25,000 persons have joined the club, hundreds of them residing outside of St. Louis. In fact members are from sixteen states, having become interested in the movement through speeches broadcast by Colonel Courtesy from Radio Station KMOX, the "Voice of St. Louis." The two slogans of the club are: "Be Courteous and Save A Life" and "Drive Safe and Stay Alive." The code of driving promulgated by the club covers twelve rules.

Safety Work Continues on Ohio Lines

Chairmen of departmental safety committees of the Indiana, Columbus & Eastern Traction Company and the Dayton & Columbus Transportation Company were elected at the semi-annual meeting of the committees held in Springfield, Ohio, on March 15. The organization has been functioning five years, and during this period the employees of various departments have submitted 369 safety suggestions, 279 of which have been definitely acted upon. Ten inspections of the entire property have been made during this period. Since the safety organization has been in existence, railway cars have operated on an average of 20,835 miles per traffic accident, and the buses 18,500 miles per traffic accident.

Bus Service Started to Plant of American Chatillon Corporation

The Rome Coach Company, Rome, Ga., a recently organized subsidiary of the Georgia Power Company, has started a service of buses for workers and visitors to and from the plant of the American Chatillon Corporation. This service is operated in co-ordination with the railway system under the direction of T. S. Sloan, division manager.

Financial and Corporate

Tacoma-Seattle Line Sale Continued

Action on the confirmation of the sale of the Puget Sound Electric Railway's Tacoma-Seattle interurban line has been continued for ten days by Judge J. Stanley Webster in federal court, on request of Scott Z. Henderson, receiver for the interurban, who asked a stay until Judge E. E. Cushman returned to the city. A possibility exists for a new call for bids. The court is now considering four bids, as follows: Louis Rosenthal, San Francisco, $360,000, for the entire interurban property; The Puget Sound Electric Company, Seattle, $348,208 for the right-of-way and operating property; Perry, Buxton, Doane Company, Boston, $251,873 for the entire property, and $191,878 for the operating property alone; the Hofius Steel & Equipment Company and the Hyman Micheals Company, $178,250 for the operating property.

Cessation of Massillon Service

The Northern Ohio Power & Light Company will abandon its Massillon street car system on April 26 and discontinue all service. The rails are to be taken up and streets placed in repair. The Massillon system was built more than 25 years ago. Some two years ago the City Council granted The Fidelity Transportation Company the right to operate buses over streets adjacent to the car lines. Since that time the railway has been endeavoring to discontinue service. Its franchise does not expire until 1932.

The railway has had a fare of 8 cents cash, with four tickets for 25 cents. The bus company is to receive a 10-cent flat fare. Permission to remove the lines was granted by the City Council on March 25. The property of the Massillon Street Railway System is valued at approximately $600,000. Abandonment of the Massillon line fits in with the general plan to remove the interurban from Massillon south to Uhrichsville, referred to elsewhere in this issue.

Atlantic City & Suburban Road to Liquidate

Unable to meet expenses for several years the Atlantic City & Suburban Railway, which has been operating between Atlantic City, Absecon and Somers Point, N. J., since 1902, will abandon the service, remove its tracks and sell its equipment. P. R. Goldy, receiver for the company, denied that the company was planning a bus service. Real estate holdings and equipment will be sold as speedily as possible and the receipts applied to claims of creditors. This road is paralleled throughout practically its entire length by the fast electric line of the Atlantic City & Shore Railroad.

Eastern Massachusetts Net Up

Returns for 1928 show an improvement of $220,729—situation reviewed—public control extended

Stockholders of the Eastern Massachusetts Street Railway, Boston, Mass., held their annual meeting on March 4. In the management of the road they have no other power now, under public control, than to elect a board of directors which can act merely in an advisory capacity, and keep the organization intact until the property is returned to them. At this year's annual meeting they made no change in the directorate, voting unanimously for the old board. The board will meet later to elect its own chairman.

Since the issuance of the last annual report of the public trustees, the Massachusetts Legislature has enacted a new public control act extending public control for five years more. In certain respects the present act differs from chapter 188, acts of 1918. The chief difference between the two acts is in the constitution of the respective boards of trustees. The present act provides for a board of five trustees to be appointed by the Governor, with the advice and consent of the council. The new act provides for a board of three trustees, two to be appointed by the Governor, with the advice and consent of the council, and one to be "a representative appointed by the board of directors of the company from their own number." This gives the stockholders, through the board of directors elected by them, a direct representation on the board of trustees. The new act continues the power of the trustees to fix and regulate rates and fares and to determine the character and extent of the service and the facilities to be furnished, and a similar authority to fix such rates and fares as in their judgment will produce sufficient income to meet the cost of the service, which includes all fixed charges and dividends.

The new act eliminates various provisions about the taking over of the property and franchises of the Bay State Company, which are no longer pertinent, and provisions about the initial capitalization, which was set up by the old act. It also eliminates certain provisions as to the issue of serial bonds not exceeding $4,000,000, as to which if the earnings of the company were not sufficient to pay instalments of such bonds as they matured, the trustees could call upon the treasurer and receiver general of the Commonwealth to purchase them and assess the cost upon the cities and towns in which the company operates. The new act also eliminates provisions about a reserve fund of $500,000. Under it the powers of the directors are increased in respect to contracts for the acquisition or abandonment of lines. This is made to apply to bus lines as well as street railway lines, any such contract requiring the consent of the directors.

The annual report, which came from the Board of Public Trustees, was presented by the chairman of the trustees, Arthur G. Wadleigh. It showed income of $9,248,119 for the year 1928, compared with $9,625,434 in 1927, a decrease of $377,315. Revenue from bus operation, however,

COMBINED INCOME STATEMENT OF EASTERN MASSACHUSETTS STREET RAILWAY FOR ALL DISTRICTS

	1928	1927	Increase or Decrease
Street car revenue	$8,090,020	$8,472,602	*$382,588**
Auto bus revenue	431,357	381,375	49,982
Express and other revenue	31,042	36,773	*5,731*
Rentals, advertising, etc	188,882	190,171	*1,289*
From sale of power	264,457	262,275	2,182
Interest and other income	242,361	282,238	*39,877*
Total revenue	$9,248,119	$9,625,434	$377,315
Expenses:			
Way and structures	$1,055,021	$1,221,227	*$166,206*
Equipment	882,453	1,240,498	*358,045*
Power	1,215,992	1,270,720	*54,728*
Car operation	2,194,210	2,249,449	*55,239*
Injuries and damages	234,469	252,050	*17,581*
Insurance	75,592	73,003	2,589
Law expenses	18,708	15,217	3,491
Rent of tracks	80,622	82,382	*1,760*
General wages and expenses	246,595	241,583	5,012
Pensions	23,644	22,242	1,402
Group insurance	73,394	69,314	4,080
Stationery and printing	32,854	33,917	*1,063*
Stores and garage expenses	60,516	56,652	3,864
Miscellaneous expenses	47,083	45,307	1,776
Auto bus expenses	441,193	399,221	41,972
Survey and study of property	32,058	.....	32,058
Total operating expenses	$6,714,404	$7,272,782	*$558,378*
Total operating expenses and taxes	$7,079,163	$7,631,676	*$552,513*
Gross income	2,168,956	1,993,758	175,198
Interest and rentals	1,176,167	1,221,698	*45,531*
Net income	$992,789	$772,060	$220,729

Note—*Italics* denote decrease.

which is included in the figures quoted, showed an increase from $381,375 for 1927 to $431,357 for 1928. There were losses during the year in railway revenue, express service, rentals and interest on income. The only items that showed gain were the auto buses and the sale of power, the latter item showing an increase from $262,275 in 1927 to $264,457 in 1928.

Expenses were reduced. They amounted to $6,714,404 in 1928 for purely operating functions, as against $7,272,782 in 1927. The items which cost less in 1928 than in 1927 were way and structures, equipment, power, car operation, injuries and damages, rent of track, and stationery and printing. The items that cost more in 1928 then in 1927 were insurance, law, general wages, pension, group insurance, storage and garage, auto bus expenses, survey and study of property.

Computing taxes and other fixed charges it is found that the net income for the year was $992,789. This is $220,729 more than the net income in 1927. The increase in the net income is due to savings.

Operating expenses include charges for depreciation amounting to $824,007 in 1928 and $848,467 in 1927. During the year 1928 $1,169,090 of the depreciation reserve was applied to reconstruction and amortization.

Change on P.R.T. Board

At the annual stockholders' meeting of the Philadelphia Rapid Transit Company, Philadelphia, Pa., N. H. Pettitt was elected a director to succeed L. W. Hackett. He is chairman of the Committee of Employes Co-operative Association.

Change in Denver Directorate

Stockholders of the Denver Tramway, Denver, Col., at their annual meeting accepted the resignation of J. C. Bullock, Providence, R. I., as a member of the board of directors. In his place they elected F. E. Kingston, Hartford, Conn. W. A. Doty, secretary, also was elected to the board and was given the additional office of treasurer, succeeding the late H. J. Alexander, of Denver.

$251,824 Available in San Diego

The San Diego Electric Railway, San Diego, Cal., reports to the Railroad Commission its 1928 operating revenue at $1,659,767, compared with $1,676,501 for 1927. Operating expenses, excluding taxes for 1928, are $1,384,800 and $1,381,324 for 1927, leaving a net operating revenue of $274,967 for 1928 and $295,176 for 1927. During 1928 taxes charged to operation amounted to $120,086, and for 1927 to $124,387. Deducting the taxes leaves operating income of $154,880 for 1928, and $170,789 for 1927. Adding the non-operating income of the company to the operating income, and deducting non-collectible revenue and rents, results in a gross corporate income of $251,824 for 1928, compared with $263,055 for 1927.

Substantial Improvement Shown by Iowa Interurban

Net earnings of the Waterloo, Cedar Falls & Northern Railway, Waterloo, Ia., for 1928, after operating expenses and taxes, were more than 90 per cent greater than that of 1927, and 620 per cent in excess of those of 1925, being the largest net result since 1917. Net income for 1928—$203,734—is equal to 3½ per cent on the first mortgage bonds. All this money has gone back into the property in renewals and extensions, thereby enabling it to handle with efficiency the steadily increasing business.

A condensed comparative statement of operations for the past four years follows:

Comparative Statement of Earnings at Waterloo, Cedar Falls & Northern Railway

	1928	1927	1926	1925
Gross earnings	$1,123,437	$980,910	$914,698	$827,353
Operating expenses	882,682	834,009	755,084	750,899
Net revenue	$240,755	$146,901	$159,613	$76,454
Taxes	37,021	39,881	44,064	48,166
Net operating income	$203,734	$107,020	$115,550	$28,288

The gross revenues for 1928 show an increase of $142,528; freight and switching revenues increased $156,785; passenger revenues fell off $20,471; miscellaneous earnings, including sale of power, increased approximately $7,000. The loss in passenger revenue is all chargeable to interurban lines, as earnings on motor coach and city lines increased $18,425. The loss in interurban passenger revenue is ascribed entirely to improved highways and the great increase in the number of privately-owned automobiles.

Operating and maintenance expenses increased $48,674, due to extra cost of handling a larger freight business, and more money expended in the maintenance of the property. C. M. Cheney, in his report to the protective committee, says that whatever prosperity the company might reasonably expect to enjoy must necessarily come from increased freight traffic, and every effort possible has been put forth to this end during the past five years.

With rather a thin population, improved highways practically paralleling the company's interurban lines, and the ever increasing number of privately-owned automobiles, Mr. Cheney feels there is little possibility of maintaining passenger levels.

With industrial conditions at a low ebb during the years 1923, 1924, and 1925, freight traffic continued to show some increase over the preceding years, and since 1925 there has been a decided gain each year: $87,596 in 1926; $101,504 in 1927, and $156,785 in 1928.

To liquidate overdue taxes, pay off floating indebtedness, properly maintain the property, construct new tracks and purchase additional equipment made necessary by heavier freight business, it has been necessary each year to use the net revenues. That this course has been fully justified is best evidenced by improvement in the physical condition and earning power of the property.

During the year 1928 the John Deere Tractor Company decided to spend $5,000,000 for the purpose of expanding its Waterloo plant. The interurban was fortunate in being able to grasp the opportunity to serve this plant exclusively. It was necessary, however, in order to do this to spend $135,000 to cover the purchase of additional real estate, freight equipment and the construction of 1⅓ miles of new trackage. Mr. Cheney estimates the company will enjoy an increased freight revenue of from $200,000 to $250,000 per annum from this plant. Gross revenues earned on business from the John Deere Tractor Company during 1927 were $111,983; during 1928, $238,409.

E. V. Kane, chairman of the committee representing the holders of the first mortgage bonds, in a recent statement says:

The results of the operation for the calendar year 1928 further justify the waiting policy of the protective committee. Nursed through the trying period ending with 1925, and maintained in an excellent state of efficiency, the property was in the best of condition to handle the increased traffic when the tide of prosperity turned in 1926. The full meaning of this is best shown in figures. Gross earnings for 1928 were the largest in the company's history, showing a gain over 1927 of more than 14 per cent, and of more than 35 per cent over those of 1925. The increase was entirely from freight. Passenger traffic, owing to automobile competition, continues to show a loss.

Service in Santa Barbara To Be Discontinued

Finding that it is impossible to fix a rate structure that will produce an adequate revenue to permit the operation of the Santa Barbara & Suburban Railway, the Railroad Commission has authorized that company to discontinue operation as a common carrier in the city of Santa Barbara, Cal., upon 30 days' notice to the public.

On Jan. 16, 1928, the State Railroad Commission authorized the company to increase its rates and to make certain alterations in its service with that end in view. The revenues of the utility under these rates having proved inadequate, the commission found no alternative but to grant the request of the company for permission to abandon operation.

Legal Notes

ALABAMA—*Use of Streets. Company Responsible for All Injuries Resulting from Negligent Act.*

A street railway has no paramount right to the use of the streets occupied by its tracks as against other vehicles or pedestrians. Where a car strikes an automobile and drives it against a prospective passenger, the company was responsible, even if it was difficult to foresee the precise injury which would be occasioned by the negligent act. A motorman may assume that a vehicle on the track, or in dangerous proximity, would turn aside to avoid collision, when the danger of collision becomes imminent. [Alabama Power Company vs. Bass, 119 S., 625.]

CALIFORNIA — *Adequate Crossing Protection.*

It cannot be said, as a matter of law, that a "Railroad Crossing" sign, located within a few feet of the rails and partly behind a telephone or telegraph pole, was of any significance in affording protection to users of the highway. [Baldwin et al. vs. Pacific Electric Railway, 274 P., 72.]

NEW JERSEY—*Power of Commission to Co-ordinate Fares.*

Where a street railway and associated bus company request the Board of Public Utility Commissioners to coordinate the fare zones of the two companies in the same territory, the board has power to do so without a valuation of the used and useful property of one of the companies. [Borough of Roselle Park vs. Board of Public Utility Commissioners, 144 A., 623.]

NEW YORK—*Public Service Commission Without Jurisdiction to Issue a Certificate of Convenience and Necessity to Bus Operator Without City's Consent.*

On Dec. 11, 1925, Elliott B. Seagraves filed with the City Council of Long Beach an application for the consent of the city to the operation of a bus line. On Dec. 17, 1925, a special meeting of the Council was held, at which all the members of the Council, including the Mayor, were present. A resolution was adopted by a vote of four to one whereby the consent of the Common Council was given to the operation of the proposed bus route, the Mayor voting "no" and the others voting "aye." On Dec. 18, 1925, Seagraves assigned the consent to the Long Beach Bus Company. On Dec. 21, 1925, the Long Beach Bus Company, Inc., filed with the Public Service Commission its petition for a certificate of convenience and necessity. On Jan. 2, 1926, the City Council again met. Four of the Councilmen, having failed of election in the preceding month of November, had gone out of office and four other men had been elected to take their places. The Mayor of the city, who had been continued in office, announced his veto of the resolution previously adopted on Dec. 17, 1925, whereby consent had apparently been granted to Elliott B. Seagraves. His written veto of the prior resolution was filed with the Common Council. Thereupon the Council adopted a resolution unanimously rescinding the apparent consent given to Seagraves. It was after this meeting, in March, 1926, that the certificate of public convenience and necessity was granted by the Public Service Commission. The court ruled that the period for the exercise of the veto power had not been exhausted and that the veto filed on Jan. 2, 1926, was effective to nullify the resolution of consent. [Long Beach vs. the Public Service Commission, 164 N.E. 553.]

NEW YORK—*Use of Crossings.*

Under the Greater New York Charter, the City Police Commissioner is authorized to make rules regulating traffic and a section provided that pedestrians, where no police officer is present and no traffic light control system is in operation, shall have right-of-way on crossings, and that vehicles must slow down and stop if necessary to permit pedestrians to pass. This section was held valid, although it caused a change in the common law rule giving pedestrians and vehicles equal right on streets and highways. [Castro vs. New York Railways Corporation et al., 231 N. Y. Supp., 649.]

RHODE ISLAND—*Motormen Must See That the Overhang of Their Cars on Curves Does Not Strike Standing Automobiles.*

While travelers on the street are generally required to keep a sufficient distance from a trolley car which is in motion and changing direction on a curve to avoid the overhang of the car, the driver of an automobile, stopping for traffic alongside a trolley car, is not bound as a matter of law to move his automobile and make sufficient clearance for the overhang of the car when it is turning a corner. [Forbes vs. United Electric Railways, 144 A., 154.]

WEST VIRGINIA—*Liability for Damage by Power Plant.*

Where a public service corporation properly constructs and operates its generating plant on its own land and its operation causes a dwelling house on land nearby to vibrate to such an extent as to destroy it as a dwelling house, right of action by the owner of the dwelling may be maintained at any time within the period of limitation against such corporation; but a corporation which purchases the plant after the injury and right of action has accrued, and which properly maintains and operates the plant, is not liable for such permanent injury. [Byrne vs. Monongahela West Penn Public Service, 146 S. E. 522.]

Book Review

Practical Railway Painting and Lacquering

By H. Hengeveld, master painter Atlantic Coast Line Railroad, C. P. Disney, bridge engineer Canadian National Railway, and William J. Miskella, director Finishing Research Laboratories, Inc. Published by the Finishing Research Laboratories, Inc. Chicago, Ill. Distributed by Simmons-Boardman Publishing Company, New York N. Y. 267 pages; 154 illustrations; price $3.50.

Much of value to electric railway paint foremen will be found in the new book "Practical Railway Painting and Lacquering." Although this treats particularly of steam railroad practice, the problems are quite similar to those encountered by electric railways. This is Volume IV of a series of books on practical finishing. It is divided into five parts. The first contains general information. The second deals with the painting and lacquering of locomotives, freight and passenger cars. The third treats of the painting of signal equipment. The fourth gives information on the painting of bridges, buildings and water service, and the fifth describes practices in the lacquering of electric railway cars. The authors evidently have had considerable experience in the use of spray equipment as the book contains much information on equipment, paints, and troubles that are encountered in spray painting.

The first part gives much information on spraying equipment, accessories, sandpapers and waterproof-coated abrasives, lacquers and other paint materials, housekeeping hazards, sand blasting equipment and its operation, the lacquer and spray gun troubles and remedies, portable cleaning equipment, modern testing methods, scaffolding and ornamentation. In the second part, dealing with painting and lacquering, a large portion is devoted to passenger car painting. This describes late coach painting equipment, spraying outfits, and special exhausting arrangements. A chapter is also devoted to the painting of buses, and gives information on the size of paint shop required and the layout of a modern spray room.

The section on bridge and building painting contains material by Mr. Disney, who is bridge engineer for the Canadian National Railways, and who has had much experience in this class of work. The part on lacquering of electric railway cars is not very complete. It treats of the change which is going forward in connection with electric railway car painting, gives some comparative specifications of paint for electric railway cars, and describes the spray painting installation of the Cincinnati Street Railway.

Personal Items

Messrs. Snyder, Pettit and Studebaker Honored

Announcement is made from the executive offices of The North American Light & Power Company of the appointment of D. W. Snyder, Jr., as president of the Missouri Power & Light Company, with headquarters in Kansas City.

Mr. Snyder was formerly vice-president of the Illinois Terminal Railroad System with headquarters in Springfield, Ill.; prior to that he had been general manager of the utility properties of Illinois Power & Light Corporation at Bloomington, Ill.; Jefferson City, Mo.; and Clinton, Ill. He is a graduate of LaFayette College. His first business connection was as selling engineer for the Westinghouse Company.

L. A. Pettit, Jr., formerly vice-president of the Missouri Power & Light Company, has been appointed vice-president in charge of operation of the United Power & Light Corporation, an operating company serving the principal cities in central Kansas.

Clement Studebaker, Jr., has been elected president of the United Power & Light Corporation and A. M. Patten has been elected executive vice-president of the same company.

New Duties for H. G. Tulley of Philadelphia

H. G. Tulley was elected vice-president in charge of industrial relations of the Philadelphia Rapid Transit Company, Philadelphia, Pa., at the recent organization meeting of the board. This is a newly-created office. Mr. Tulley resigned as president of the International Railway, Buffalo, on Jan. 1, 1926, to become vice-president of Mitten Management, Inc., Philadelphia. Later in that year he was elected president of the Yellow Cab Company, which had been taken over by the Philadelphia Rapid Transit Company.

Sam Harris Leaves Pittsburgh Railways

After seventeen years' service with the Pittsburgh Railways, Pittsburgh, Pa., Sam Harris has resigned as special car agent. He is now associated with his three brothers, who operate a chain of Harris Stores. Sam Harris himself will conduct the store at Canonsburg.

Mr. Harris moved from New York to Pittsburgh in 1911, at the age of seventeen, and secured employment with the railway as checker. A few years later he was made secretary to the company's traffic agent, and in 1922 was appointed to the position of special car agent of the Pittsburgh Railways in which capacity he was unusually successful. During the past year, for example, he furnished approximately 3,000 special street cars to picnics, field meets, etc., in the Pittsburgh district.

The Tracto Club of the railway held a farewell dinner March 15 in the Fort Pitt Hotel in honor of Mr. Harris. As an expression of the high regard held for Mr. Harris by the employees of the railway, the club presented him a beautiful Gladstone traveling bag.

L. M. Brown Heads C.E.R.A.

Lemuel M. Brown, vice-president in charge of railway operation of the Interstate Public Service Company, Indianapolis, Ind., was recently elected president of the Central Electric Railway Association.

In 1905 Mr. Brown entered the electric railway field, beginning as a conductor on the Indianapolis, Columbus & Southern Traction Company, which later became a part of the Interstate Public Service Company. At that time Mr. Brown was associated with Joseph I. Irwin, one of the pioneers of the electric railway in Indiana. Shortly after entering the employment of Mr. Irwin, he became train dispatcher and in 1908 he was appointed train master at Indianapolis. This position he held for ten years. In 1912 the Interstate Public Service Company, at the time of its formation, took over the property of the Indianapolis, Columbus & Southern Traction Company as part of the proposed railroad system to Louisville, Ky. Mr. Brown continued in the employ of the Interstate and in 1918 was appointed superintendent of transportation. Four years later he was elected general superintendent of all the railroad property of the company.

L. M. Brown

At the annual meeting of the Interstate in March, 1927, Mr. Brown was made vice-president in charge of railway operation and in January, 1928, the Winona Railway made him vice-president in addition to his Interstate duties.

Mr. Brown was born in Jackson County, Ind., in 1883. His early training in the district schools was followed by a course at the Central Normal College at Danville, Ind., and later at Indiana University at Bloomington. Upon the completion of his college work, he taught school.

OBITUARY

Charles L. Kurtz

CHARLES L. KURTZ, former president of the Columbus Railway, Power & Light Company, Columbus, Ohio, died at his home in that city on March 24. Mr. Kurtz returned recently from Mexico, seriously ill after a month's business trip.

When in January, 1925, Mr. Kurtz stepped down as president of the Columbus Railway, Power & Light Company he ended a period in his career which will go down in railway history as one of the outstanding examples of generalship in the field of public utilities.

In January, 1919, Mr. Kurtz assumed that office. At that time the company was without credit, its bond interest was in default and dividends on stock had been suspended. Back wages, ordered to be paid during the war, presented another obstacle, and a suit had been instituted for receivership, an accounting and a judgment against the company.

The first thing Mr. Kurtz did when he assumed charge in Columbus in 1919 was to institute a program of the most rigid economy. Waste was eliminated. At the same time he worked to build up the morale and restore co-operation as the touchstone of success. But he knew that while economy was necessary, there alone was not the key to the restoration of the property to earning powers. During the period that the company was under the direction of Mr. Kurtz more than $13,000,000 was spent for construction and rehabilitation. Not only that, but he got from the Council an increase in fare to five tickets for 25 cents, a 6-cent cash fare, with a universal transfer free of charge. Furthermore, Mr. Kurtz succeeded in placing a $3,000,000 loan to pay floating debts. Subsequently he liquidated this loan.

These are merely some of the outstanding achievements of the company during the presidency of Mr. Kurtz. All of them were accomplished through his influence, skillfulness, level-headedness, perseverance, and last but not least, hard work. True, Mr. Kurtz was not a utility man in the strict sense of the word, but the rehabilitation work that he did at Columbus is an epic of its kind in the annals of the industry.

Between the time he started as a newsboy to the time he finished as a financier, Mr. Kurtz had been a bookseller, newsstand keeper, state legislator, private secretary to an Ohio Governor, a power in the Republican party and an inspector of oils for the state of Ohio. When he died he was president of several enterprises. He was 74 years old.

Improvement Projects Announced

New York State Railways plans expenditures of approximately $736,228. Northern State Power Company to improve its system. Other construction planned. Illinois Central Railroad orders four electric locomotives. Lehigh electrification indicated

NEW YORK STATE RAILWAYS, Rochester, N. Y., plans to expend approximately $736,228 for paving and remodeling of equipment on its systems in Rochester, Syracuse and Utica. The total operating expenses for this system are estimated at $6,805,565. The budget of the Rochester line provides for an expenditure of $156,000 for fifteen new buses and $2,600 for remodeling two buses. The purchase of these buses will provide for an extension of service in Rochester.

This company also plans the reconstruction of 45 cars for one-man operation at a cost of $36,000. These cars will be used to effect economies on unprofitable lines and as a means of giving more frequent service with a lower cost of operation. The company will also spend about $175,000 this year for street repairs and construction. The operating expenses for Rochester alone are estimated at $3,635,515.

Other Projects Planned

Improvements of the street railway system of the Northern State Power Company at Eau Claire, Wis., will represent an expenditure of approximately $82,000 this year. These improvements include replacement of several blocks of track with new and heavier rail and the addition of two new cars of the double-truck type.

The Petaluma & Santa Rosa Railroad, Petaluma, Cal., has applied to the railroad commission for authority to remodel a portion of its passenger equipment to operate this equipment on its Forestville branch. It is proposed to operate cars of the one-man type equipped with safety doors and control.

Repaving work on Main Street, Memphis, Tenn., by the Memphis Street Railway will begin in the near future. This company has agreed to renew its track from Linden Avenue to Poplar and to repave the street lying between the tracks and a strip 2 ft. wide on each side of the outside rail. It is estimated that the cost of this improvement will amount to $72,000.

Four Locomotives for Chicago

The Illinois Central Railroad, Chicago, Ill., has ordered four electric locomotives for handling freight in the Chicago terminal division. The purchase represents the first step in fulfilling the city's lake front ordinance, which requires the electrification of the railroad's freight service north of Twelfth Street by February, 1930, and south of there to the city limits by February, 1935.

The new locomotives will be built by the Westinghouse Electric & Manufacturing Company, the first being scheduled for delivery early in October and the others by the end of the year. Of identical design, they will weigh 100 tons each and develop 1,200 hp. under normal conditions with an additional 250-hp. reserve rating. Power will be supplied from an overhead system.

During the initial phase of electrifying the freight service, locomotives will operate between 39th Street and Monroe Street. The installation of power distribution facilities in this zone is well along toward completion. Transfers between steam electric locomotives will be made on tracks already constructed near 31st Street.

Between Monroe Street and the terminal yard on the south bank of the Chicago River in the Loop district, conditions are unfavorable for overhead power construction, necessitating the use of some self-contained motive power equipment. Another difficulty is that the permanent location of many of these tracks is uncertain by reason of the possibility of extensive changes in connection with development of air rights.

To meet with this situation, the Illinois Central has placed in service a 100-ton oil electric locomotive of 600-hp. capacity built by Ingersoll-Rand, General Electric and American Locomotive Companies. The generator is driven by two Diesel engines. On June 1 an all-electric locomotive powered by storage batteries will be borrowed from the Commonwealth Edison Company and tested in comparison with the oil-electric unit. Results of this test will guide the railroad in making further purchases of electric locomotives of the self-contained type.

$250,000 Construction in British Columbia

The contract for construction of a new route for the Stave Falls line of the British Columbia Electric Railway, Vancouver, B. C., has been awarded to Ellis-Cotton, Ltd., Vancouver, B. C., at a cost of $134,736. This construction entails the raising of the line for 3½ miles of its length above the level of the lake, which is now being formed by the erection of a dam in connection with the power project of the railway at Ruskin, B. C. In addition to this contract ¾ mile of new railway line will be laid by the general contractor on the Ruskin power plant project. The total length of the new line when completed will be 6 miles.

Relocation of this line calls for the removal of 170,000 yd. of earth. 17,000 yd. of rock will be taken out and 40 acres of clearing is necessary. There will be 2,000 lin.ft. of trestle work and 1,800 lin.ft. of culverts.

In addition to the cost of relocation, the electrification of the line will be carried out by the crews of the British Columbia Electric Railway, bringing the total cost of the construction up to approximately $250,000. This line is a passenger and freight railway which operates from the town surrounding the Stave Falls power plants and connects with the main line of the Canadian Pacific Railway. The line is entirely electrically-operated and was built originally by the Western Power Company of Canada at a cost of $250,000. All work is to be completed by Sept. 15 of this year.

The Rockford Electric Company, Rockford, Ill., will soon extend its East State Street line four blocks from the present terminus at Hunter Avenue. A wye at the end of the line will be installed to permit operation of its larger types of cars on this route.

Lehigh Valley Electrification

Surveys are being made for the electrification of the Lehigh Valley Railroad between Mauch Chunk and Wilkes-Barre, Pa. It is said that estimates of the cost of the project are being made by the Westinghouse Electric & Manufacturing Company, the General Electric Company and the American Brown Boveri Electric Corporation. It is indicated that the cost of electrifying this 75 miles of double track will reach $7,000,000.

The Seattle Municipal Railway, Seattle, Wash., has awarded a contract for furnishing 300 33-in. rolled-steel car wheels to the Edgewater Steel Company, Seattle. The Seattle Municipal Belt Line will accept the seven used cars, recently ordered, on terms dictated by the city. The sellers have accepted the conditions and the cars will be placed in the shops of the railway for an overhaul of their electrical equipment. It is estimated that $5,752 will be spent reconditioning the bodies.

Equipment and Material Ordered

Equipment recently ordered by the Beach Grove Traction Co., Indianapolis, Ind., includes seven Reo 21-passenger buses. The Berlin Street Railway, Berlin, N. H., plans to rebuild 2,100 ft. of track and road bed. This company has recently ordered three cars of ties, six kegs of spikes, 500 ft. of guy wire, 3,600 lb. of trolley wire, 100 insulators, four overhead frogs, and 100 trolley wheels.

The Portland Electric Power Company, Portland, Ore., is having plans drawn for a two-story equipment storage and distributing plant with repair department, to cost $40,000 with equipment.

Bids for the installation of express track on the Broad Street subway, Philadelphia, Pa., have been made. This subway is now operating on two tracks from the City Hall to the Fern Rock terminal. Express service calls for two additional tracks which will also utilize the Fairmont Avenue station now nearing completion.

Johns-Manville Elects Officers

At a meeting of the board of directors of the Johns-Manville Corporation held March 15, William R. Seigle, formerly vice-president in charge of mines and factories, was elected chairman of the board of directors, and Lewis H. Brown, formerly secretary and assistant to the president, was elected president. Mr. Seigle succeeds H. E. Manville, resigned, and Mr. Brown succceeds Theodore F. Merseles, who died March 6. Mr. Seigle has been in the service of Johns-Manville since his graduation from college in 1900, at which time the corporation was known as the H. W. Johns Manufacturing Company. Under Mr. Seigle's leadership the mines and factories making up the manufacturing units of Johns-Manville have been greatly enlarged and improved by the introduction of labor- and time-saving devices.

Mr. Brown engaged in sales work early in his career for a manufacturing company in Indiana. Immediately after the war he joined Montgomery Ward & Company. From 1921 to 1927 Mr. Brown was in close personal contact with the late Theodore F. Merseles, then president, and George B. Everitt, now president of Montgomery Ward & Company, during the remarkable years of the reorganization and revitalizing of Montgomery Ward.

Servicised Products and Carey Company End Differences

The Servicised Products Corporation, Chicago, Ill., and The Philip Carey Manufacturing Company, Lockland, Ohio, announce that they have terminated their differences including the pending litigation. The Servicised Products Corporation was granted and is now manufacturing premoulded products under a license on patents owned by The Philip Carey Manufacturing Company, including, in addition to patents formerly owned by that company, all patents heretofore owned by the Servicised Laboratories, Inc., relating to premoulded products, such as expansion joint, rail filler, track pavement, railroad crossings construction materials and other like products. It is stated, however, that otherwise the two companies are entirely distinct and independent corporations.

Detroit Car Delivery Starts

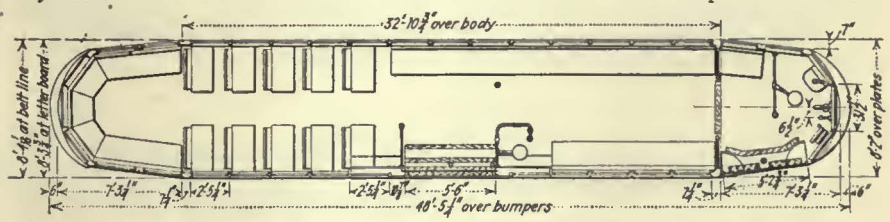
One of the Peter Witt type cars being delivered to the Department of Street Railways, Detroit, Mich.

The first of 100 new passenger cars was recently delivered to the Department of Street Railways, Detroit, Mich., by the Perley A. Thomas Car Company, High Point, N. C. These cars are of the Peter Witt type and are being built to practically the same specifications as the 500 of this type now in operation on the lines of the Detroit Street Railway. The new cars are of the city, single-end, double-truck type, each seating 52 passengers. They are 48 ft. 5 in. long and have a maximum width of 8 ft. 4 in., being of the front-entrance, center-exit type. The two center-exit doors are of the sliding type with stationary steps and the two front-entrance doors are of the two-leaf folding type, arranged to swing inward, with stationary steps.

All doors are pneumatically-operated, the center doors being selective controlled by the conductor and interlocked with the car circuit so that the car cannot be moved while the doors remain open. No signal light is used. All seats will be fully upholstered in genuine leather and will have deep spring cushions and offset horizontal grab-handles of wood. When completed each car will carry the underwriter's label, thus enabling the Department of Street Railways to secure a low fire insurance rating under its 100 per cent blanket fire insurance coverage.

The interior trim of the Detroit cars is in natural cherry. The leather upholstered seats are equipped with horizontal grab-handles

The trucks have a 5-ft. 6-in. wheelbase and are spaced 23 ft. 9 in. on the bolster centers. Each truck is equipped with two 35-hp. inside-hung motors and 26-in. rolled-steel wheels. Half of the motors will be furnished by the General Electric Company and half by the Westinghouse Electric & Manufacturing Company. A survey is now being made to ascertain if the system needs 100 cars in addition to the present order.



Floor plan of one of the 100 cars being built by the Perley A. Thomas Car Company

Car body	17,130 lbs.
Trucks per pair	11,000 lbs.
Motor and control equipment	6,620 lbs.
Air brake equipment	1,250 lb.
Total	36,000 lbs.
Length over bumpers	48 ft. 5 in.
Truck center distance	23 ft. 9 in.
Truck wheelbase	5 ft. 6 in.
Height Rail to step	15 in.
Width of aisle	35 in.
Width of seat	23 in.
Axle bearing diameter	4 in.
Wheel diameter	26 in.
Height, rail to trolley base	10 ft. 9½ in.
Air brake type	Westinghouse
Body	Semi-steel
Car signal system	Faraday high voltage
Compressors	Westinghouse DH-16 and GE CP-27
Control	K-35-HH
Destination signs	Hunter
Doors	Center-sliding, end-folding
Door mechanism	National Pneumatic
Hand brakes	Peacock Staffless
Heaters	Consolidated 1522-T or Gold 478
Headlight	Electric Service Supply Company, Type RRX-96
Headlining	Agasote
Interior trim	Natural cherry
Journel bearings	Plain
Lamp fixtures	Electric Service Supply Company 22010
Motors	Four—35-hp. 600-volt interpole, ventilated box frame inside-hung, General Electric 265-A and Westinghouse A-510
Painting scheme	Ivory with green trim
Roof	Arch
Sash fixtures	Curtain Supply Company
Seats	Heywood-Wakefield 8-M-5 Special
Seating material	Brown leather
Step treads	Kass type 14
Trolley base	Ohio Brass Form 1
Trolley catcher	Ohio Brass 13141
Truck type	Standard
Ventilators	Railway Utility, honeycomb
Wheels	26-in.-rolled-steel

Russian Railway to Be Electrified

Electrification of the 63 km. (40 miles) of the Sestafoni-Chashuri section of the Baku-Batum Railway, of Russia, in which is located the Souram Pass, is now under consideration. The oil traffic is expanding at such a rate that even the doubling of the old Baku-Batum pipeline is insufficient to cope with the increasing trade. Moreover, the completion of the Maritime line from Batum northwards along the Black Sea coast has put an additional strain on the one track of the Baku-Batum line which now serves as one of the feeders of the Maritime Railway. The authorities are therefore forced either to double the track or electrify the "bottle-neck," thus increasing the scheduled speed over the Souram Pass to the average for the rest of the line. Electrification has been decided upon as being more economical, and the Russians are now in the international market for the equipment necessary.

The scheme decided upon will use direct current at 3,000 volts, with regeneration of electrical energy when descending the steep gradients instead of using brakes. Three or four substations and 24 electric locomotives will be necessary; of the latter fourteen are to be ordered abroad and the remaining ten are to be built in Russia under the supervision of the foreign contracting concern. The value of the order to be placed abroad is about $1,750,000. The electrification of the Souram Pass is the first of several electrification schemes of Russian main lines. Plans are also in hand for the electrification of other sections—viz., of the Moscow-Kazan and Moscow-Koursk Railways.

Purchasing Agents to Meet

Approximately 1,500 industrial buyers will study the latest economic changes of their profession at the fourteenth annual meeting of the National Association of Purchasing Agents to be held at the Hotel Statler, Buffalo, N. Y., from June 3 to 6 inclusive. The convention will attract the purchasing agents in practically every industry in the United States, Canada, and Mexico, whose combined buying power annually runs in the billions. These industrial buyers will study commodity trends and business conditions, up-to-the-minute purchasing practices, new sources of supply, new services, and new products.

It is realized that the downward trend in commodity prices is bringing about tremendous fundamental changes that strongly militate against the success of many companies, while at the same time working in favor of others, and that assistance in buying right, under these changing economic conditions, is the greatest need of the purchasing agent. For this reason much stress is being laid upon the development of a strong convention program which will anticipate the buyer's needs.

Apart from the general sessions, a great deal of time will be allotted to the various industrial groups within the association so that they may convene on their common interests. Buyers for particular industries, for instance, such as public utilities, oil companies, banks and insurance companies, mining, smelting, and refining concerns, etc., as well as those interested in major commodities, such as coal, iron and steel, textiles, etc., will have ample opportunity to thrash out their own problems and discuss and hear the latest developments of importance.

Supplementing the convention itself, there will be an exhibit of industrial equipment, services, and improved products. This is called the "Informashow" because of its informative character. The show is of unusual merit and affords each purchasing agent an opportunity to keep abreast of development. In the past it has proved very educational.

Square D & Industrial Controller Unite

Manufacturing, financial and engineering resources of the Square D Company, Detroit, Mich., and Peru, Ind., and of the Industrial Controller Company, Milwaukee, Wis., have been united. Henceforth the two companies will be conducted under one management and will be known as the Square D Company. The new company will serve the industry through three divisions, the switch and panelboard division, Detroit; the porcelain division, Peru, and the industrial controller division, Milwaukee.

The management of this new and larger Square D Company will be in the same hands that guided the two combining companies previously. T. J. Kauffman continues as president and operating head of the business. A. A. Schueler, for several years sales manager of the Square D Company, becomes general sales manager of the new organization. F. W. Magin, who was general manager of the Industrial Controller Company, will continue as general manager of the industrial controller division of the new Square D Company, in addition to becoming vice-president of the company. H. L. Van Valkenburg will be chief engineer of the industrial controller division of the new Square D Company, continuing in the same position he held with the Industrial Controller Company.

ELECTRIC RAILWAY MATERIAL PRICES—MARCH 26, 1929

Metals—New York

Copper, electrolytic, cents per lb	23.775
Lead, cents per lb	7.775
Nickel, cents per lb., ingot	35.
Zinc, cents per lb	6.975
Tin, Straits, cents per lb	48.75
Aluminum, 98 to 99 per cent, cents per lb	23.90
Babbitt metal, warehouse, cents per lb.:	
Commercial grade	54.00
General service	31.50

Bituminous Coal

Smokeless Mine Run, f.o.b. vessel, Hampton Roads, gross tons	$4.375
Somerset mine run, f.o.b. mines, net tons	1.875
Pittsburgh mine run, Pittsburgh, net tons	1.80
Franklin, Ill., screenings, Chicago	1.70
Central, Ill., screenings, Chicago	1.175
Kansas screenings, Kansas City	1.70

Track Materials—Pittsburgh

Standard steel rails, gross ton	$43.00
Railroad spikes, drive, ⅝ in. and larger, cents per lb	2.80
Tie plates (flat type), cents per lb	2.15
Angle bars, cents per lb	2.75
Rail bolts and nuts, cents per lb	3.90
Steel bars, cents per lb	1.925
Ties, white oak, Chicago, 6 in. x 8 in. x 8 ft	$1.40

Hardware—Pittsburgh

Wire nails, base per keg	$2.70
Sheet iron (24 gage), cents per lb	2.90
Sheet iron, galvanized (24 gage), cents per lb	3.65
Galvanized barbed wire, cents per lb	3.35
Galvanized wire, ordinary, cents per lb	3.15

Waste—New York

Waste, wool, cents per lb	18.
Waste, cotton (100 lb. bale), cents per lb.:	
White	17.25
Colored	13.5

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), cents per lb	10.6
White lead in oil (100 lb. keg), cents per lb	13.50
Turpentine (bbl. lots), per gal	$0.60
Putty, 100 lb. tins, cents per lb	5.725

Wire—New York

Copper wire, cents per lb	25.875
Rubber-covered wire, No. 14, per 1,000 ft	6.95
Weatherproof wire base, cents per lb	26.875

Paving Materials

Paving stone, granite, 5 in., f.o.b. New York—Grade 1, per thousand	$150
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd., f.o.b.	$2.78
Paving brick 3½x8½x4, N. Y., per 1,000 in carload lots, f.o.b.	51.00
Paving brick 3x8½x4, N. Y., per 1,000 in carload lots, f.o.b.	45.00
Crushed stone, ¾-in., carload lots, N. Y., per cu.yd., delivered	3.25
Cement, Chicago consumers' net prices, without bags, f.o.b.	2.05
Gravel, ¾-in., cu.yd., delivered	3.25
Sand, cu.yd., delivered	2.00

Old Metals—New York and Chicago

Heavy copper, cents per lb	19.875
Light copper, cents per lb	17.875
Heavy yellow brass, cents per lb	12.875
Zinc, old scrap, cents per lb	3.375
Lead, cents per lb. (heavy)	6.125
Steel car axles, Chicago, net ton	$17.75
Cast iron car wheels, Chicago, gross ton	14.75
Rails (short), Chicago, gross ton	19.25
Rails (relaying), Chicago, gross ton (65 lb. and heavier)	28.50
Machine turnings, Chicago, gross ton	7.75

Once to Every Car!

THE BIG EMERGENCY, ANTICIPATE IT WITH

Peacock Staffless Brakes

That one emergency may cost you plenty. Can you afford to be without braking equipment which functions positively in the emergency?

National Brake Company

890 Ellicott Square, Buffalo, N. Y.

Canada:—Lyman Tube & Supply Co., Ltd., Montreal

The Ellcon Co., General Sales Representative, 50 Church Street, New York City

comfort
that Builds Bus Business

CONSIDER this Palace Highway Pullman. Seats, too, made by Bender which means passengers not only ride but rest—an absence of strain, of poor posture, of restlessness, of muttered hopes for the ride to end.

Other Features:

Inside width exceeds any body on the market with the same outside dimensions. That means wider seats and wider aisle. Ample luggage space *inside*. Luggage protected against weather, against loss or damage claims. An individual light at each seat. A window for each seat—and every window can be opened all the way up—*every window*. Full head room in aisle.

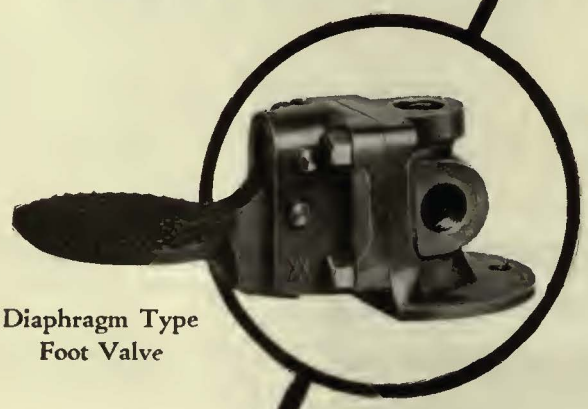
The Palace Highway Pullman is a type of bus that will make money for you. Give it a chance to prove itself on your operations.

BENDER BODIES

THE BENDER BODY CO.
W. 62nd & Denison, Cleveland, O.

We could not improve the Principle... So we improved the Details

Diaphragm Type
Cut-Off Valve



Diaphragm Type
Foot Valve

Because the basic idea of interlocking power, brakes, and door control to provide maximum safety and convenience for cars operated by one man was sound in principle it has won universal recognition.

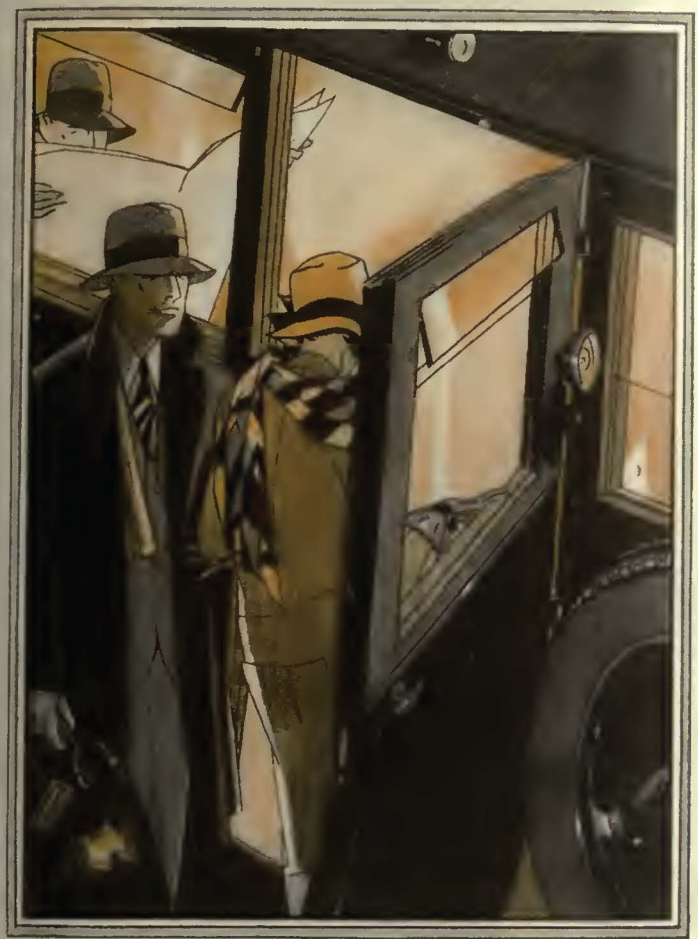
But experience has given us a better understanding of the functional requirements of equipment details, and improvements have been made as needed. To simplify installation and reduce air leakage, a Foot Valve and Cut Off Valve of the "WABCO" Diaphragm Type are now furnished with Safety Car Control Equipments.

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

Postal and Telegraphic Address:
WILMERDING, PA.

CHICAGO SAN FRANCISCO NEW YORK WASHINGTON PITTSBURGH

The Safety Car Control Equipment has been a vital factor in safeguarding accelerated transportation.



Exide
MOTOR COACH
BATTERY

Fares show the way to Better Business

They choose the well-lighted motor coach that gives them READING COMFORT

TWO motor coaches may be identical in almost every respect. But if one is brightly lighted and one is dim inside—Mr. and Mrs. "Fare" will choose the bright motor coach. It gives them *reading comfort* as well as riding comfort. For comfortable, well-placed reading lights make the trip seem shorter—the service more friendly.

To maintain this constant light through long hours of gruelling service, a powerful generator is needed—backed by a dependable storage battery. Exide Motor Coach Batteries were designed for just such hard work—such continued exhausting service.

Exide engineers have been building batteries for forty-one years. They know the hard job a motor coach battery must perform. The Exide Motor Coach Battery has the stamina for long running hours—the reserve power for peak lamp loads—the rugged strength for years of day-in-and-day-out duty. And the operating cost is surprisingly low . . . made possible by the scientific construction. Small wonder that hundreds of operators use Exide exclusively.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto

TYPICAL installations of Carey Elastite System of Track Insulation on the Cincinnati, Hamilton & Dayton Railway. Note the neat appearance of the roadway, since this improved track insulation was installed.

They multiplied fifty-

THREE years ago, the Cincinnati, Hamilton & Dayton Railway Company began to improve their extensive properties throughout Southern Ohio. By way of experiment, they "cushioned" a section of track with Carey Elastite System of Track Insulation—two thousand lineal feet of it.

Immediately they noticed a silencing of excessive track noise—as well as a lessening of wear on the paving alongside the rails. Patrons, too, began to comment on how much more smooth-riding the CH&D cars were. Carey

the "trial footage" fold!

Elastite System of Track Insulation certainly was a decided success! Small wonder, then, that, since '26, CH&D officials have installed no less than fifteen thousand additional feet of this remarkable traction improvement!

Electric railways in more than 150 cities, large and small, are being given the lasting protection of Carey Elastite System of Track Insulation. Of course, you will want to know more about this highly-endorsed traction improvement. Write.

THE PHILIP CAREY COMPANY · *Lockland* · CINCINNATI, OHIO

Carey Elastite

REG. U.S. PAT. OFF.

TRADE MARK REG'D. U.S. PATENT OFFICE

SYSTEM OF
TRACK INSULATION

. . . an asphaltic compound substantially reenforced with asphalt-saturated fibre preformed under heavy pressure. Impervious to moisture and temperature changes.

Signaling to Meet Competition

WHEN present day competition with other systems of travel gets serious, the best answer usually is "Union" signals. A properly signalled system permits higher speeds. Time saved is money earned.

The Pittsburgh Railways Company is finding its A.P.B. installation of 58 "Union" color-light signals between Pittsburgh and Washington, Pa., an investment well placed. So much so in fact has this been the case, that other similar installations are being made and are being contemplated.

Write or call our nearest office for additional information. Our specialists are at your service and will gladly assist you in making a survey of your lines. No obligation.

1881 **Union Switch & Signal Co.** 1929

SWISSVALE, PA.

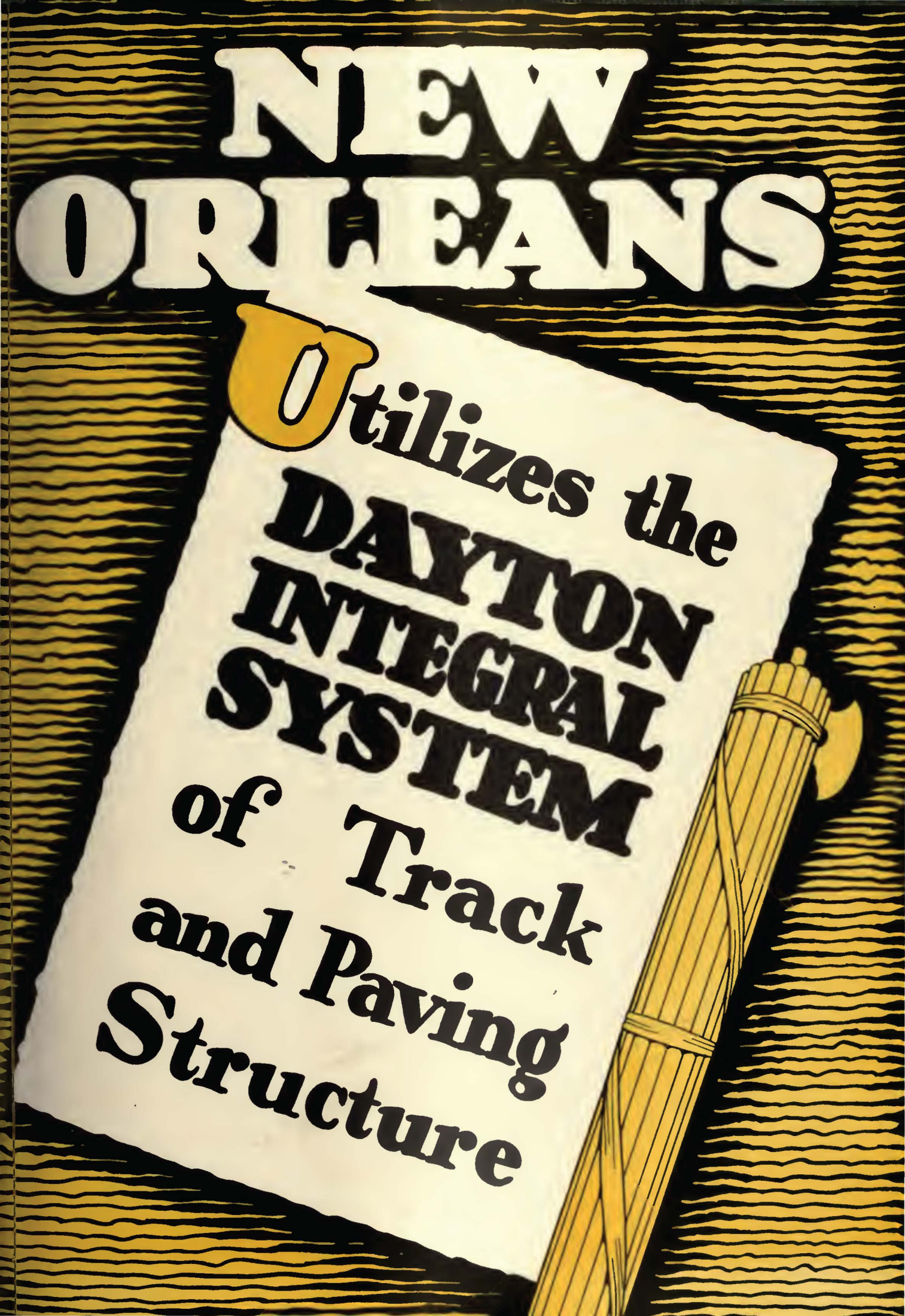
NEW YORK MONTREAL CHICAGO ST. LOUIS SAN FRANCISCO

NEW ORLEANS

Utilizes the

DAYTON INTEGRAL SYSTEM

of Track and Paving Structure




MAYER ISRAEL & CO. INC.
$tevens
UNITED STATES BRANCH
CANAL-COMMERCIAL
TRUST & SAVINGS
— BANK —
INTEREST PAID ON SAVINGS ACCOUNTS
SAFETY DEPOSIT BOXES FOR RENT

New Orleans Utilizes The Dayton Integral System of Track and Paving Structure

A thorough analysis of track costs by the New Orleans Public Service Inc. during the past two years brought to life a number of important facts. It was found that the value of the road bed was over one half of the total investment in railway property, and that maintenance costs were staggering. Specific analysis in a number of cases indicated that in an endeavor to make the track last for twenty years or more, *the cumulative maintenance costs over this period equalled and often exceeded the original investment cost.*

With a view of developing a type of track construction that would have a life commensurate with the required investment and minimize maintenance costs, a thorough study and analysis of track designs was undertaken. Past practices were reviewed, inspection and investigation of track designs in other Cities of the United States was made, materials were tested, and a type of track design developed, based upon thorough engineering analysis and the proper application of construction materials.

Dayton Ties are being utilized in this developed type of construction. This improved design does not cost as much as the obsolete type of track previously employed under like conditions.

We believe the New Orleans Public Service Inc., in their research and development of this inexpensive but more nearly permanent type of paved track construction, which can be used to an advantage by Street Railways anywhere, has performed a service of inestimable value to the industry.

What the Dayton Integral System of Track and Paving Structure Means to You

Increased Life With Reduced Maintenance Less Costs

Dayton Integral System of track and pavement construction, by utilizing the concrete paving base formerly bisected by wood ties, combines the track foundation and pavement structure into a monolithic unit of maximum stability and ruggedness.

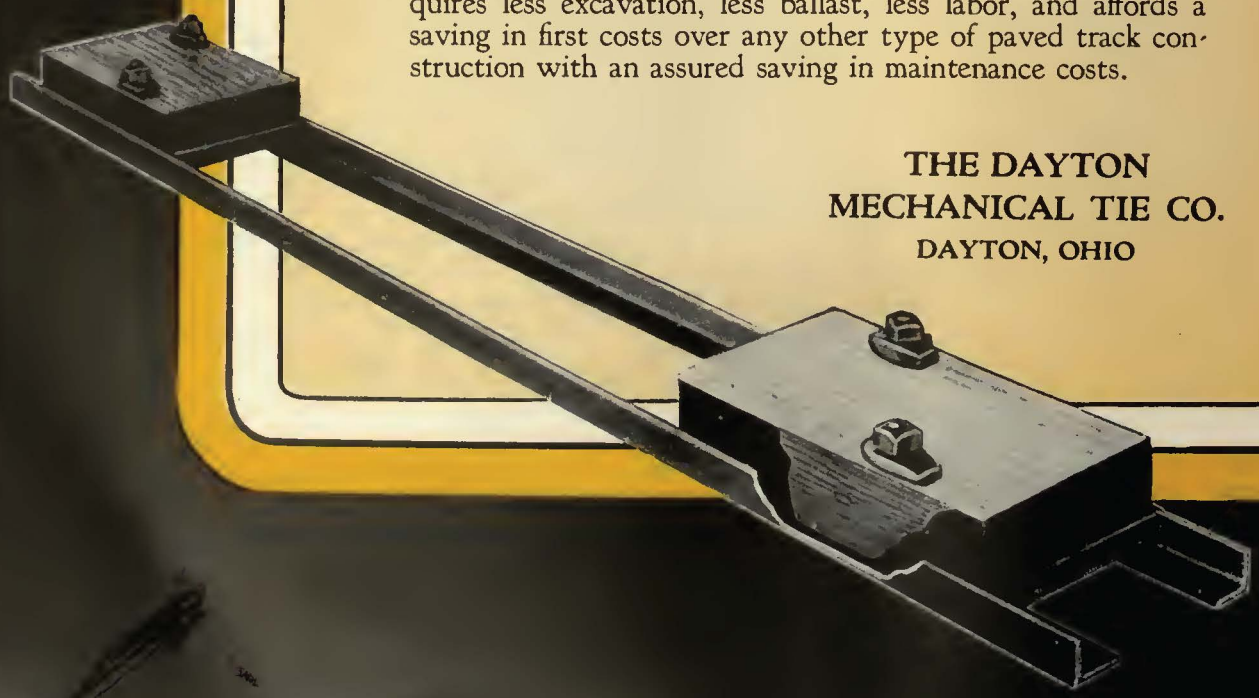
The steel angles of the Dayton Tie provide a transverse reinforcement of the foundation in a plane, where the stresses and strains tend to produce cracking and disintegration of the concrete.

The combined constructional features of the rail anchorage absorb and dissipate rail vibration, thus protecting the foundation and pavement from this abuse.

Reinforced concrete, adequately protected from vibration has proven itself to be a material of long and useful life for industrial application. Rails, laid upon a reinforced concrete foundation, with a *vibration absorbing anchorage*, provide a track structure that will develop the full wearing life of the component parts *with no major maintenance at all.*

The Dayton Integral System of Track Construction requires less excavation, less ballast, less labor, and affords a saving in first costs over any other type of paved track construction with an assured saving in maintenance costs.

THE DAYTON MECHANICAL TIE CO.
DAYTON, OHIO



mileage

FISK'S excess *mileage* is due to two unique features...the *All-Cord* carcass and the Multiple Cable Bead.

The *All-Cord* process does away with cross threads in the tire fabric...prevents internal friction and overheating.

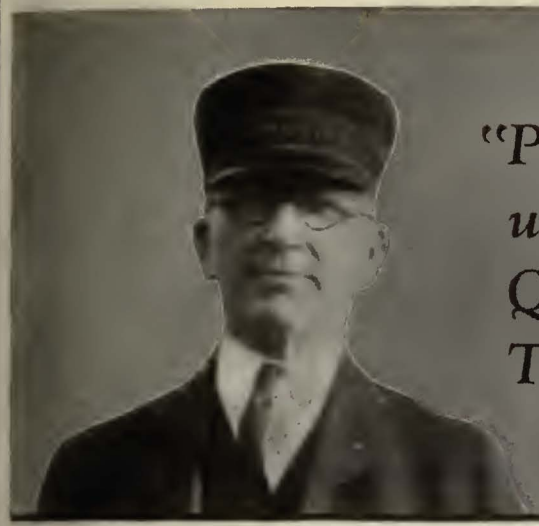
The Multiple Cable Bead gives a solid grip at the rim and adds extra strength to the sidewalls. It provides a firm foundation for the frictionless *All-Cord* action.

These two Fisk features give Fisk Motor Coach Balloons the stamina to pile up *mileage* over any kind of going. Try Fisks on your hardest routes... you'll find they help keep operating costs down to a profitable level.

THE FISK TIRE COMPANY, INC.
Chicopee Falls, Mass.

FISK

MOTOR COACH BALLOON



"Passengers Compliment Me upon the Easy, Smooth and Quiet-Riding of our Timken-Equipped Trains"

That's the Conductor's Story

Chicago, Milwaukee, St. Paul and Pacific Railroad Co.

573 Superior Street,
Milwaukee, Wis.
December 14, 1928.

Mr. W. C. Sendere,
General Mgr. Railway Division,
The Timken Roller Bearing Company,
Canton, Ohio.

Dear Sir:-

I am sorry that our meeting on the train the other day when coming into Chicago was so brief, for I was anxious to talk to you at greater length and tell you some of my observations as concerns your roller bearings that are being used on our Milwaukee trains.

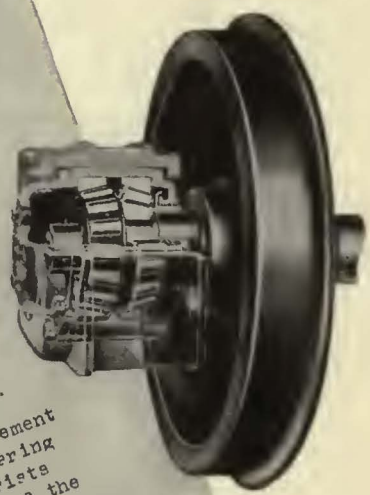
I do, however, want to take this opportunity to tell you that during the years that I have been in the railroad service as a conductor on passenger trains, I have never seen any one improvement in train service meet with such popularity as have the roller bearing equipped trains. On nearly every trip I am complimented by tourists and passengers upon the easy, smooth and quiet riding qualities of the train, and our plain bearing trains are hard to beat. Many of the tourists, upon leaving the train at Chicago have made a special effort to tell me what a pleasant and comfortable journey they have had, at the same time expressing their desire to return west on the Milwaukee Road.

The advantages in train operation, resulting from the use of roller bearings, and these expressions which I hear daily from the passengers, have made me an ardent enthusiast of your bearings.

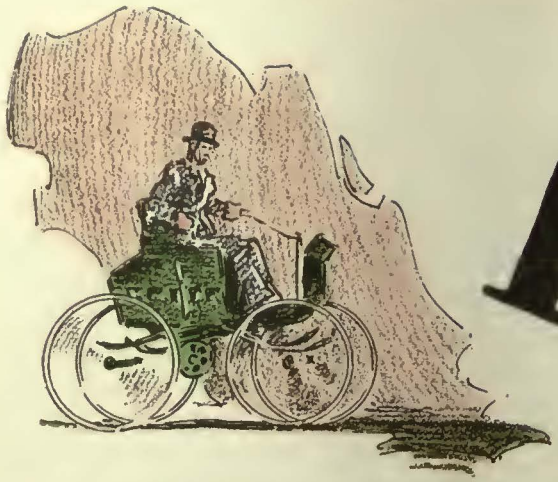
I hope that the next time you come to Chicago I may have the privilege of again seeing you.

Yours truly,

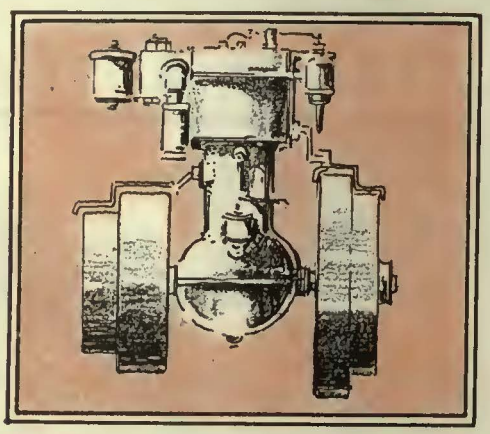
a. Kirby
Conductor.



TIMKEN Tapered Roller BEARINGS



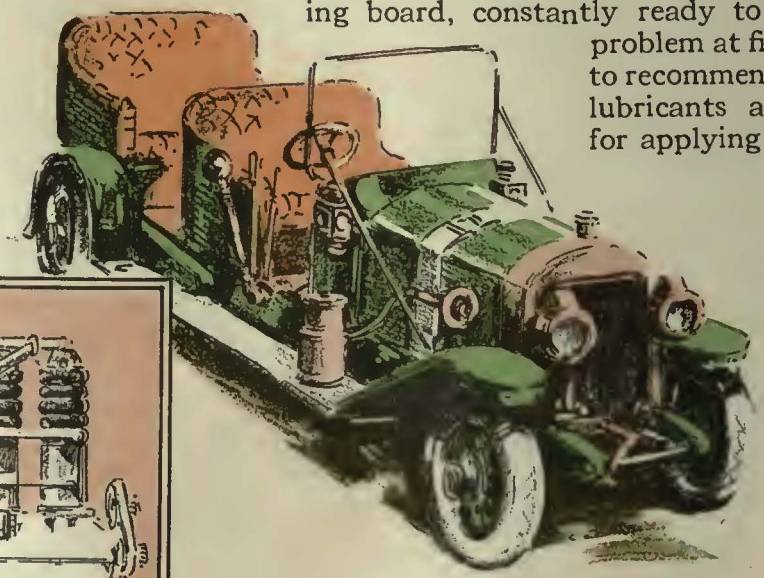
Longer

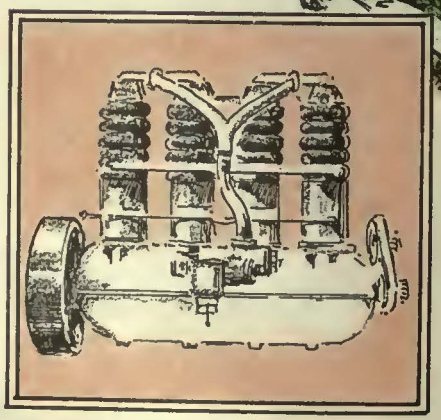


An improved lubrication service that meets today's motor and load requirements

Engine overheating due to continual operation; heavy strain on moving parts due to peak loads; excessive wear from high speeds to maintain schedules; imperfect lubrication under ever-changing weather conditions—these are causes of high operating and maintenance costs in bus transportation systems.

KOOLMOTOR Bus Oils are specially processed to reduce these difficulties to a minimum. They are pure petroleum products, perfected in Cities Service laboratories by Cities Service lubrication experts. These same experts can help you safeguard your profits by lowering operating expenses. They are available without cost, as a free consulting board, constantly ready to study your problem at first hand and to recommend the proper lubricants and methods for applying them.





OIL DIVISION

CITIES SERVICE COMPANY

60 WALL STREET, NEW YORK, N. Y.

Koolmotor Products

The public has tasted luxury in transportation and likes it. Nothing short of full measure will now satisfy it in public transportation. The industry must meet changed conditions . . . and that quickly . . .

from an editorial in *Electric Railway Journal*, February 16, 1929.

WE ARE READY

Cincinnati has the designs—Cincinnat has built the most modern cars fo years, is building the most modern car today—cars that are modern in efficienc as well as luxury. And Cincinnati's Sur vey and Plan Method of selling enable any property to have modern cars at onc —and to pay for them out of increased earnings.

We recently submitted a Survey and Pla to a large property in Indiana. The pla was approved and Cincinnati Cars sup plied. Running time on all routes was cu about 8%. The shop organization was cut creating a saving of $9,000.00 in wages Power bills were so reduced that a monthly saving of $3,000.00 in powe was established (the power rate is 1.1c pe K.W.H.) Figures to date indicate an an

TO GO AHEAD

nual saving of approximately $85,000.00. As soon as the planned one-man car operation is put into effect a further saving of about $25,000.00 will be made. And these savings tally exactly with our original Survey figures.

The Electric Railway Industry is paying a high price for the continued operation of its obsolete equipment. Some few companies have had the courage to junk old cars, and buy new ones. That courage has paid! Those companies are giving the public what it wants, and the public is responding with increased patronage. Let us lay our cards on the table. The public has tasted luxury in transportation and demands it. We are ready to go ahead. Are you?

THE public has a quaint habit of demanding luxurious transportation —at old-fashioned prices. That demand can be met with the right kind of rolling stock and the right kind of operation. We do not advocate street cars where coaches should be used—nor try to sell coaches where street cars will do the job. But we will welcome the opportunity to submit to you a survey and plan—based on the right kind of transportation units—for we build both cars and coaches. Cincinnati cars are as modern as this morning, Versare Coaches have a distinctive passenger appeal—both bring a luxury to transportation that pays!

THE CINCINNATI CAR CORPORATION
Winton Place
Cincinnati, Ohio

One journal oil the year round

No epidemic of spring and autumn pullins for oil change . . . no rush to pull out old waste and repack journal boxes . . . no shifting of schedules to compensate for cars out of service . . . and an important item of maintenance cost eliminated. How? By using Superla Car Journal Oil.

Superla Car Journal Oil refutes the theory that winter and summer grades of oil are necessary. It has proven successful in all seasons in high speed interurban and ordinary street car service. It has made possible marked savings in power and waste consumption, increased the life of bearings and reduced bearing temperatures.

The flexibility of Superla Car Journal Oil, its ability to stand up under heavy service requirements and its wide atmospheric temperature range make it the ideal year around car journal oil.

Our engineers will gladly give you additional information and data. Consultation with them places you under no obligation.

Listen In

CHICAGO SYMPHONY ORCHESTRA

Sunday Evening 6 to 7 o'clock
Central Standard Time

Over Following

WGN Chicago — WHO Des Moines
WTMJ Milwaukee — WDAF Kansas City
KSD St. Louis — WOW Omaha
WOC Davenport — KSTP St. Paul
WEBC Superior

STANDARD OIL COMPANY (*Indiana*)

General Offices: 910 South Michigan Ave. CHICAGO, ILLINOIS

ILLINOIS
Chicago
Decatur
Joliet
Peoria
Quincy

INDIANA
Evansville
Indianapolis
South Bend

KANSAS
Wichita

IOWA
Davenport
Des Moines
Mason City
Sioux City

S. DAKOTA
Huron

MICHIGAN
Detroit
Grand Rapids
Saginaw

N. DAKOTA
Fargo
Minot

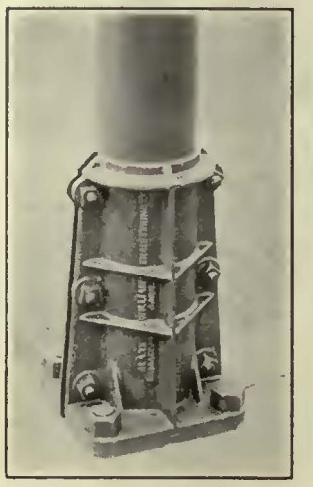
WISCONSIN
La Crosse
Milwaukee
Green Bay

MINNESOTA
Duluth
Mankato
Minneapolis

MISSOURI
Kansas City
St. Joseph
St. Louis

1316

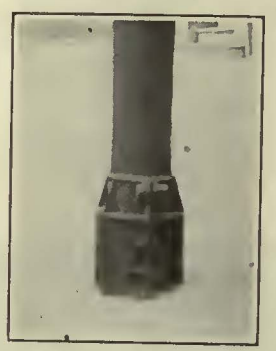
"B" Clamp Reinforcing Corroded Swaged Joint

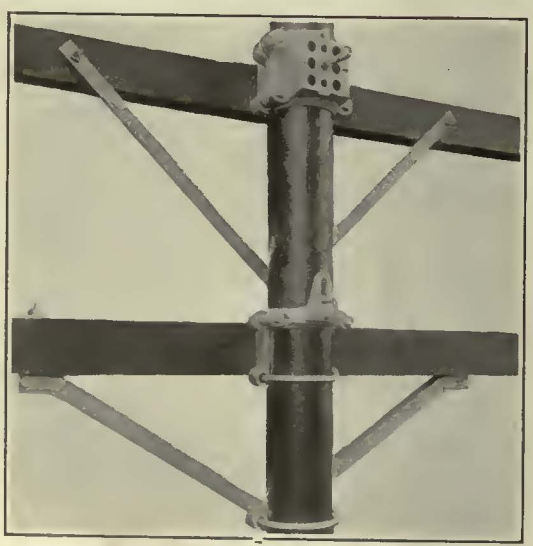


Typical Pole Mount Installation on Concrete

At Right—
"C" Clamp Supporting Pole Corroded at Base

Below—
Pole Mounts—12-in. to 6-in.





M.I.F. Crossarm Gain Installed

Typical M.I.F. Reinforcing and Extension Clamps

Tubular Pole Maintenance

It is not economical to replace a corroded tubular iron pole if it can be salvaged at reasonable expense. M.I.F. Tubular Pole Specialties prove most satisfactory and most economical as salvage devices.

"A" Reinforcing and Extension Clamps

—for reinforcing corroded upper joint where reduction in pipe size is full inch.
—for extending pole with section of pipe of one inch smaller diameter.
—for reinforcing at ground-line over collar.

"B" Reinforcing Clamps

—for reinforcing corroded upper joint where lower section is swaged over smaller pipe.

"C" Reinforcing and Extension Clamps

—for reinforcing poles corroded at ground-line— without collar, or after its removal.
—for extending pole with section of same size.

Variations of these types meet all conditions, including salvaging of ornamental poles.

Williams Pole Mounts

—for salvaging poles corroded at ground-line, by supporting them anchored to concrete base.
—for maximum clearance above ground with new or old poles, possibly jacked up out of ground.
—for anchorage on bridges, retaining walls, rock, etc.
—also provided in similar type for wood poles.

Crossarm Gains

—for attaching wood crossarms to tubular poles, with or without braces.

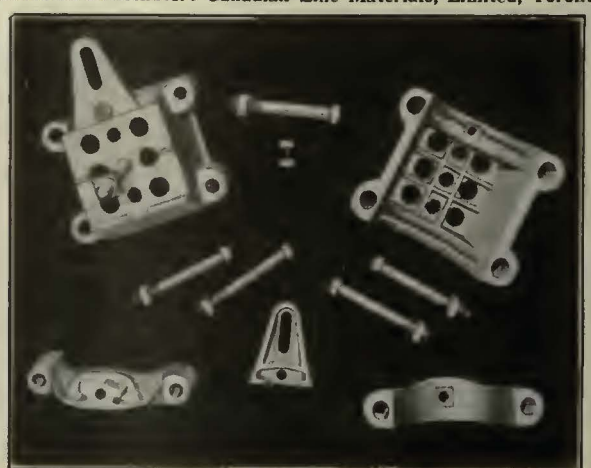
Cable Insulator Hangers

—for stringing signal wires, etc., along or across span wires.

Send for literature and prices

Malleable Iron Fittings Co.

Pole Hardware Department
Factory and New England Sales Office: Branford, Connecticut
New York Sales Office:
Thirty Church Street
General Sales Agents elsewhere in U. S.:
LINE MATERIAL COMPANY, South Milwaukee, Wis.
Canadian Distributor: Canadian Line Materials, Limited, Toronto



M.I.F. Crossarm Gain—Dis-assembled

Try this keyboard—

It is one of the most important features of the National Fare Register

Section of keyboard on National Fare Register, actual size

TAP the keys on this illustration as you would those of a real machine if you were recording a fare. They are exactly the same size as the keys on the keyboard of a National Fare Register.

Note how easy it is to pick out the correct key, the ample clearance between keys, the small chance to make a mistake by striking the wrong key.

Although the illustration cannot show it, these keys are of the most flexible type, easy to operate yet absolutely positive in their action. Once an amount is set up on this keyboard, it stays that amount until the transaction is completed or release key is pressed.

Only in National Fare Registers can interurban operators get the benefit of this fast, accurate and positive keyboard. *And the keyboard is just one of the ten distinctive features of the register.*

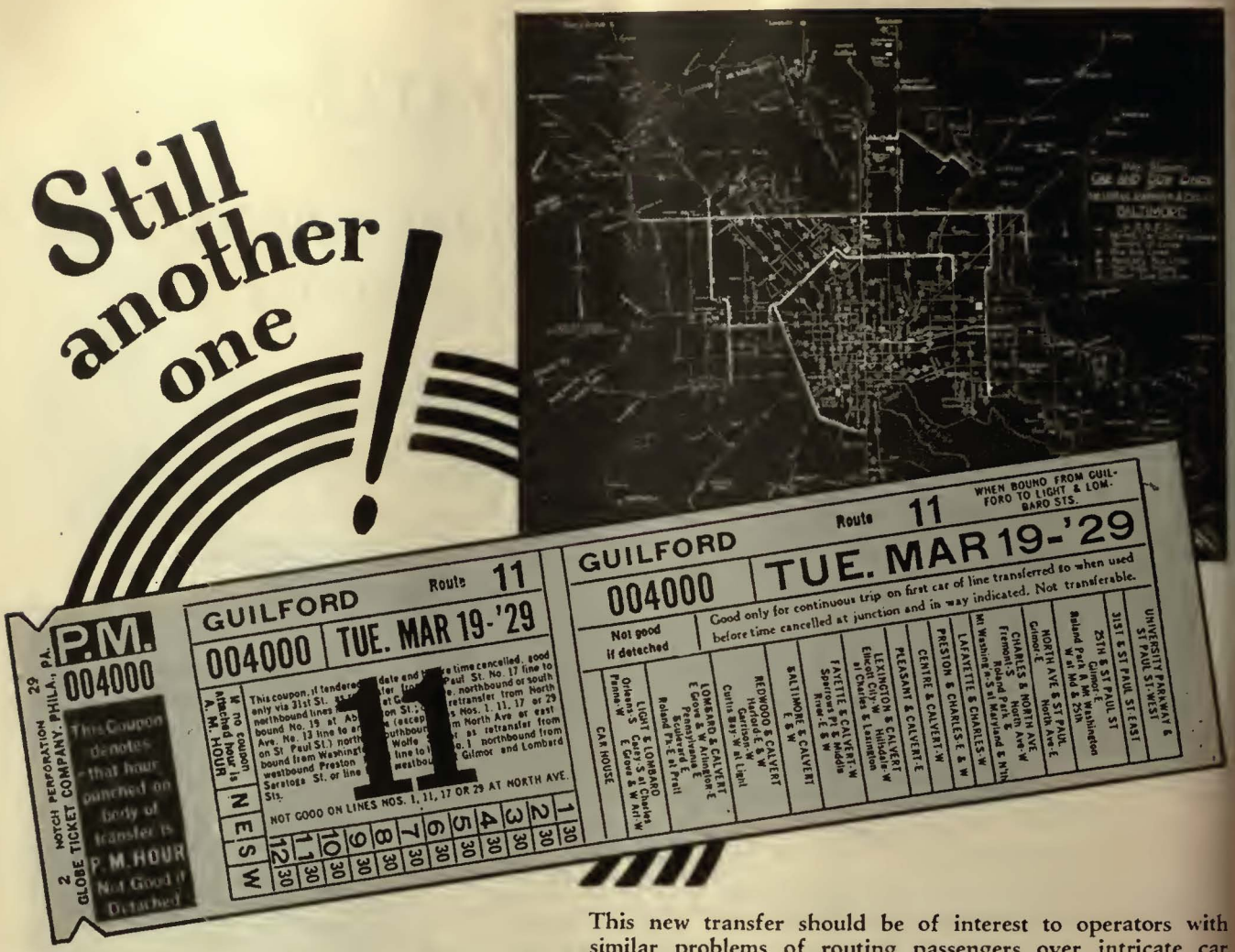
Ten Distinctive Features

Printed tickets
Printed trip sheet
Flexible keyboard
Special keys for each kind of fare
Public indication
Total of cash
Electric operation
Small size
Repeat key
Operator's identification key

THE NATIONAL FARE REGISTER

Product of The National Cash Register Company

Dayton, Ohio



Baltimore *uses a specially designed* Globe Transfer

This new transfer should be of interest to operators with similar problems of routing passengers over intricate car systems.

It was designed by Mr. J. A. Stoll, Superintendent of Traffic, of the United Railways and Electric Company, of Baltimore. Baltimore's old system involved the issuing of transfers and identification checks where passengers used three cars to reach their destinations. The new transfer eliminates the identification check. The conductor of the second or crosstown lines simply detaches and returns to the passenger the "Re-transfer Coupon" for use under certain conditions on a third line.

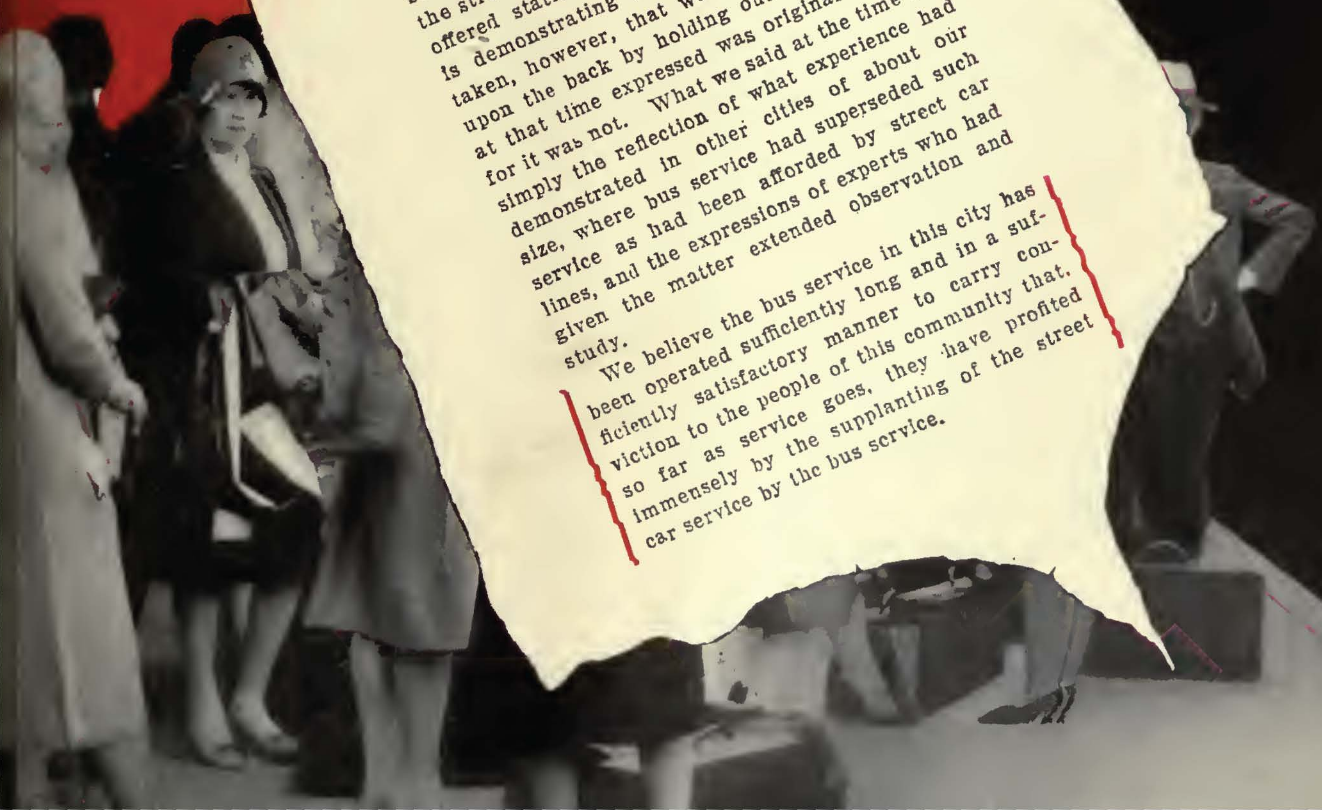
The United Railways and Electric Company of Baltimore say: "It is easier for the car rider to use and easier for the conductor to handle"— "Another advantage is that riders desiring to re-transfer need no longer board cars at the rear platform as formerly"— "Afford riders a quicker means of travel between outlying points without having to ride through the downtown section."

We shall be glad to explain the full advantages of this new "Re-Transfer" system. Our specialized experience enables us to design and supply a ticket or transfer system best adapted to your needs.

Globe TICKET COMPANY PHILADELPHIA

Factories:
Philadelphia
Los Angeles
Boston
New York
Jacksonville

Sales Offices:
Albany
Atlanta
Baltimore
Cincinnati
Cleveland
Pittsburgh



pped from the "Marion Star"

The City Bus Service.

While it is possible that sufficient time has not yet elapsed since the inauguration of the city bus service to permit the bus management to determine whether or no all the routes over which it is running its vehicles will be sufficiently remunerative to justify the continuation of the service as now routed, there can be no question of the popularity of the service as a whole with the local public generally.

Patrons of the line have found the buses new, neat and sanitary. They have found that they can enter and leave them far more easily than they could the street cars, and that the buses ride more smoothly and are in every way much more comfortable. Again, patrons have found how much it means to be able to step into the buses from the curb and leave them in the same way, thus eliminating the possibility of being run down by some reckless motorist, of which they always ran the chance while standing in the street awaiting the approach of a street car or alighting from one, as they were compelled to do when they depended on the street car service for transportation. And, in addition to all these advantages, the buses cover more territory.

We said in these columns, something like three years ago, that street car service in cities the size of Marion was doomed; that it would prove unable to compete with the service offered by bus lines. At that time the street car people questioned our view and offered statistics to contravert it, but time is demonstrating its merit. Let it not be taken, however, that we are patting ourself upon the back by holding out that the view at that time expressed was original with us, for it was not. What we said at the time was simply the reflection of what experience had demonstrated in other cities of about our size, where bus service had superseded such service as had been afforded by street car lines, and the expressions of experts who had given the matter extended observation and study.

We believe the bus service in this city has been operated sufficiently long and in a sufficiently satisfactory manner to carry conviction to the people of this community that, so far as service goes, they have profited immensely by the supplanting of the street car service by the bus service.

How Marion, *Ohio*, change

Complete Transportation Service now given by Yellow Coaches

Revenues of the street railway serving the city of Marion, Ohio, a city of 35,000 population, had for the past few years been dwindling. The handwriting on the wall told a story clearly disheartening.

Funds were lacking to put equipment and track in good condition. The riding public was plainly disgruntled. Even the press came out boldly with the assertion that street car service was doomed—yet the operating company did the best it could to stem the tide. Fares were increased, but still revenue failed to keep pace.

Something drastic had to be done.

On October 4th, 1928, all trolley service was discontinued and on October 5th motor coach service was inaugurated with twelve Type "W" 23-passenger Yellow Coaches—*a complete replacement.*

Results were immediate. The citizens of Marion were well satisfied. Riding increased. Red figures changed to black. The Marion

Red figures into Black

Rapid Transit, Inc. (the operating company) began to make money and has good reason to be proud of the support extended by the public and the authorities.

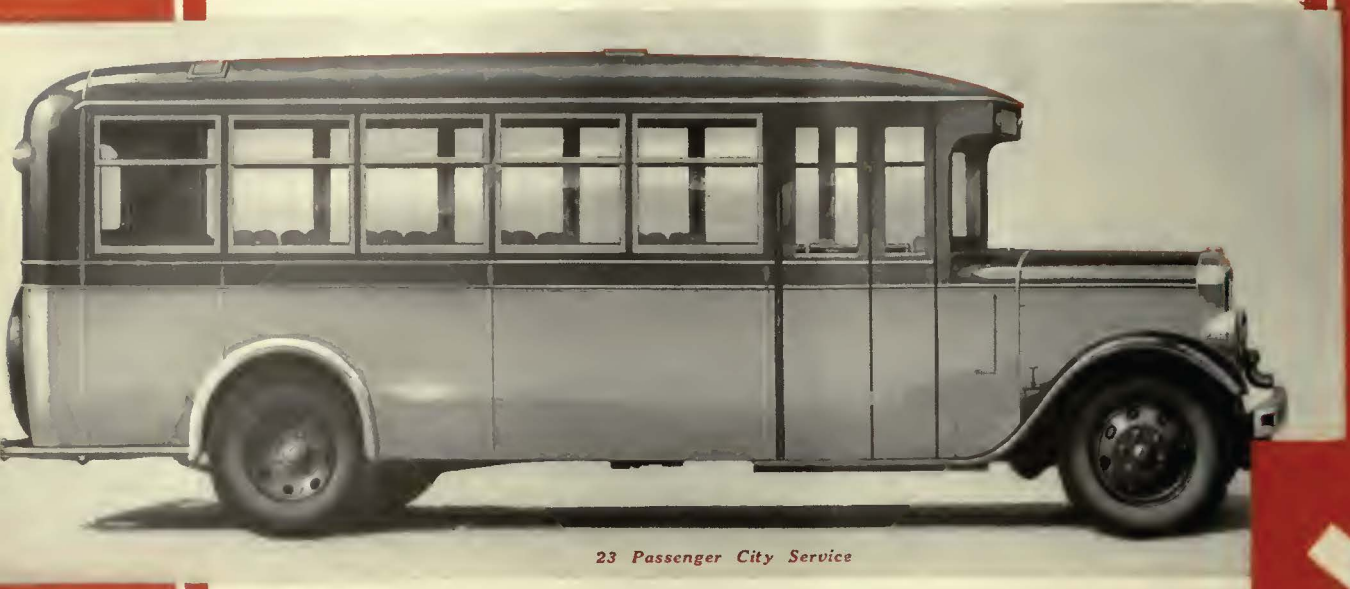
The press, also, has changed its tone. What better evidence of satisfaction than the following extracts quoted from the editorial columns of the Marion Star of January 9, 1929—

"There can be no question of the popularity of the service as a whole with the local public generally . . . Patrons have found how much it means to be able to step into the buses from the curb and leave them in the same way . . .

"We believe the bus service in this city has been operated sufficiently long and in a sufficiently satisfactory manner to carry conviction to the people of this community that, so far as service goes, they have profited immensely by the supplantry of the street car service by the bus service."

Operating Cost
19.78 Per Coach Mile

	Cents per Coach Mile
Maintenance	2.68
Depreciation	3.76
Garage	0.42
Transportation	9.19
Administration	1.50
General	2.23
TOTAL	19.78



23 Passenger City Service

Marion Standardized on Type W YELLOW COACH

TWELVE 23-passenger City Service Type "W" Coaches were selected to render a complete local city service for Marion.

With a growing population of 35,000 and an area of 8 square miles to be served, Type "W" Yellow equipment was selected because it possessed all the modern qualities desired for rendering a local service to a progressive community of moderate size.

Style and graceful appearance, combined with practical operating utility—smooth 8-cylinder power, fast acceleration, quick, sure brakes, low operating cost and, for a community of this size, ample load capacity without crowding,—

Type "W" Yellow Coaches are ideally fitted for the kind of service they are now rendering the city of Marion.

General Motors Truck Co., Pontiac, Mich.


No. 8M5 Special


No. 327-M Special

No. 327-M Special seats are in use by the Virginia Electric and Power Company, which was awarded the Charles A. Coffin medal for 1928.

DESIGNED FOR INTERURBAN USE

THE 327-M Special is a popular Heywood-Wakefield electric railway seat. The deep, double spring construction of the cushion and the restful pitch of the spring-filled backs make this attractive style one of the most comfortable interurban seats ever offered.

The 8M5 Special is a de luxe interurban type with spring-filled seats and backs. It has been purposely designed and built to withstand the most severe use and abuse, while delivering trouble-proof service year after year.

Our car seating experts will be glad to assist in solving your equipment problems. This service is yours without cost or obligation. Just write to the nearest Heywood-Wakefield sales office.

HEYWOOD-WAKEFIELD COMPANY

Boston, Massachusetts

516 West 34th St., New York City
439 Railway Exchange Bldg., Chicago, Ill.
J. R. Hayward, Liberty Trust Bldg., Roanoke, Va.
A. W. Arlin, Delta Bldg., Los Angeles, Calif.
H. G. Cook, Hobart Bldg., San Francisco, Calif.
The G. F. Cotter Supply Co., Houston, Texas
The Railway and Power Engineering Corporation
133 Eastern Ave., Toronto; Montreal; Winnipeg, Canada

Busy Men often prefer to "See" you by Telephone

Your customers are busy people. There are times when they prefer that you visit them by telephone. You save their time as well as your own.

A sales executive does 77% of his out of town business by telephone. He says, "you get the undivided attention of the man you are calling. Without any preliminary conversation, you are right down to basic facts. Think also of conserving the time of the buyer."

Many such practical experiences have grown out of the Key Town Plan. As your business in the larger towns grows and takes more and more of your salesmen's time, why neglect the smaller towns? Keep up your contacts; cover them by telephone from the larger towns. The Bell System has prepared a national and regional Key Town Map, which may be procured free upon request to your local Bell business office.

Study these key town maps to learn the most effective method of reaching your market by telephone—the modern way to meet competition. Cover more towns. Make more contacts. Use classified telephone directories to uncover new outlets. Develop each territory with savings in cost.

The quickest way to make the calls from each key town is by Sequence Lists.

The Bell System Credit Plan makes it unnecessary to carry cash for the calls. It helps keep a record of all contacts.

Ask the local business office today for complete information. Bell Telephone Service . . . . *Quick* . . . . *Inexpensive* . . . . *Universal.*

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM AND ASSOCIATED COMPANIES

MORE-JONES QUALITY PRODUCTS

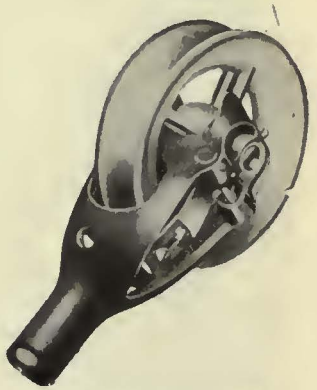
...ished Service

More-Jones Armature Babbitt Metal

Back of the More-Jones reputation for service is a great organization embracing equipment and personnel that has contributed to the general betterment of the industry, and has solved many of the perplexing problems which have confronted its customers.

The company's plants, operated under chemical and physical laboratory control, produce the very finest quality of bronze bearings, castings, babbitt metals, and solders that can be obtained.

The personnel of the More-Jones organization is composed of many men of proven ability whose connections with it date back to the very beginning of electric railway transportation in America and earlier periods.



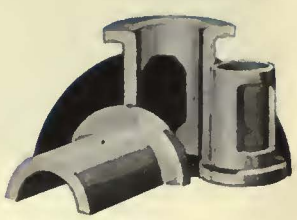
More-Jones Trolley Wheels

More-Jones Armature Babbitt Metal

No less than twenty-five different grades of Babbitt have been successfully perfected in the More-Jones line, designed for varying services and at varying prices. "Armature" for electric railway motor bearings is unexcelled for durability and economy.

More-Jones Trolley Wheels

This company is the largest manufacturer of trolley wheels in the world—one of our products perfected in cooperation with experts from various large electric railway systems.



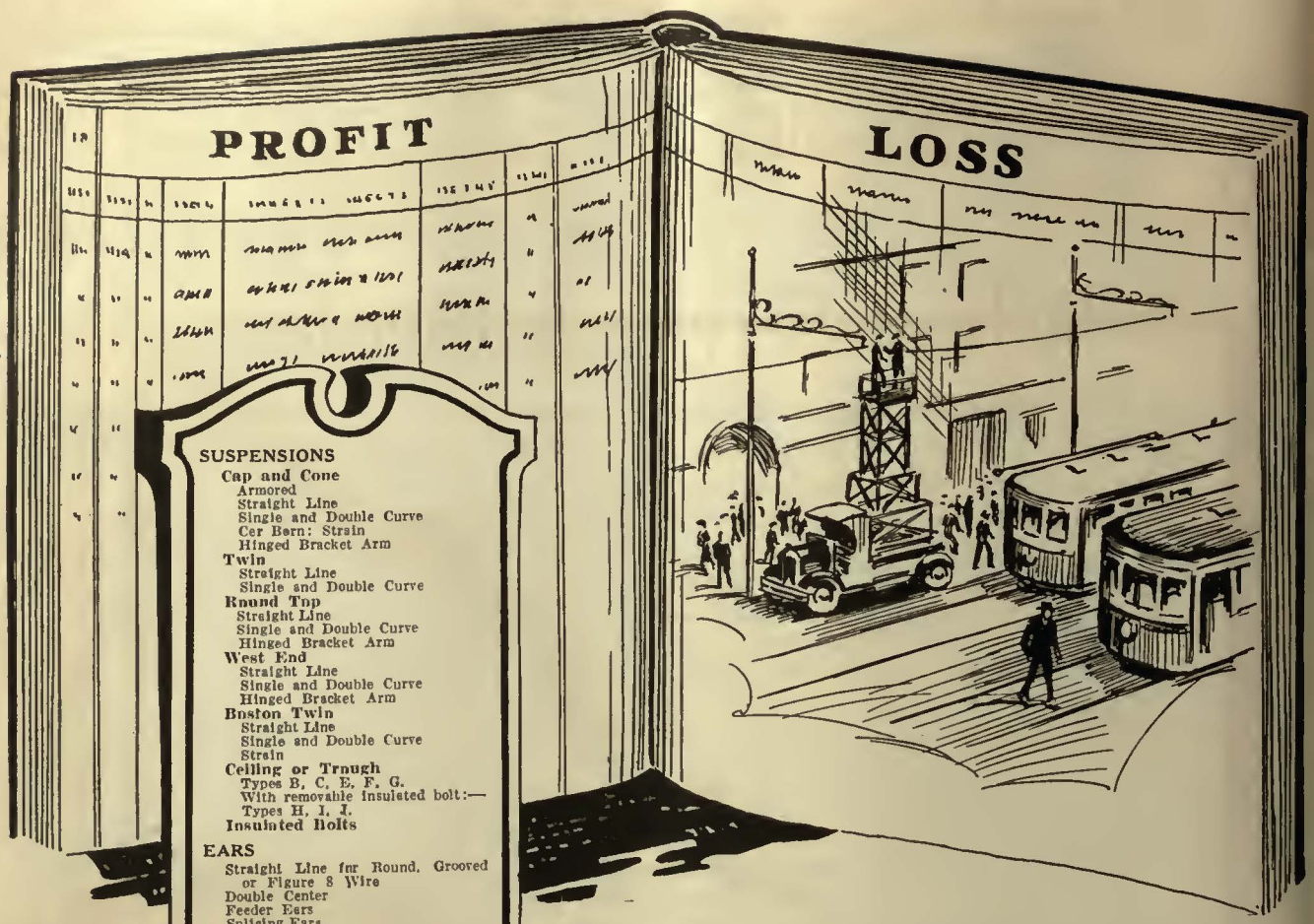
"Tiger" Bronze Axle and Armature Bearings

"Tiger" Bronze Axle and Armature Bearings

Being one of the early achievements of More-Jones and probably the most widely known bronze on the market, the product has done much to establish More-Jones' name as one of the leaders in the manufacture of bearings.

NATIONAL BEARING METALS CORPORATION
More-Jones Division
St. Louis, Mo.

New York, N. Y. Jersey City, N. J. Pittsburgh, Pa. Meadville, Pa. Portsmouth, Va.



SUSPENSIONS
- **Cap and Cone**
  - Armored
  - Straight Line
  - Single and Double Curve
  - Cer Bern: Strain
  - Hinged Bracket Arm
- **Twin**
  - Straight Line
  - Single and Double Curve
- **Round Top**
  - Straight Line
  - Single and Double Curve
  - Hinged Bracket Arm
- **West End**
  - Straight Line
  - Single and Double Curve
  - Hinged Bracket Arm
- **Boston Twin**
  - Straight Line
  - Single and Double Curve
  - Strain
- **Ceiling or Trough**
  - Types B, C, E, F, G.
  - With removable insulated bolt:—
  - Types H, I, J.
- **Insulated Bolts**

EARS
- Straight Line for Round, Grooved or Figure 8 Wire
- Double Center
- Feeder Ears
- Splicing Ears
- Half Strain
- Double Strain
- Clamp
- Mechanical

Splicing Sleeves
Feeder Cable Solicers
Wire Connectors
Strain Plates
Wire Protecting Sleeves

FROGS
- Bronze
- Malleable Iron
- Two, four and six pull-offs
- In any degree, right and left hand
- High Speed
- With and without removable ears

Frog wearing plates

CROSSINGS
- Bronze
- Malleable Iron
- Steel
- Insulated
- Uninsulated
- Adjustable
- Rigid
- With and without removable ears

Overhead Conductor Bar Construction

YOKES
- Feed in
- Feeder Plug
- Straight Line
- Single and Double Curve
- Swivel Strain
- Double Trolley Wire

INSULATORS
- Wood Strain
- Elephant Strain
- Giant Strain
- Globe Strain
- Porcelain
- Feed Wire
- Feeder Tap
- Brooklyn
- Turnbuckle

Third Rail Section
- Single and Double Beam
- Automatic
- High Speed

Split Spools
Solid Spools
Overhead material for Bridges
Line Material for Cranes
Sectionalizing Switches
Trolley Wheels
Sleet Wheels and Cutters
Harps
Pole Bands
Eye Bolts
Insulator Pins
Tools for installing overhead material

Does line maintenance cost put your balance on the wrong side?

Hurrying crowds! A line down! Tied-up traffic! The loss of time, money and public goodwill!—often due to the use of obsolete or inefficient line material.

Properly to serve the public and to insure its co-operation and support, the policy of using modern material of recognized quality and durability must be adhered to. Where Anderson equipment is used, maintenance should be simplified and maximum service assured!

Backed by forty years of experience and development, *Anderson* engineers are prepared to serve railway companies in the solution of their overhead line material problems and to consult on the special requirements for local conditions.

Examine the accompanying partial list of *Anderson* equipment, select according to your requirements and write for quotations.

Send for the hundred page illustrated Bulletin No. 39

ALBERT & J. M. ANDERSON MFG. CO.

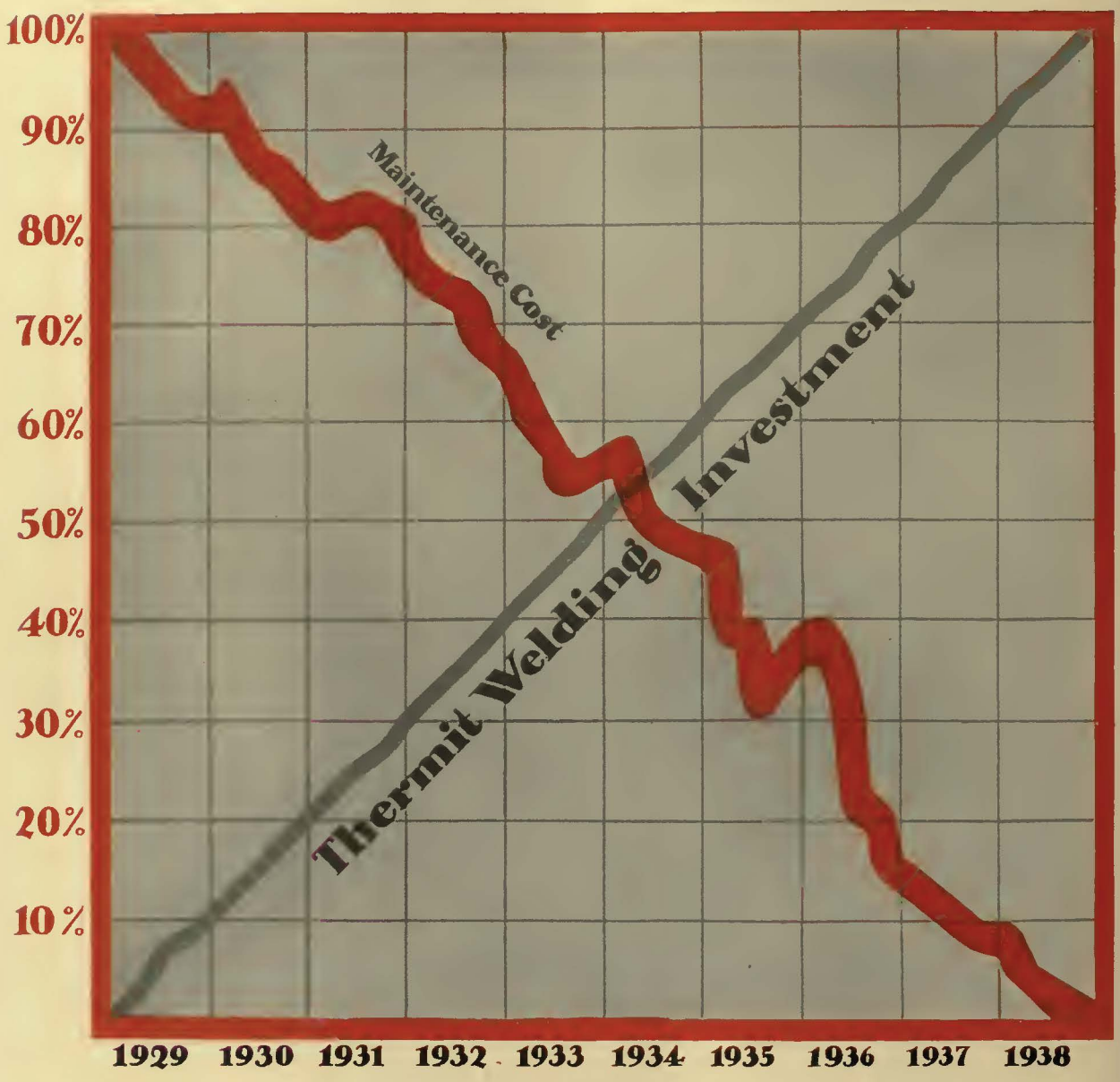
289-305 A ST., BOSTON, MASS.

PHILADELPHIA—129 Real Estate Trust Bldg.
CHICAGO—105 S. Dearborn St.
NEW YORK—135 Broadway
LONDON, E. C. 2, 12 Moor Lane


—dig and patch
—dig and patch!
You pay for
Thermit
whether you
use it . . . . . .
. . . . . or not

Thermit Welds are a

Patched joints are a



As the Thermit curve goes up
track maintenance comes down

permanent investment
permanent expense!

176 joints to every mile of track, each one demanding its share of the yearly track repair appropriation — each one an item of expense. One remedy, but unfortunately the more expensive one is patching. The better method —and the cheaper one in the long run—is the permanent cure of Thermit welding. The little extra cost involved is an investment,—not only in better, smoother track,—but in protection against all future joint repair.

No matter how you figure it, you pay this extra cost whether you use Thermit or not. The only difference is that you pay it many times over if you patch.

Every railway company with Thermit equipment has first-hand proof of these facts. They know from actual experience that Thermit welds are free from future maintenance.

Start now a regular program toward jointless track. Make an appropriation to Thermit-weld a definite proportion of your existing rail joints during 1929, and each succeeding year. Then watch track maintenance costs head downward.

Lay Track Economically—With Mass Production Methods

MASS PRODUCTION is largely responsible for industrial progress in the United States. Men are most profitably employed for the control and guidance of power.

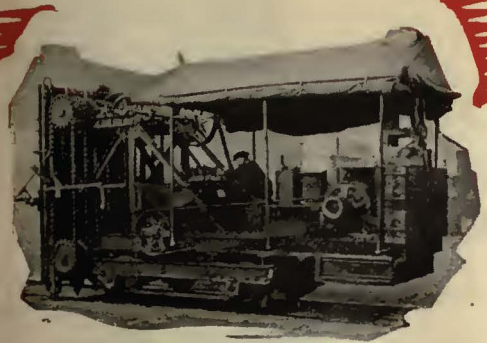
Differential methods for laying and maintaining track are modern methods—the principle of mass production economically applied.

The Differential method is approved and employed by more than 65 electric railways. By its use transportation is improved, more riders are attracted to their lines, revenue is increased.

Let us explain the Differential method and show you actual savings made by representative railways. Write—

The Differential Steel Car Co.
FINDLAY, OHIO, U. S. A.

Differential Electric Locomotive Crane Car: Handles rails, special track work, ties, bridge timbers, poles, etc. Capacities: 5 tons at radii up to 26 ft., 2½ tons at radii up to 44 ft.



Clark Concrete Breaker: Breaks concrete at less than 2 cents per track foot. Protects man-holes, underground conduits, etc. Fast and economical.

Differential Electric Dump Car: Dumps either side — no labor required — places material clear of trench — load distributed as desired—material placed on job at gross cost of less than 2 cents per ton mile.

Differential Body, 3-way Dump: Dumps right, left, rear. Patented down-folding door slides load clear of wheels. Great in close quarters or when track is torn up.

The new WHITE Six Light Duty Trucks

The new White Six Light Duty Trucks combine advanced style with complete driver comfort and practical utility. Available in a new range of color combinations. Chassis alone, including newest lighting and starting equipment, bumper, vacuum feed system, air cleaner, hot-spot manifold, rebound front spring plates, and complete equipment ready for body—$1850, f. o. b. Cleveland.

Built for the Modern Demands of *Speed and Economy* in Business

INCREASED business follows the policy of today's sales delivered today. The new Whites were built to make such service possible and have set up a new standard of values in the light delivery field. Conceived, engineered and built by White, the new light duty Sixes have a background of experience, resources and proved performance that cannot be attached to any other trucks of the same capacity rating.

Complete Traffic Mastery

In flexibility, ease of handling and acceleration the new Whites set a new record in truck performance. At sustained high speeds they travel all day with no trace of exertion. Top traffic speed is reached with surprising ease and diminished to a dead stop with the application of the positive 4-wheel hydraulic brakes.

In hundreds of businesses the new White Sixes will demonstrate an amazing reduction in operating costs and time—a new efficiency in transportation that means greater profits and service for the truck user.

White Built Throughout

The new Whites are built throughout in the vast White factory at Cleveland. They are notable examples of White's ability to pass on to users of transportation the benefits of the best engineering thought.

No matter what use you make of a truck, the new White Sixes offer advantages never before available in this field. On the basis of cost per package, per load, per eight hours of transportation service, there is no truck built that can do the job of the new Whites. The new Whites will prove economies and efficiency in your own operation that will amaze you. Call the nearest White Branch or Dealer.

Before You Buy Any Truck, See the New Whites Perform. You Will Be a Better Judge of Truck Values

We want you to see the new White Sixes and not take performance for granted. We want the new Whites to demonstrate to you a new kind of truck performance that is difficult to describe. Take advantage of this opportunity to learn first hand about the new Whites. We know there is nothing like them in the truck field today and a demonstration will prove every claim we make for them. Telephone the nearest White Factory Branch or Dealer for appointment.

THE NEW WHITE SIX LIGHT DUTY TRUCKS

THE WHITE COMPANY, CLEVELAND

LIGHT DUTY

Light Delivery Chassis (6-cyl.)	$1850
1-Ton Chassis (4-cyl.)	1545
1¼-Ton Chassis (4-cyl. (Special)	2725
Light Duty Chassis (6-cyl.)	2450
1½-Ton Chassis (4-cyl.)	2125

HEAVY DUTY

3-Ton Chassis (High Speed)	$4400
3½-Ton Chassis	4650
Heavy Duty Chassis	5100

WHITE
FOUR AND SIX CYLINDER TRUCKS AND BUSSES

FAST EXPRESS

2 -Ton Chassis	$3125
2½-Ton Chassis	3750

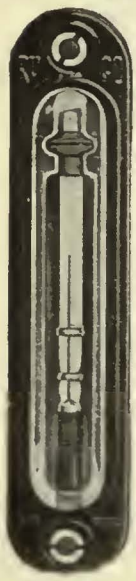
BUSSES

Model 53—4-cyl., 16-pass	$4250
Model 50-B—4-cyl., 25-pass	5350
Model 54—6-cyl., 29-pass	7500
Model 54-A—6-cyl., 39-pass	8000

ALL PRICES LISTED ABOVE ARE FOR CHASSIS ONLY — F. O. B. CLEVELAND

Comfort assured

on Chicago's 100 New Cars with UTILITY HEATERS, VENTILATORS and HEAT REGULATORS



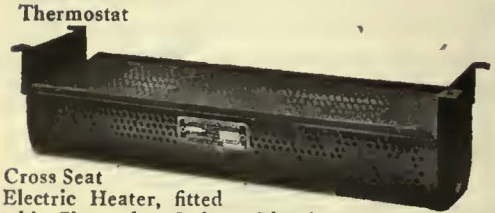
Thermostat

This is Not an Experiment

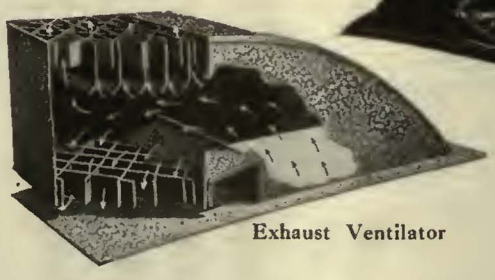
There are more than **100,000** Utility Chromalox Enclosed Heaters in operation on 600 to 1500 volts, giving entire satisfaction. Every Heater Carries the Underwriters' Label.

The **Utility Compensating System of Natural Ventilation** has met the most stringent ordinance requirement ever prescribed by any municipality in the country, and after rigorous service tests was universally adopted by the Chicago Surface Lines in 1916.

The **Heat Regulators** keep the air in the cars at uniform temperature and avoid the spread of contagious disease by preventing overheating the cars.



Cross Seat Electric Heater, fitted with Chromalox Strips. Listed as Standard by Underwriters' Laboratories. Delivers 100 per cent output for electric energy input.



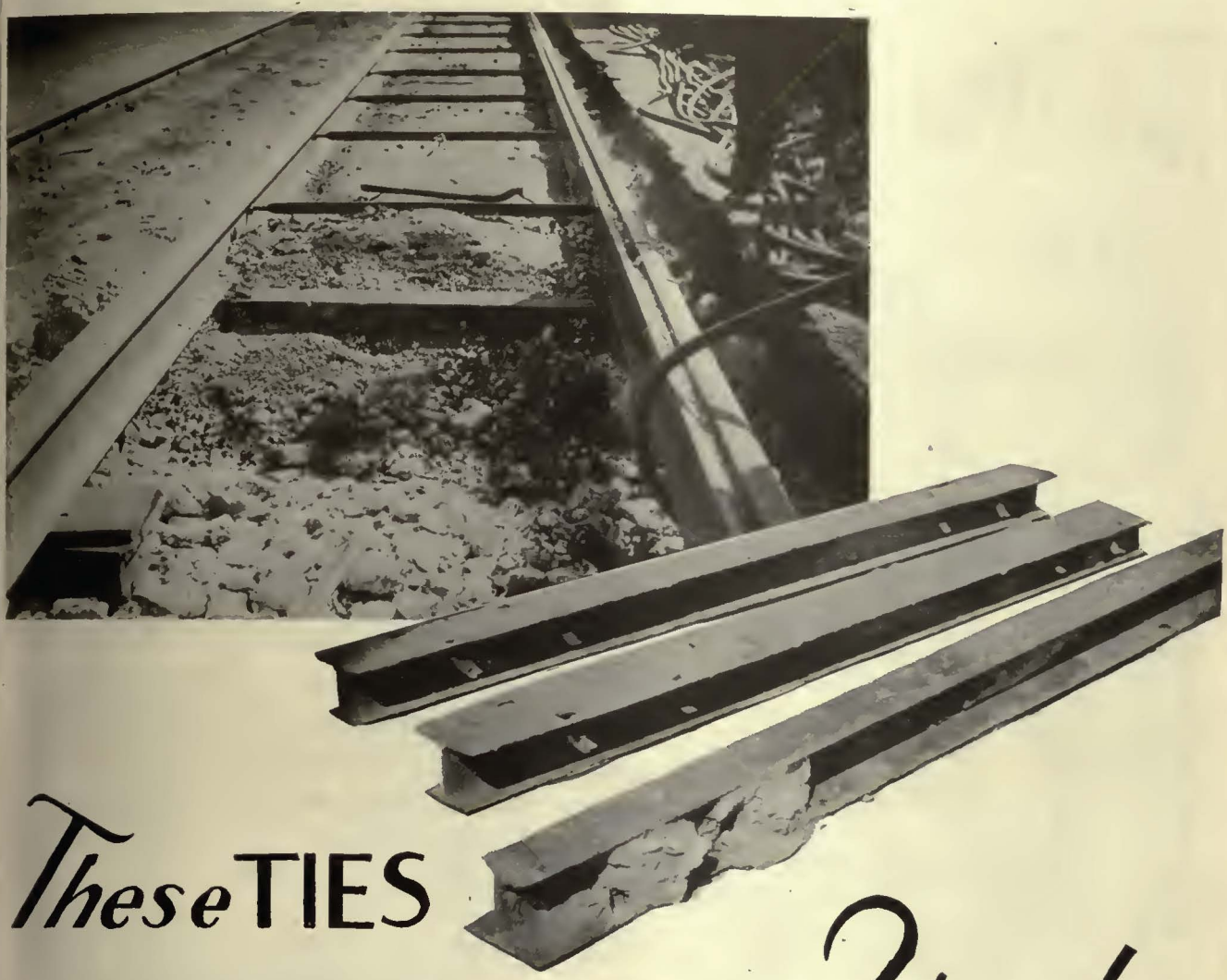
Exhaust Ventilator

Intake Ventilator

Write us. Let us tell you in detail the further advantages of Utility Equipment.

RAILWAY UTILITY COMPANY

2241 TO 2247 INDIANA AVE. CHICAGO, ILLINOIS



These TIES Answer Yes!

Does it pay to use steel ties in track construction? The Carnegie Steel Cross Ties pictured above are old enough to vote and will add their voice to the affirmative. In 1907 they were laid in the tracks of the Chicago Surface Lines. Recently uncovered, it was decided to rerail the ties inasmuch as they were in such splendid condition. Twenty-two years of service and still going strong!

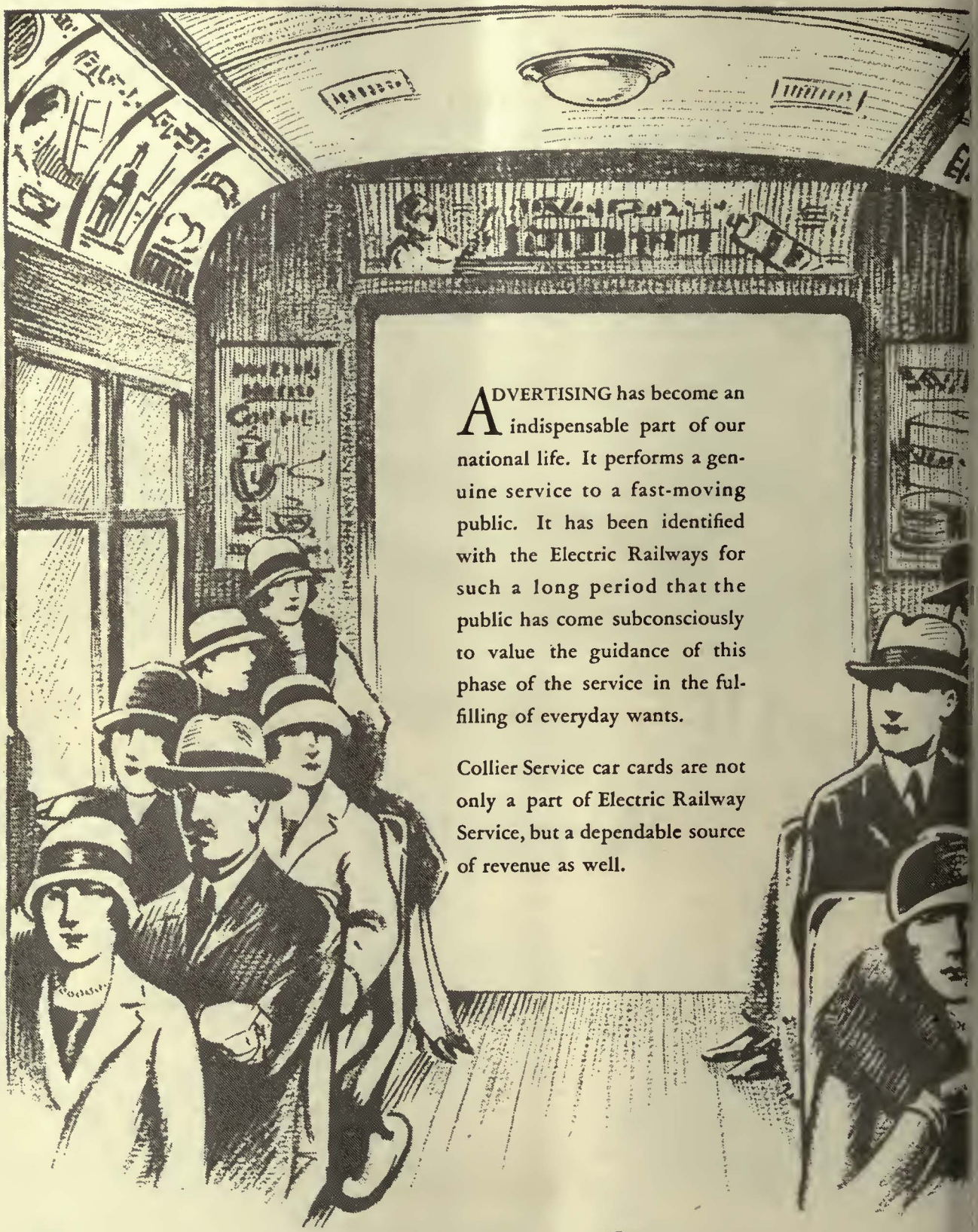
Yes! It pays to use Carnegie Steel Cross Ties. Nor is long service their only dividend. They provide a track that is free from interruptions for track repairs—a smooth track on which your passengers ride swiftly, safely and comfortably. Passenger appeal starts with the track. A poor track not only offsets the advantages of luxurious rolling equipment, but hastens it to a premature discard. In your 1929 track construction program, plan to include Carnegie Steel Cross Ties—an investment that pays dividends.

Booklet on Request.

CARNEGIE STEEL COMPANY

Subsidiary of UNITED STATES STEEL CORPORATION

CARNEGIE BUILDING—PITTSBURGH, PA.



ADVERTISING has become an indispensable part of our national life. It performs a genuine service to a fast-moving public. It has been identified with the Electric Railways for such a long period that the public has come subconsciously to value the guidance of this phase of the service in the fulfilling of everyday wants.

Collier Service car cards are not only a part of Electric Railway Service, but a dependable source of revenue as well.

BARRON G. COLLIER INC

CANDLER BLDG. — NEW YORK CITY

Car Card Advertising Almost Everywhere

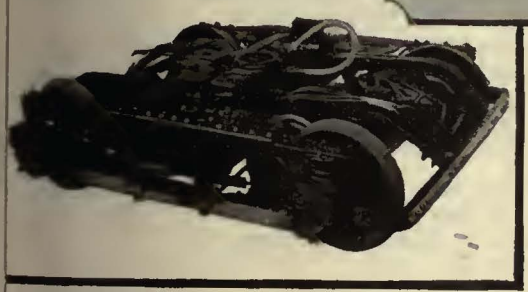
The Osgood Bradley 1929 Model

Hyatt Equipped

ON all modern street cars, anti-friction journal bearings are standard equipment, and Hyatt Roller Bearings a favorite among the equipment builders.

That is why the Osgood Bradley Car Company placed Hyatt Roller Bearing Journal Boxes under their 1929 model, which is the "last word" in up-to-date car construction.

The car illustrated is the one you undoubtedly saw at the last A.E.R.A. Convention. Duplicates of this car are already in operation at different points, and are giving a splendid account of themselves. Below, their truck, showing the application of Hyatt Journal Boxes.



The railways of America are fast realizing that modern equipment is the way to combat competition, build public good will, and sell more rides.

With Hyatt Roller Bearing Journal Boxes more comfortable riding is made possible. However, this is but one of their many advantages, for in addition they effect worthwhile operating economies—savings in power, maintenance, and shoppings.

Whichever way you figure it, Hyatt Roller Bearings soon pay for themselves, and then go on many years earning profits on the investment.

The Osgood Bradley Car Company, in equipping their new cars with Hyatt Roller Bearings, when so specified, are offering you modern cars with modern bearings. Investigate.

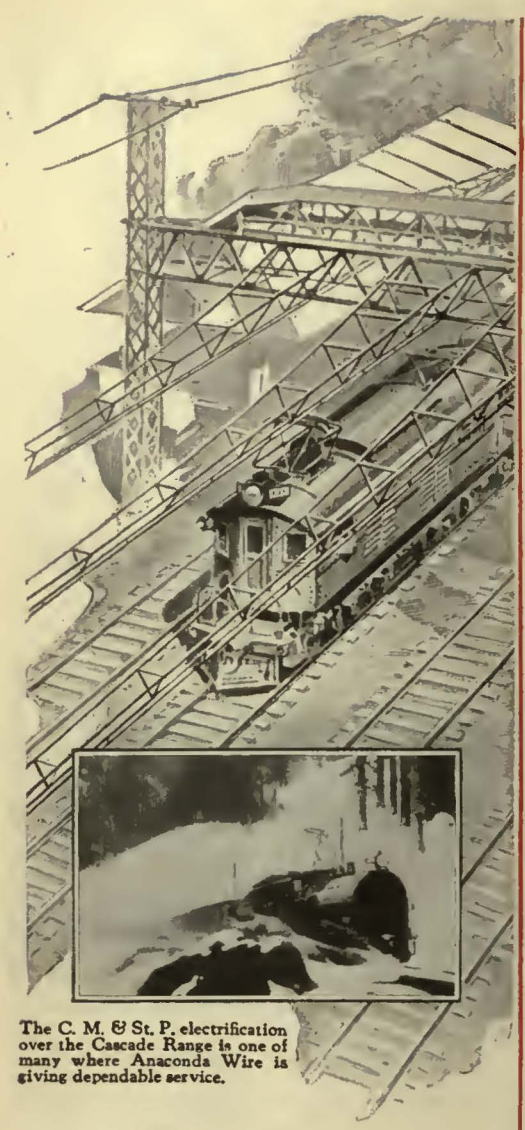
HYATT ROLLER BEARING COMPANY

Newark Detroit Chicago Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS



The C. M. & St. P. electrification over the Cascade Range is one of many where Anaconda Wire is giving dependable service.

ANACONDA
from mine to consumer

Six wire mills offer a coast-to-coast service unequalled in promptness and dependability.

A Technical Department is maintained to assist electrical engineers in the adaptation of copper and copper alloys to specific requirements. You are invited to make use of this service.

ANACONDA TROLLEY WIRE

for every Transportation Requirement

Anaconda Trolley Wires are made in round, grooved and figure-8 sections and in the following grades:

HITENSO "C" (*Copper-Cadmium alloy*)
An exclusively Anaconda product combining high tensile strength and the utmost wearing quality with the least sacrifice in conductivity. Meets the physical requirements of the A. S. T. M. specifications for *High* Strength Bronze and exceeds the required conductivity by 15%.

HITENSO "A" (*Copper-Cadmium alloy*)
This Anaconda product embodies the same general characteristics as Hitenso "C". It meets the strength requirements of A.S.T.M. specifications for *Medium* Strength Bronze but exceeds the required conductivity by 15%.

Hitenso Trolley Wires are recommended not only because their conductivity is higher than that of Tin-Bronzes of equivalent strength, but also because they do not become brittle when overheated by short-circuits—a recognized characteristic of Tin Bronze alloys.

HARD DRAWN COPPER
Is recommended for normal service conditions where traffic is not heavy. This product is made from Anaconda Electrolytic Copper guaranteed 99.9% pure.

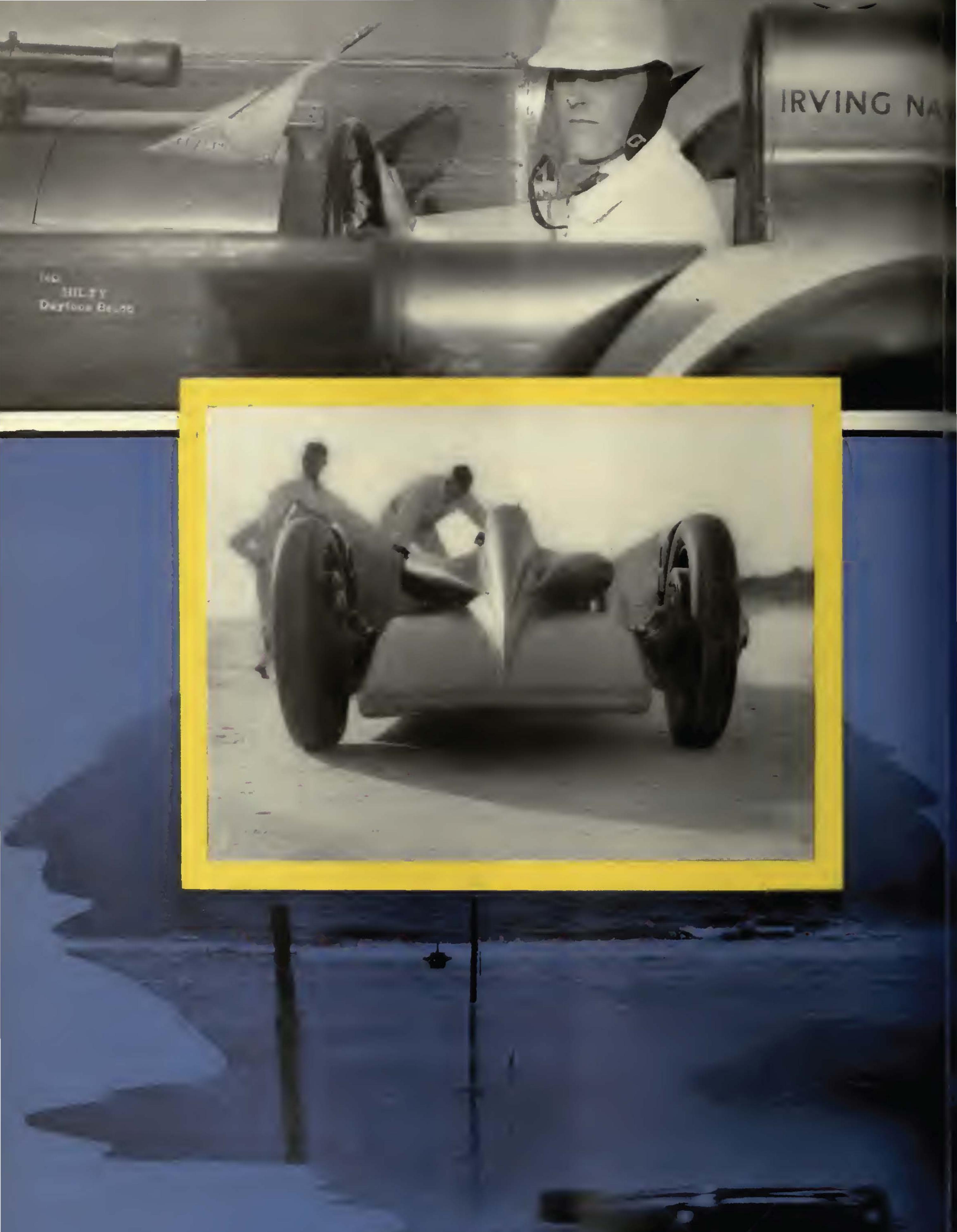
MEDIUM and HIGH STRENGTH BRONZES
Anaconda Tin-Bronze Trolley Wires can be manufactured to meet the A.S.T.M. Specifications B-9-25T, also the specifications recommended by the A.E.R.A.

For detailed information on Anaconda Trolley Wires, write for Publication B-11.

ANACONDA COPPER MINING CO.
THE AMERICAN BRASS COMPANY
Rod, Wire and Cable Products
General Offices: 25 Broadway, New York
Chicago Office: 111 West Washington Street

ANACONDA WIRE PRODUCTS

The Champion



M[illegible] D. S[illegible], of England, drove 23[illegible] beach at Day[illegible] 1929, using a 12-cyl[illegible] special car [illegible] world [illegible] for [illegible]

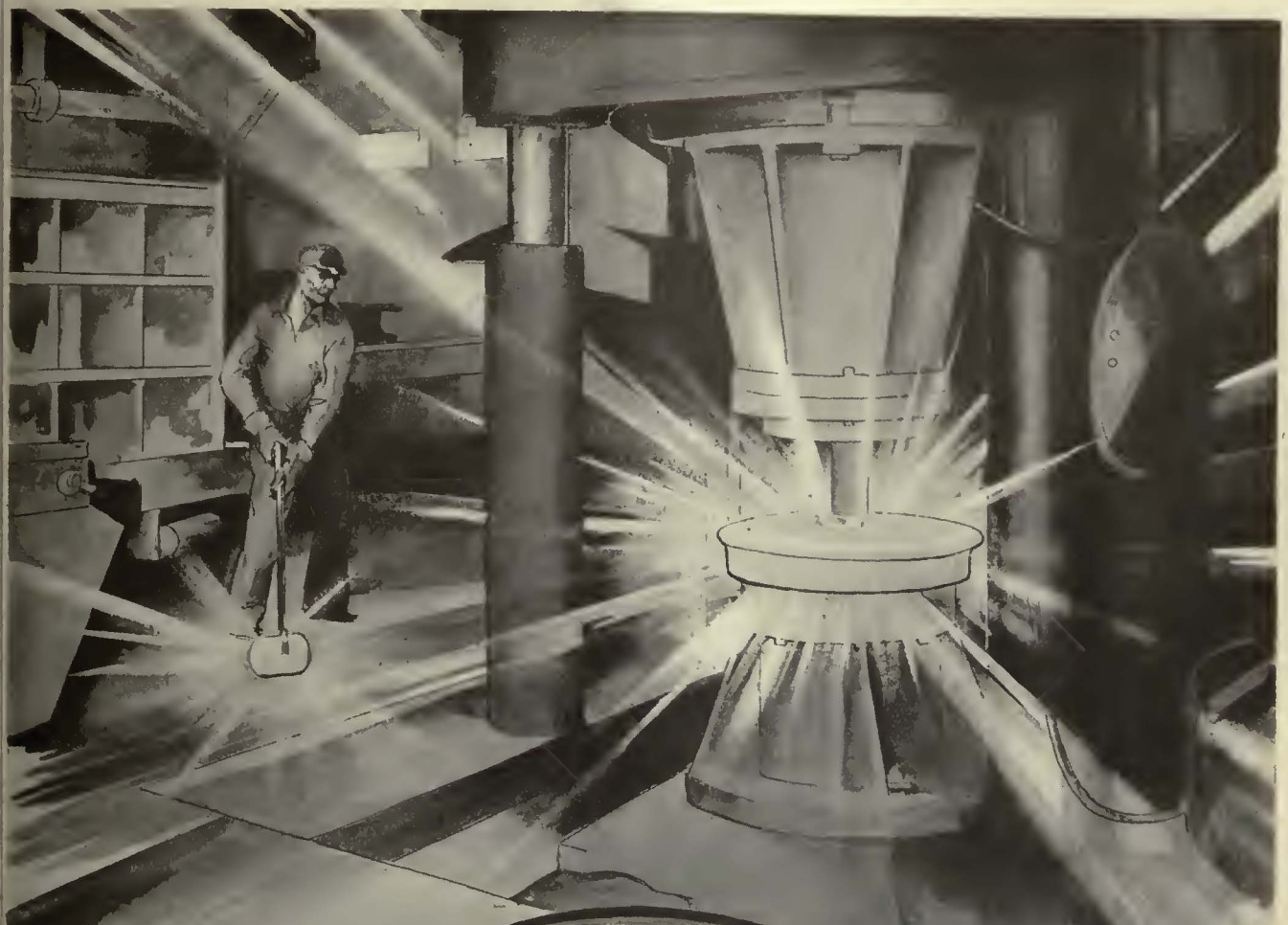
The fastest human sought comfort!

"In my opinion the principles of the Twin Coach by which the total road area is utilized for carrying passengers is an advance in coach construction over common practices. The road ability and public utility faculties are excellent in this vehicle. I was surprised at its speed."

Major H. O. D. Segrave

Miami Beach, Florida
March 20, 1929

During his leisure hours in Florida, Major Segrave used a Twin Coach Parlor Car for the recreation purposes of himself and English party, repeatedly expressing his frank admiration of the capacity of the latest Twin Coach motors with their multiple cylinders and dual drive arrangement.



Every Stage
A Step to Multiplied Mileage

The principal object of the operation pictured above is to remove from the center of the hub of a Gary Wheel Blank a cylinder of steel concentric with the vertical axis of the ingot from which it was made. The object is accomplished by placing the blank in a centering die and pressing through it a punching die. . . . . This is just one of many stages in the journey that leads from wheel blank to shipping dock. . . Each is carefully designed according to most modern practice. . . Each makes use of long experience and equipment kept at maximum efficiency by constant inspection and maintenance. . . Each contributes its part to multiplied mileage.

Our wheel engineers are at your service.

Illinois Steel Company
Subsidiary of United States Steel Corporation
General Offices:
208 South La Salle Street, Chicago

GARY
WROUGHT STEEL WHEELS

VIZABLEDG
PATENTED
SAFKAR
TRADE MARK REG.
SAFSTEP

Two dominating considerations point the way to your adoption of these all-steel safety steps:

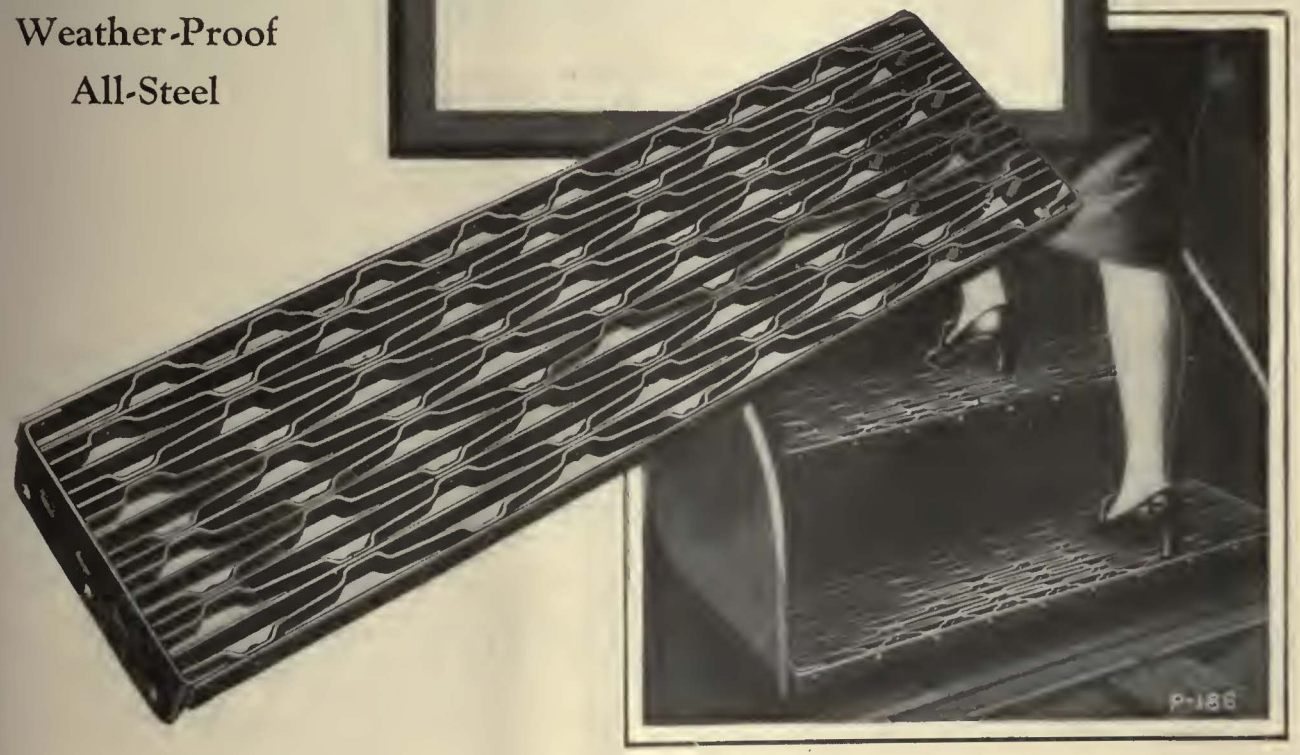
Passenger Safety against the all-too-frequent "step accidents" which may result in costly damage claims.

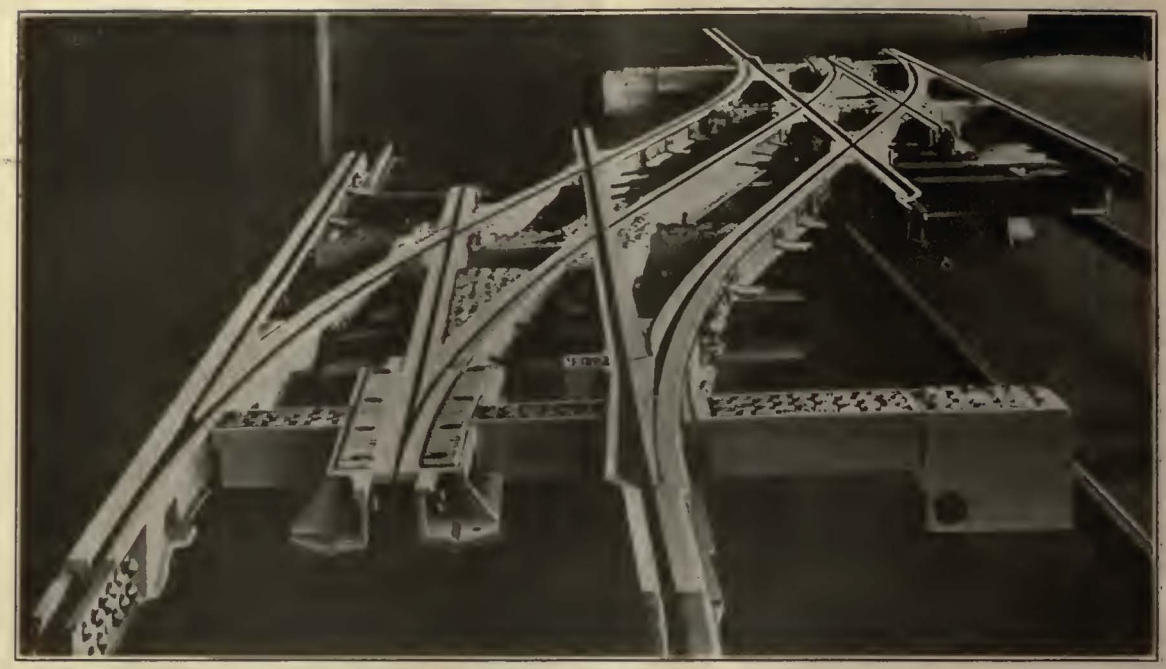
Operating Economy resulting from the elimination of all car step maintenance and a lower cost of car cleaning.

Let us send Bulletin 2D28.

IRVING IRON WORKS CO.
LONG ISLAND CITY, N.Y. U.S.A.
Established in 1902
SALES OFFICES IN ALL PRINCIPAL CITIES
See Your Telephone Book for Local Address

Slip-Proof
Miss-Proof
Self-Cleaning
Time-Proof
Weather-Proof
All-Steel





Your cars are on the right track if the TRACKWORK *is* TISCO

PRESENT-DAY trackwork is called on to bear an ever-increasing burden—and it *must* stand up for on it depends the flow of traffic and the safety of passengers. *One* failure means an expensive tie-up and time, money and public confidence lost.

This company has concentrated on the problem of trackwork for frogs, switches, crossovers and crossings and offers you TISCO trackwork which will stand up under all present-day traffic conditions.

TISCO
MANGANESE STEEL
—The Original in the Trackwork Field—gives super-enduring qualities to frogs, switches, crossovers and other special trackwork.

We can furnish also, trackwork of Chrome Nickel Construction, if desired.

WM. WHARTON JR. & CO., *Inc.*
EASTON, PA.

TISCO TRACKWORK *for Frogs, Switches, Crossovers, Crossings*


Low
Costs——
Good Looks
More
Frequent Service

Your Investment
is Certain wit

DODGE BROTHERS

CHRYSLER MOTORS PRODUCT

DODGE
MOTO

SOLD BY DODGE BROTH

afe, Your Return
odge Motor Coaches

They pay out for Operators everywhere in mile after mile of fast, safe, dependable service.

There is no guess, no experiment about Dodge Brothers Motor Coaches . . . . . For years they have been paying to increasing thousands of owners a high return on a small investment—in passengers carried, in schedules maintained, in dollars saved and in dollars earned.

Correct in each fine detail of design and workmanship, built for passenger transportation and honestly priced, Dodge Brothers Motor Coaches are dependable always . . . . . powerful, fast, economical, comfortable, safe, good-looking.

The 21-passenger street car type coach is favored by hundreds of operators who realize the importance of great frequency of service with low operating cost.

Owners say of the Dodge—"Everything a motor coach should be or have." Have a transportation talk with your Dodge Brothers Dealer—or write direct to Detroit.

B R O T H E R S
C O A C H E S

EALERS EVERYWHERE

Photograph at left shows the large saving in excavation when track is laid with Bethlehem No. 3 Steel Ties.

Photograph below shows laying and finishing concrete 12 in. deep on double-track construction job, in which Bethlehem No. 3 Steel Ties were used.

These Steel Ties

Reduce Construction Costs

Bethlehem No. 3 Steel Ties offer many advantages in electric railway track construction. These ties cost less than wood ties, speed up construction, and stand up under heavy vehicular and rail traffic. Substantial savings in installation costs are to be had, because of the low first cost of Bethlehem No. 3 Ties and the simplicity of track laying when they are used.

Bethlehem No. 3 Steel Tie, showing the two movable clips and stationary clip which form a strong, rigid rail fastening.

Considerably less excavation is necessary with Bethlehem No. 3 Steel Ties, and there is a corresponding reduction in the amount of concrete used, and in the labor required. Estimates of the cost of construction compared with conventional practice indicate savings of more than 30 per cent when track is laid with these ties. In addition, due to the shallow, compact section, the Bethlehem No. 3 Steel Tie reduces the cost of handling, distributing, and fastening to the rails.

The Bethlehem No. 3 Steel Tie is made in one piece; the tie is complete in itself, and is made to fit any gage of track. There are no extra parts to become lost or mislaid. It is shipped with locking clips open, and because there are no other parts needed, the tie is ready for immediate installation—all that is required is to drive the locking clips into position with a hammer. Bethlehem No. 3 Ties are rugged in construction and give years of service under severe traffic conditions.

Write for illustrated bulletin explaining more in detail the advantages and economies of Bethlehem No. 3 Steel Ties in electric railway track construction.

BETHLEHEM STEEL COMPANY, General Offices: Bethlehem, Pa.

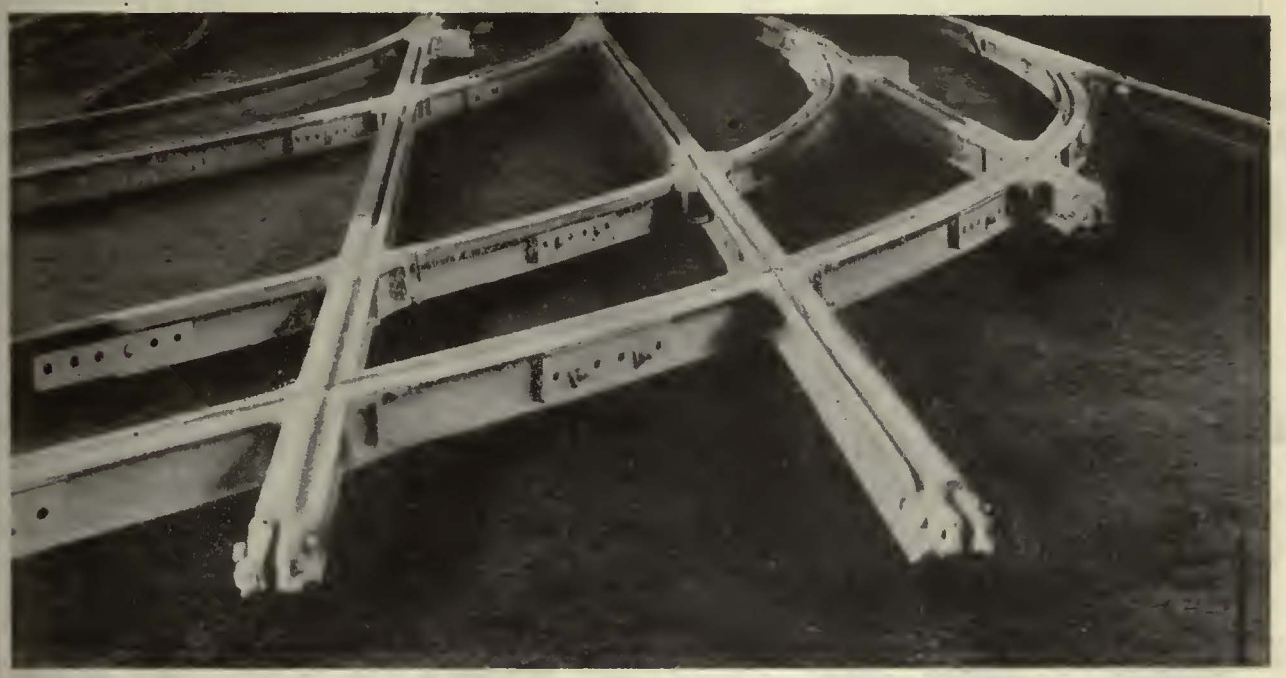
District Offices:

New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

Bethlehem Steel Export Corporation, New York, Sole Exporter of our Commercial Products

BETHLEHEM

Wear-Resisting! Weldable!



Bethlehem Welded Turnout and Crossover, made of silico-manganese steel.

Silico-Manganese Special Trackwork

The shock- and wear-resisting properties of silico-manganese steel are well established. This material has already been accepted as standard for highest grade automobile springs and other parts subject to shock and wear, as well as for high grade tools such as punches, chisels, shear blades, etc.

In the manufacture of special trackwork, Bethlehem uses silico-manganese steel of tool steel quality, that is hard enough to resist wear, yet sufficiently tough to withstand violent shocks and pounding. In addition the silico-manganese steel castings can be readily welded, and built up in the field.

Bethlehem Welded Special Trackwork—called Design No. 999—combines solid, one-piece construction with virtually all the desirable features of the best previously-used forms. In addition it has the decided advantage of being easily repaired by welding. This new welded special work is recommended for your 1929 requirements.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

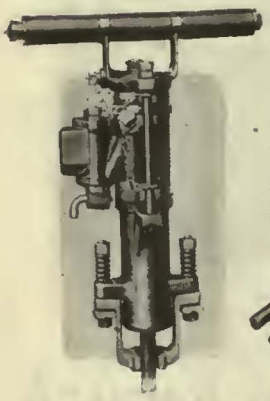
DISTRICT OFFICES: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland, and Honolulu.

Bethlehem Steel Export Corporation, 25 Broadway, New York City. Sole Exporter of our Commercial Products.

BETHLEHEM

Increase 1929 Earnings, with Sullivan Air Power

Sullivan Portable Compressor and Sullivan Busters removing concrete for the Mobile Light and Railroad Company, Mobile, Alabama.



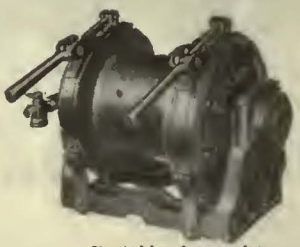
39-lb. Rock Drill (Catalog 3281-S)

Make Track Maintenance *Quicker and Cheaper*

SULLIVAN PORTABLE AIR COMPRESSORS will speed up construction and repair work on the track. They are trouble-free because they are built to run without vibration.

The electric motor-driven 103 and 206-ft. compressors were designed especially for electric railway service, can be connected anywhere, and are good for 100 lbs. pressure. Mountings are steel wheels, rubber-tired trailer trucks, or skids ready for mounting on motor truck. Gasoline models are also available.

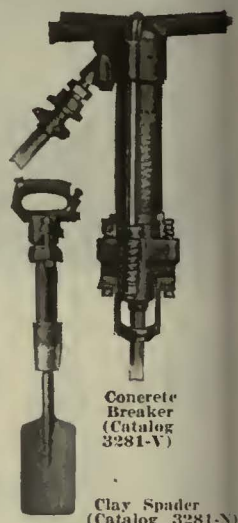
The 103-ft. compressor will run a concrete breaker, two tampers, four riveters, four clay diggers, or a rock drill. *Catalog 3283-F.*



Portable Air Hoist (Catalog 3276-F1)

SULLIVAN CONCRETE BREAKERS, ROCK DRILLS, AND CLAY SPADERS are convenient air tools for removing concrete, rock, and hard clay. Numerous models can be furnished for a variety of work. *Send for Catalogs.*

SULLIVAN PORTABLE HOISTS will save you time and money in pole setting, rail handling and on many other jobs around your barns, shops, or garages. The 345-lb. single-drum Turbinair Hoist will lift a ton on single line, or pull a 50-ton car. Electric hoists also available in single and two-drum models to 35 H.P. *Send for Catalogs.*

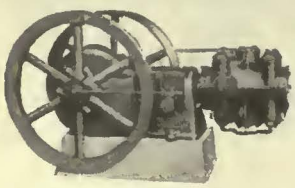


Concrete Breaker (Catalog 3281-V)

Clay Spader (Catalog 3281-N)

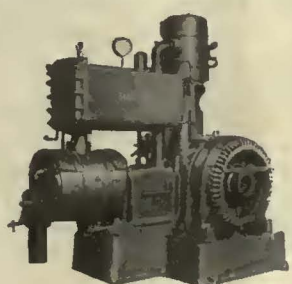
Simplify Brake Testing, Cleaning, Painting, and many other tasks in shop and garage

SULLIVAN BALANCED ANGLE COMPRESSORS are free from vibration—and supply low-cost air to simplify many tasks in the shop and garage. They can be had in capacities from 313 to 5,100 cu.ft. Any Balanced Angle Compressor can be driven by belt, or by direct connection to electric motor, or oil engine. Additional features of these machines are multi-step control, Wafer valves, and positive, automatic lubrication. *Catalog 3283-J.*



WG-6 Compressor

SINGLE STAGE BELT DRIVEN COMPRESSORS, class "WG-6", offer dependable air power for smaller requirements. Capacities are 68 to 500 cu.ft. "WG-6" is splash-oiled, and has "sweep control" unloading, "Wafer" valves, and two-part die-cast removable main bearings. *Catalog 3283-I.*



Direct Connected Balanced Angle Air Compressor

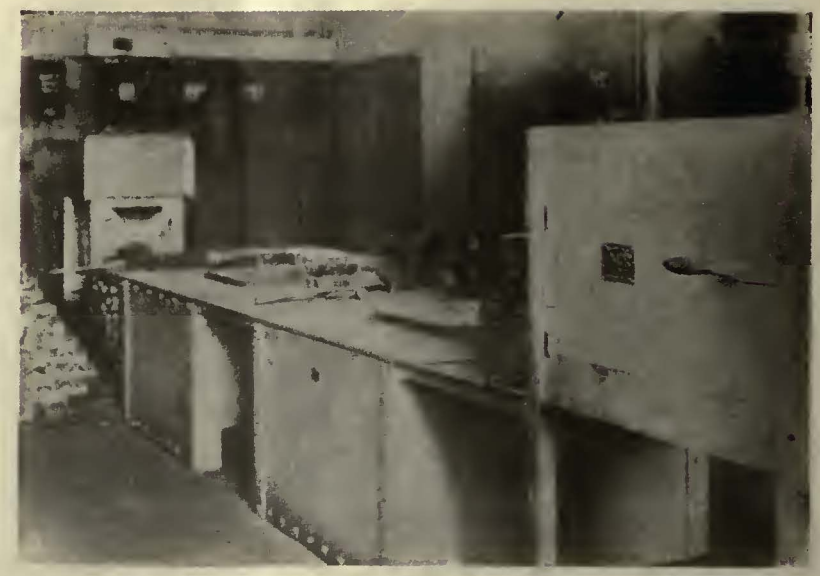
SINGLE STAGE DIRECT CONNECTED COMPRESSORS, Class "WL-22", and Class "WL-44" are especially adapted to small shops, isolated departments, or standby or night service. They embody advantages of small floor space, easy portability, direct motor drive, or automatic, hand, and combination control. Capacities 100 to 350 cu.ft. *Catalog 3283-H.*

WLDX-44 Compressor

SULLIVAN

TRADE MARK

SULLIVAN MACHINERY COMPANY, 150 South Michigan Ave., Chicago



Electrically controlled and operated Oakite cleaning vat, babbitt pot and preheating furnace in babbitt room of an electric railway car shop.

Cleans used bearings before rebabbitting

IN the shops of a Pacific Coast traction company, axle and armature bearings are cleaned the Oakite way before rebabbitting. Shopmen find that the adoption of Oakite cleaning materials and methods speeds up work all along the line; enables them to pour approximately 2500 lbs. of babbitt per day.

Worn bearings are boiled in a vat containing a solution of an Oakite material. When taken out they are free of all grease and dirt; ready for the removal of the old babbitt. And, because the bearings are absolutely clean, without a trace of film they can be prepared for rebabbitting in a fraction of the usual time.

Oakite cleaning materials and methods effect similar savings in time and effort wherever they are used. Write for booklets describing their use in car, bus, repair and paint shops. No obligation.

Oakite Service Men, cleaning specialists, are located in leading industrial centers of U. S. and Canada.

Manufactured only by

OAKITE PRODUCTS, INC., 28B Thames St., NEW YORK, N. Y.

OAKITE

TRADE MARK REG U.S PAT. OFF.

Industrial Cleaning Materials and Methods

"Consolidated Equipment will advertise your service"

Only with up-to-date rolling stock, can the electric railway hope to hold a "White-Light" public. The best advertisement of transportation is a truly modern car —*fast, safe* and *comfortable*.

CONSOLIDATED ELECTRIC CAR HEATING, with THERMOSTAT CONTROL *for comfort*.

CONSOLIDATED BELLS AND BUZZERS *for speed* and passenger *convenience*.

CONSOLIDATED PNEUMATIC DOOR OPERATORS and EXIT TREADLE *for speed* and *safety*.

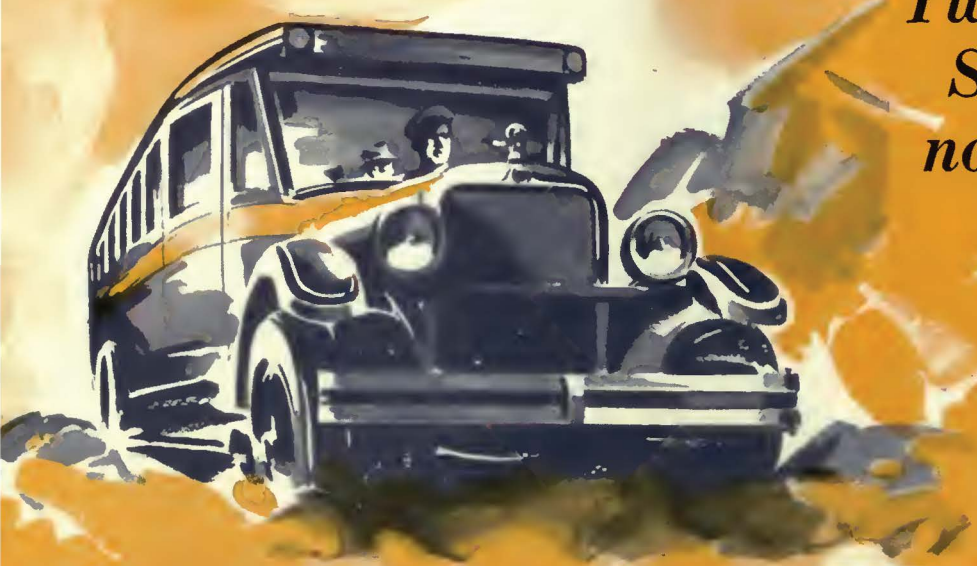
These are essential devices for any modern car.

CONSOLIDATED CAR-HEATING COMPANY, INC.

NEW YORK ALBANY CHICAGO

Oklahoma Transportation Co. Buys 20th Studebaker

Two New 8-Cylinder STUDEBAKERS now cover difficult route



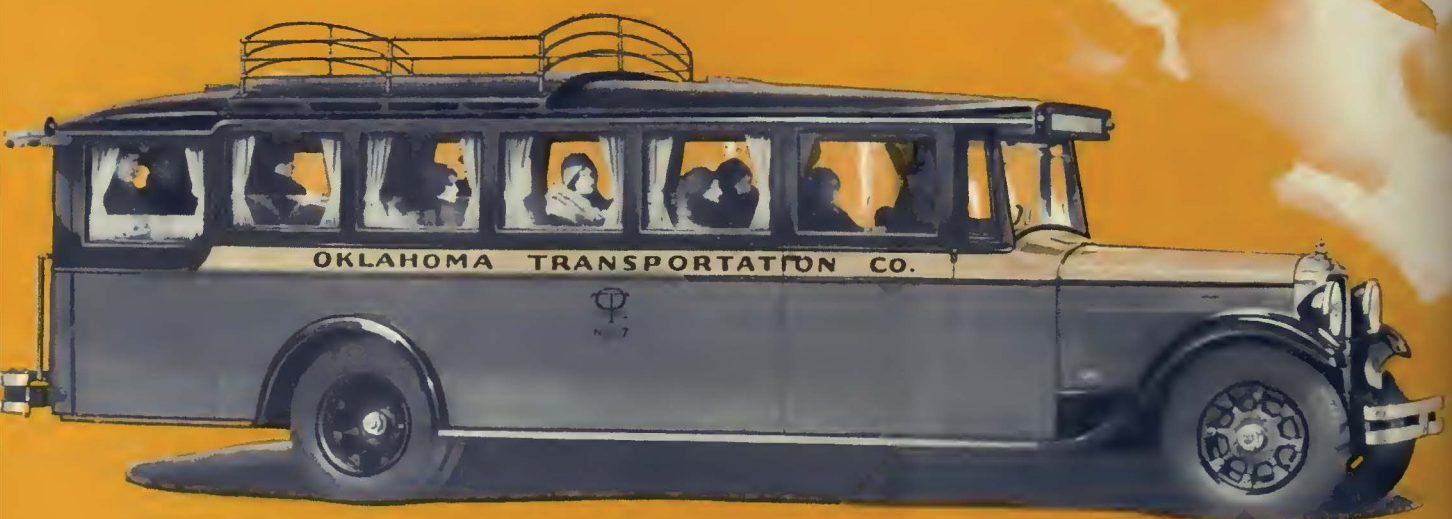
CONFIDENCE based on years of experience with Studebaker busses caused R. G. Hickox, General Manager of the Oklahoma Transportation Company to purchase the first two Studebaker Straight Eight Busses delivered in Oklahoma.

"They are splendid units," said Mr. Hickox, "and come up to our expectations in every way. They were put on our most difficult route because of the excess power of the new 8-cylinder motors. Ease of handling enables our drivers to maintain their schedules regardless of the mud. And when it rains down here we have gumbo.

FIRST BUS STILL SERVES

"Studebaker busses have played a vital part in the development of this company. When we decided to go into the bus business in 1924, we bought a Studebaker. This original bus has now gone more than 300,000 miles and is still covering 200 miles a day.

"Every phase of our operation is comparable to Pullman service. Our four termin-



With the purchase of two new Studebaker Straight Eight busses the Oklahoma Transportation Company now has a fleet of 20 Studebaker units. Evidence of this Company's complete satisfaction is seen in its repeat orders.

STUDEBAKERS are

Americas First Straight Eight Bus

STUDEBAKER meets tomorrow's demands in what it does today. The demand for greater power, higher speeds and smoother operation made the production of straight eight motors for large units inevitable.

Studebaker anticipated this condition and for two years has been perfecting a straight eight motor which provides every essential for better bus operation.

The exhaustive driving tests at the Studebaker Proving Ground proved the stamina, power and economy of this new straight eight bus motor. The result is a proven motor of 115 horsepower which gives smooth effortless speed, economical operation, plus the stamina to carry heavy loads with ease and absolute dependability.

Not only have Studebaker engineers turned a new page in bus transportation history by developing this new straight eight motor, but they have gone still further by strengthening the chassis and providing larger and huskier units throughout. The entire chassis has been designed to give still greater power and stamina - - - qualities for which Studebaker busses are famous the world over.

als are well kept depots; our way stations provide every essential for passenger comfort.

"This company is managed by experienced transportation and railway executives. My own experience dates back to '89 when I drove a four horse stage between El Reno and Oklahoma City. Our general passenger agent, C. O. Jackson, was 30 years with the Frisco Railroad where he served as general freight and passenger agent. R. K. Adams, our general superintendent is from the Santa Fe.

"Fortified with such experience, this company has grown until our routes now cover 411 miles. We have a daily mileage on our 20 Studebakers of 3500 miles, handling an average of 700 passengers.

STUDEBAKERS MOST ECONOMICAL

"We are buying Studebaker busses when new equipment is needed because our records prove them to be most economical to operate and to maintain. Studebakers cost less to buy and stand up well for thousands of miles, therefore the depreciation is low. With reasonable traffic, Studebaker equipment, common sense and proper finance any bus operator can make a success."

first cost
operating cost
maintenance
depreciation
Lower

Prices

Studebaker Straight Eight Bus

Model 77

158-inch Straight Eight Junior Chassis

Chassis only, single or dual rear wheels..... $2585

Model 88

184-inch Straight Eight Special Chassis

Chassis only, single or dual rear wheels..... $2985

22-Pass. Seminole Parlor Car $6595

Model 99

184-inch Straight 8 Heavy Duty Chassis

Chassis only, single rear wheels.... $3385

Chassis only, dual rear wheels..... $3485

21-Passenger Street Car Bus..... $6095

All prices F. O. B. Factory. Purchase can be arranged on Studebaker's liberal budget payment plan.

THE STUDEBAKER CORPORATION OF AMERICA,
Dept. B South Bend, Ind.

Please send complete information on Studebaker Straight Eight Busses, without obligation.

We have_____busses at present. Check below the Studebaker Bus about which you desire information. Seminole_____ Street Car_____

Name_____

Address_____

City_____

State_____

11-4-29

Profit Makers

"Our 100% one man operation

would not have been possible without

JOHNSON ELECTRIC FARE BOXES"

—a statement by a prominent
Street Car and Bus operator

THE COIN AUTOMATICALLY AND VISIBLY RECORDS THE FARE ON BOTH THE FARE BOX AND REGISTER

Over 6000 in use

Johnson Electric Fare Boxes are now available for varied classifications of fare collections including—

Dimes only.
Nickels and Dimes.
Dimes, Tokens and half-fare Tokens.
Nickels, Dimes and Quarters.
Zone Fares.

With all fares registered, both on the fare box and overhead register, substitution of fare values is prevented. The box brings the Treasurer's office direct to the passenger on the car or bus platform.

It protects alike the operator, the company, and the public.

Plus these four exclusive advantages

1. *Speed:* Electrical operation gives instantaneous registration and speeds up loading without loss of fares.
   Two leading operators cut schedules 7% and 5% respectively.
2. *Safety:* Operator gives individual attention to loading and operating street car or bus, thereby greatly *reducing accident hazards.*
3. *Revenue:* Positive and instantaneous operation eliminates human element in accounting. The coin does all the work.
   Revenues increased 3% to 10%.
4. *Checking:* Instantaneous, visible registration of fares and audible signal makes checking positive.
   Loading can be accurately checked from sidewalk.

Prominent Users

Public Service Co-Ordinated Transport, Newark
Albany
Brooklyn
Twin City
Milwaukee
Worcester
Holland Tunnel
County Transportation
Chicago Motor Coach Co.

JOHNSON FARE BOX COMPANY

CHICAGO, ILL.
4619 Ravenswood Ave.

NEW YORK, N. Y.
2 West 61st St.

Over 50,000 Type D Johnson Fare Boxes have been placed in service in the past 16 years.

Already over 6,000 Type J Electric Fare Boxes have been placed in service in the last 4 years

Upper left, Wheeling, W. Va. *Upper right,* Vancouver, B. C. *Lower left,* Zanesville, Ohio. *Lower right,* Cleveland, Ohio.

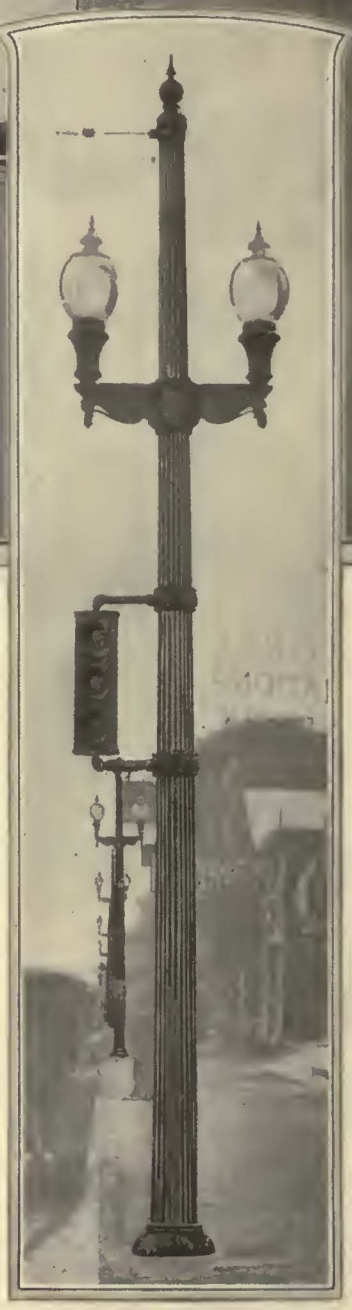
Cities Everywhere Stage Curbline Cleanup

NEVER before has the City Beautiful plan met with such success as it has during the past few years. Cities everywhere are making their streets safer and more beautiful.

Important in this work is "cleaning up the curbline." Dozens of Utilities, cooperating with municipal officials, have installed Union Metal Fluted Steel Poles and combined all street electrical equipment on this one set of poles.

The net result is economical service and more beautiful streets. This method has been followed in such cities as Detroit, Cleveland, Vancouver, B. C., Wheeling, W. Va., Pontiac, Mich., Youngstown, Ohio, and is contemplated by many more. In every case invaluable good will has accrued to the benefit of the companies responsible for the improvement.

Union Metal Poles are used for transmission and distribution, for telegraph and telephone wires, and for supporting lighting units, trolley span wires and traffic signal lights. They represent the most modern equipment yet developed for this service.



Union Metal Fluted Steel Pole equipped with lighting units, traffic signal and trolley span wire support as used in Pontiac, Mich.

THE UNION METAL MANUFACTURING CO.

General Offices and Factory, Canton, Ohio

Sales Offices—New York, Chicago, Philadelphia, Cleveland, Boston, Los Angeles, San Francisco, Seattle, Dallas, Atlanta.

Distributors:

G-E Merchandise Distributors Association Graybar Electric Company, Incorporated

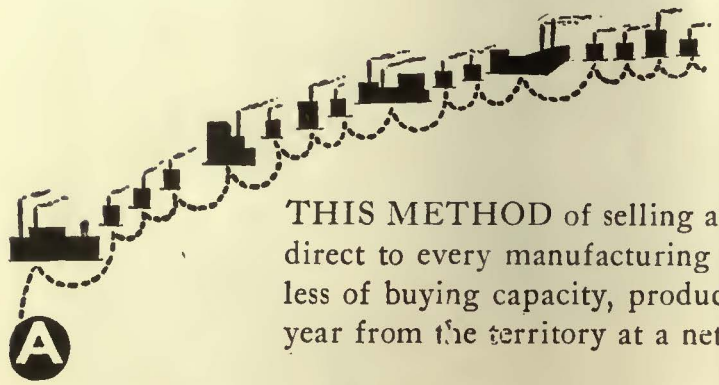
Offices in all principal cities

UNION METAL

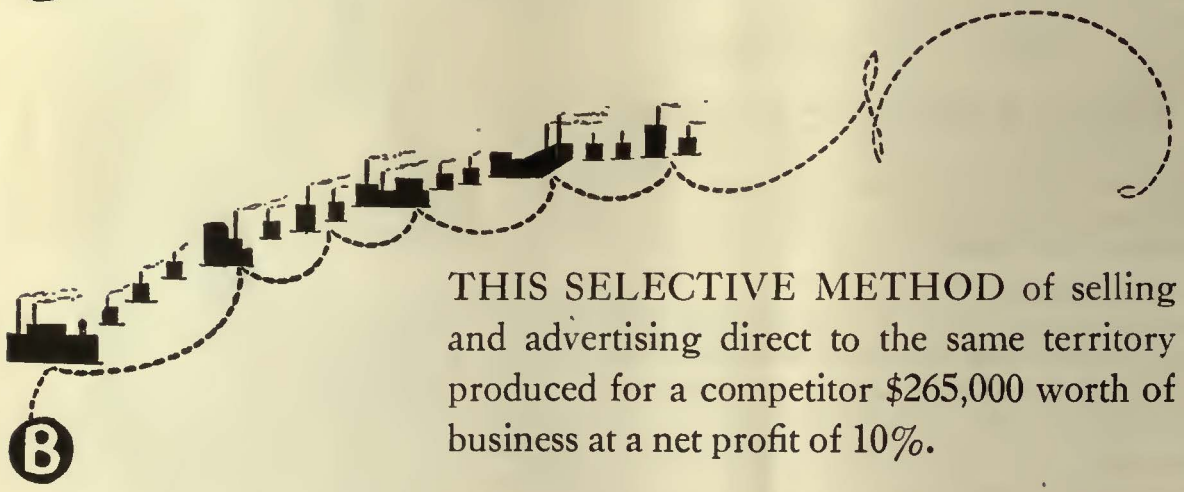
DISTRIBUTION AND TRANSMISSION POLES

This is one of a series of McGraw-Hill advertisements directed originally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility.

VOLUME *vs.* PROFITS



THIS METHOD of selling and advertising direct to every manufacturing plant, regardless of buying capacity, produced $250,000 a year from the territory at a net profit of 2%.



THIS SELECTIVE METHOD of selling and advertising direct to the same territory produced for a competitor $265,000 worth of business at a net profit of 10%.

Practical Industrial Advertising Coverage, like practical sales coverage, is a problem of selecting the plants with buying capacity and directing sales and advertising effort thereon.

You are invited to make at any time a personal inspection of McGraw-Hill circulation methods which produce the Practical Industrial Advertising Coverage illustrated in "B."

—The publishers

WHY POLES BREAK

conomy prompts
he same care in selecting
ole types, sizes, spacing,
nd other line details
s is used in design-
ng any important
lectrical equipment.

Turn the page for a rather complete discussion of pole strength and its relation to pole line design.

"Rule of Thumb" methods have no place in the modern successful utility. The design of pole lines is one of the last strongholds of the old system.

Why Poles Break

A pole is a cantilever beam. While it is subject to a variety of stresses failure is almost invariably caused by bending moments. A pole breaks, therefore, when the stress in the outer fibres resulting from the bending moments exceeds the natural resisting strength of the wood.

Where Poles Break

While a mathematical solution shows the critical section in a pole to be at the point where the diameter is one and one-half times the diameter at the point of load application, for practical designing purposes this point coincides with the ground line.

Calculating Load

The maximum load tending to break a pole is that produced by a transverse wind when pole and wires are covered by sleet. The bending moment at the ground line is the sum of two quantities—(1) the moment calculated as the wind pressure times the projected area of the pole, times the distance of the center of gravity of the exposed section of the pole above the ground and—(2) the wind pressure times the projected area of the wires (with sleet, if any) in the adjacent span times the distance of the wires above the ground.

The Resistance to Breaking

The moment of resistance of a pole opposes the bending moments calculated as shown above. This moment of resistance is calculated as the ultimate fibre stress in pounds per square inch, times the cube of the ground line diameter in inches divided by 122. Whether a pole breaks, therefore, depends on whether the moment of resistance is greater or less than the moment of bending.

The bending moment is multiplied by the factor of safety required on the line. From the resulting moment of resistance is computed the ground line diameter by reversing the process referred to above, using in this calculation the fibre stress of the species wood selected. Ordinarily the strongest wood is the most economical.

Ultimate Fibre Stress Critical Factor

It is obvious, therefore, that one of the critical factors in designing an economical pole line is the selection of the pole with the highest ultimate stress. The remainder of the design, of course, requires good judgment and careful calculations but it is all subject to ordinary engineering design procedure.

How Do We Know the Ultimate Fibre Stress?

The ultimate fibre stress of a given pole can only be determined by elaborate testing methods far beyond the possibilities of the ordinary buyer. Since wood is a product of Nature and not subject to scientific control, its physical properties are not absolutely uniform. The test of a single pole would not be conclusive, therefore. The only practicable way to determine ultimate fibre stress in species of wood available for poles is to rely on records of extensive tests undertaken by government and other disinterested agencies.

Southern Pine Association tests show a modulus of rupture of that wood of 7500 to 8800 lbs. per square inch green and 13,900 to 18,300 lbs. per square inch air dry. The same wood is shown by Forest Products Laboratory tests to have a modulus of rupture 7600 to 8700 lbs. per square inch green, and 13,000 to 15,500 lbs. per square inch air dry. These figures are all based on averages of many tests. There is no other wood commercially available for pole use with a strength approaching these figures. For purposes of comparison, the fact may be mentioned that the Forest Products Laboratory figures for western red cedar are 5200 lbs. per square inch green, and 7700 lbs. per square inch air dry.

Conservative designers take these and similar figures to indicate that if 7200 lbs. per square inch is used for southern yellow pine, the comparable figure for cedar should not exceed 5000 lbs. and if 6800 lbs. per square inch is taken for pine as is frequently done, the comparable figure for cedar should not be more than 4300 lbs.

Moment of Resistance Tabulated

For convenience in comparing designs, the following tables showing moment of resistance to bending have been computed for both pine and cedar on the basis of the modulus of rupture indicated above.

WESTERN RED CEDAR POLES CONFORMING TO N. E. L. A. AND A. T. & T. SPECIFICATIONS

Based on Modulus of Rupture of 4300 Pounds per Square Inch

Length of pole (feet)	Class A		Class B		Class C		Class D	
	Cir. 6 ft. From Butt	Moment of Resistance	Cir. 6 ft. From Butt	Moment of Resistance	Cir. 6 ft. From Butt	Moment of Resistance	Cir. 6 ft. From Butt	Moment of Resistance
20	30	30,563	28	24,849	26	19,895	24	15,648
25	34	44,491	31	33,723	28	24,849	26	19,895
30	37	57,338	34	44,491	30	30,563	28	24,849
35	40	72,447	36	52,814	32	37,092	30	30,563
40	43	90,001	38	62,114	34	44,491	32	37,092
45	45	103,152	40	72,447	36	52,814	....	.....
50	47	117,526	42	83,866	38	62,114	....	.....
55	49	133,177	44	96,427	....	.....	....	.....
60	52	159,166	46	110,183	....	.....	....	.....
65	54	178,247	48	125,188	....	.....	....	.....
70	55	188,334	50	141,498	....	.....	....	.....
75	56	198,795	52	159,166	....	.....	....	.....
80	57	209,636	54	178,247	....	.....	....	.....
85	59	232,486	56	198,795	....	.....	....	.....
90	61	256,940	58	220,864	....	.....	....	.....

CREOSOTED YELLOW PINE POLES—AMCRECO SPECIFICATIONS OR A. T. & T. 6050

Using a Modulus of Rupture of 6,800 Pounds per Square Inch

Length of Pole (Feet)	SIZE CLASSIFICATION OF SPECIFICATION No.25						
	Class AAA	Class AA	Class A	Class B	Class C	Class D	Class E
16	.....	.....	.....	.....	.....	15,457	11,360
18	.....	.....	.....	.....	23,285	17,811	13,304
20	.....	.....	39,387	33,390	26,386	20,437	15,457
22	.....	.....	43,760	35,316	29,750	21,285	17,831
25	67,455	53,452	48,444	39,387	33,390	26,386	20,437
30	76,927	67,455	58,793	48,444	39,387	33,390	26,386
35	90,883	76,927	67,455	58,793	48,444	39,387	33,390
40	102,391	90,883	76,927	67,455	58,793	48,444	39,387
45	114,831	102,391	90,883	76,927	67,455	58,793	.....
50	128,240	114,831	102,391	90,883	76,927	67,455	.....
55	142,654	128,240	114,831	102,391	90,883	.....	.....
60	163,500	142,654	128,240	114,831	102,391	.....	.....
65	180,401	163,500	142,654	128,240	.....	.....	.....
70	198,428	180,401	163,500	142,654	.....	.....	.....
75	217,618	198,428	180,401	163,500	.....	.....	.....
80	238,007	217,618	198,428	.....	.....	.....	.....
85	259,631	238,007	217,618	.....	.....	.....	.....
90	282,528	259,631	238,007	.....	.....	.....	.....

For additional copies of this series of studies of pole line design or for quotations and information on AMCRECO Creosoted Southern Yellow Pine Poles, address the nearest sales office.

AMERICAN CREOSOTING COMPANY

INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCREO LOWRY PROCESS CREOSOTED WOOD

GEORGIA CREOSOTING COMPANY INCORPORATED

LOUISVILLE ~ KENTUCKY

SALES OFFICES

332 S. Michigan Ave., Chicago
350 Madison Ave., New York City
401 W. Main St., Louisville, Ky.
Brunswick, Ga. Bogalusa, La.

One tiny vulnerable spot — Death found it!

THETIS, goddess mother of mortal Achilles, Hellenic hero of Trojan war, plunged him into ıe River Styx to make his body invulnerable. But ıe held him by one heel, which the waters did not ›ver with their protective charm. Before the bloody alls of besieged Troy, Achilles wrought havoc and estruction among the Trojans, himself escaping ounds, defying harm. And then, as he stood in the mple of Apollo, negotiating with Priam for the hand his daughter, Polyxena, the poisoned arrow of eacherous Paris found his ılnerable heel, dealing death. he magic of the Styx was od protection as far as it nt. But its application had cked thoroughness.

It is fact, not legend, that structive termites (white ts), woodpeckers, decay-oducing fungi or marine borers are swift to find the vulnerable spots in partially-improperly or under-treated transmission poles, cross ties, bridge timbers or piling. Spotty or uneven penetration of the preservative does not afford complete protection. And treated wood is no safer than its least protected spot.

Thoroughness distinctively characterizes Prettyman timber preservation. The most complete and modern pressure treating plant in the industry, coupled with finished engineering skill and care, assure deep and uniform penetration full length to the heartwood with creosote oil conforming to standard A.R.E.A. specifications. It completely encases the heartwood in highly toxic sheathing, thick as the sapwood itself. It leaves no vulnerable spots. Yet, Prettyman Preserved Forest Products cost no more. Write for prices.

No vulnerable spots here!

PRETTYMAN PRESERVED P29 FOREST PRODUCTS

Note thorough penetration of creosote oil

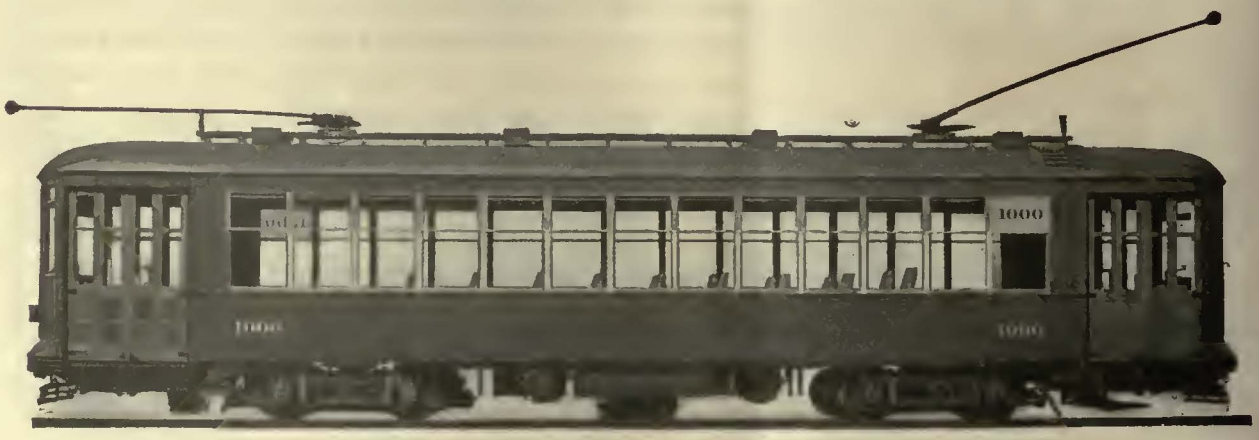
J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

Making Profits in transportation *is a "Selling Job"*

INCREASING patronage to make greater profits is a selling job in which the transportation service as a whole is offered to the public. One most important item of this service is the car itself. That is why electric railway companies are giving so much thought to better cars.

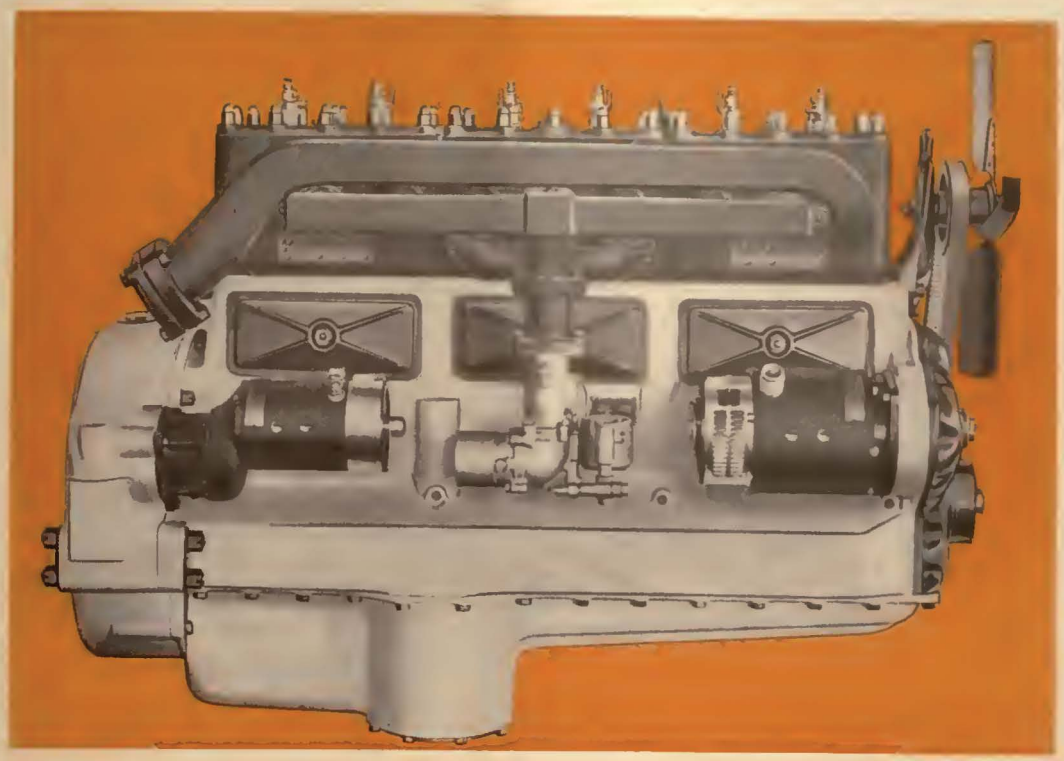
And that is also why so many communities are being served by "Thomas-Built" Cars. Their attractive appearance, extreme safety and unusual comfort attract the riding public, while their lower operating cost appeals strongly to the operator.

Throughout the country "Thomas-Built" Cars are proving their ability to sell more rides at lower cost. Our proposition on your next car order will prove attractive.



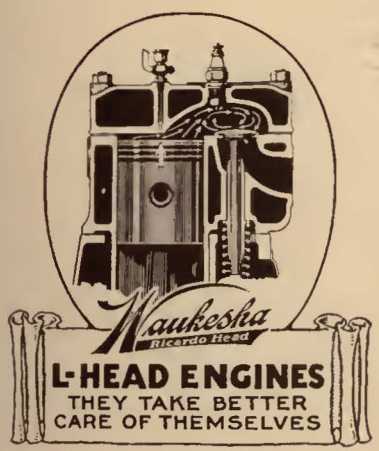
PERLEY A. THOMAS CAR WORKS

High Point, N. C.



here's an engine with *Remarkable Stamina*

The engine of the old "benzine buggy" fairly bristled, it had so many different parts. Since trouble was always developing with one or another of them, it was decidedly a case of compulsory accessibility.



Today it's different. The Waukesha Engine is famous for its NON-STOP features. The working parts KEEP ON WORKING. Take a look at this Heavy-Duty Waukesha Engine with its genuine Ricardo Head. See how perfectly protected the working parts are. Not only that but Waukesha has positive filtered oil lubrication, triple strength crankshaft, "girder" type crankcase, "truncated non-rocking cylinders." All these features combine to give Waukesha its remarkable stamina in heavy-duty service. Write Automotive Equipment Division for descriptive Bulletin No. 710.

928

WAUKESHA MOTOR COMPANY

New York Office: 8 West 40th St. WAUKESHA, WISCONSIN San Francisco: 7 Front Street

Exclusive Builders of Heavy-Duty Internal Combustion Engines for Over Twenty Years

What a "PROVING GROUND" for tires!

In long distance passenger service, Southern Pacific Motor Transport Company of San Francisco uses Goodyear Balloon Bus Tires

Round trip 2030 miles. Los Angeles to El Paso and return. 160 feet below sea level to more than a mile high. Blistering desert trails—remote mountain roads—fast schedules on fine paved highways—beside palms and cacti—from the modern civilization of great cities, past the crumbling reminders of a civilization lost in antiquity—this is one of the several routes run by the motor coaches of the Southern Pacific Motor Transport Company.

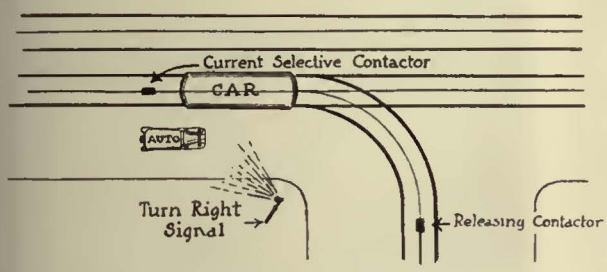
Undaunted, this fleet travels the Apache Trail on Goodyear 40 x 9.75 Balloon Tires. The sharp-cleated All-Weather Tread must hold the coaches safely on their way, on every road in every weather. The extra resilience, the extra vitality of SUPERTWIST in the tire body must play its important part in heat resistance, and in cushioning passengers over stretches far from smooth.

Under such conditions, the Southern Pacific Motor Transport Company reports that Goodyears are delivering *long and trouble-free mileage.* What more could anyone ask of tires?

For every Goodyear Cord Bus Tire there is an equally fine Goodyear Tube, built especially to the needs of bus service, and there are also Goodyear Rubber Tire Chains

GOODYEAR

Nachod Turn-Right Signal



An effective signal against autoists to prevent them from passing a car on the right when that car is about to make a right turn. The motorman of a car of the main street line will *drift* under current selective contactor and will go straight ahead without causing any signal display. The motorman of car for the diverging route will *use power* under this contactor, to cause the display of a brilliant 3-light Red Signal, lettered on the lenses

STOP—
—CAR
TURNS—

From this the autoist to the side of the car knows that the car will not continue straight, but will make the right turn, and he will wait behind the car. As the car makes the turn, the releasing contactor around the curve restores the signal to the normal dark again.

The Indication Is Arrestive, Explanatory and Is Automatically Displayed Only When Needed.

The Turn-right Signal may be operated in connection with a Cheatham Switch, so that the current selective contactor is the same as that for the switch. The signal may also be arranged to operate by *all* cars, if for instance, the main line should end in a loop to the right.

NACHOD SPELLS SAFETY

The NACHOD Turn-right Signal will prevent sides-wiping collisions. State your conditions with sketch so that we may submit quotations.

NACHOD & UNITED STATES SIGNAL CO., Inc.
Louisville, Ky.
Manufacturers Block and Crossing Signals.

Two transportation companies *stop* $17,700 a year loss-

JUST as the Birch Transportation Co., Inc., of New Brunswick, N. J., is saving $200 a week . . . just as the Newburgh Public Service Corporation increased receipts approximately $7,300 a year . . . you also can profit by the use of OHMER registers.

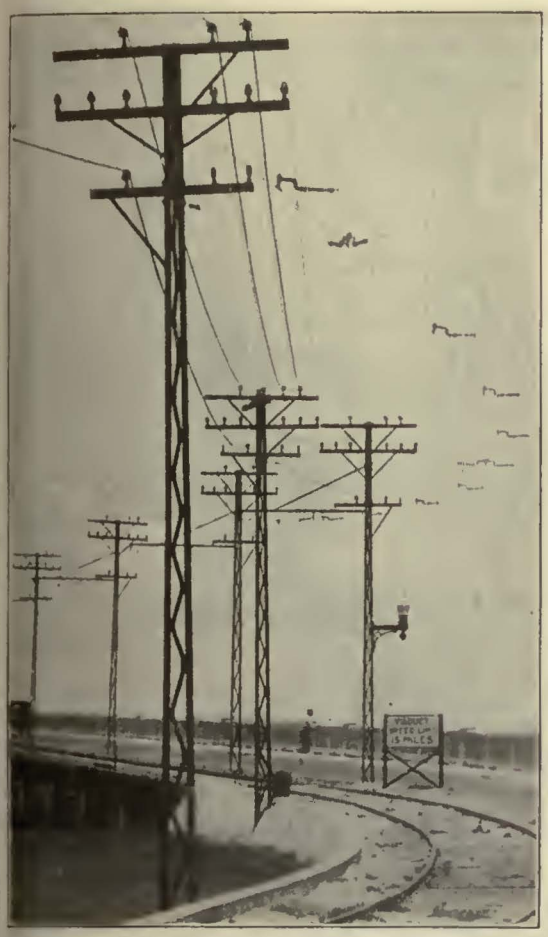
The OHMER Type 80 Register

This is the type register which is earning the Birch Transportation Co., Inc., $200 a week. It publicly indicates the amount registered. It totalizes all money received. It prints a ticket and keeps a detailed record of each fare.

Write today for the *facts* about the equipment which makes possible these savings . . . facts which will show you how to realize them in *your* business. Let us explain to you how OHMER registers will safeguard collections, print tickets and simplify bookkeeping . . . how they will more than pay for themselves by stopping cash-fare losses and by eliminating clerical detail.

Write at once for more detailed information. Let us help you determine the type adaptable to your business. This will not obligate you in any way.

OHMER
REG U.S. PAT. OFF. AND OTHER COUNTRIES
FARE REGISTER COMPANY
Dayton, Ohio, U. S. A.



Bates-Truss Poles for Trolley Suspension

MODERN transportation demands modern methods. The Bates-Truss Pole is the solution of trolley suspension problems. The general tendency of electric railways toward the increased use of Bates-Truss Poles is significant in these days of high costs and keen transportation competition.

Structural simplicity, combined with lasting strength and fine appearance, makes the Bates-Truss Pole ideal for all forms of overhead construction. Let us quote you on poles, structures or towers.

BEST
Bates Expanded Steel Truss Co.
EAST CHICAGO, IND.

TRUCK WITH TOWER IN RUNNING POSITION

TRENTON TOWER
This 3-Section

is not only more convenient, but stronger than the older type.

The top section is reinforced by the intermediate section. The 3-section design makes it possible to raise the platform 16 inches higher and drop it 12 inches lower than can be done with the old-style 2-section tower.

We'll gladly send you details.

J. R. McCARDELL CO.
Trenton, New Jersey, U. S. A.

Roebling
Welding Wire

Makes strong welds and is used where only the highest quality of welding wire is acceptable.

John A. Roebling's Sons Company
Trenton, New Jersey

ENGINEERS *and* CONSULTANTS

May Issue Closes
APRIL 15th

Early receipt of copy and plates will enable us to serve you best—to furnish proofs in ample time so changes or corrections may be made if desired.

Electric Railway Journal.

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.

Positions Vacant and all other classifications, excepting Equipment, 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$6.00 an inch
4 to 7 inches..... 5.75 an inch
8 to 14 inches..... 5.50 an inch

Other spaces and contract rates on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

R.J.

POSITION WANTED

SUPERINTENDENT transportation, qualified by wide experience, proven successful record, every phase of transportation. Successful in employe and public relations, increasing revenue, decreasing operating costs. Available short notice. Fine references. PW-167, Electric Railway Journal, Tenth Ave. at 36th St., New York.

For Sale

The following Sangamo Ecooomy Watt Meters:

34—600 volts, 300 amp. Meters, 120 watthours per disk revolution.

28—600 volts, 100 amp. Meters, 40 watthours per disk revolution. Above meters in A-1 condition.

For Sale or Exchange

8—Westinghouse 506 Motors complete and and in good running condition, less pinions and gear cases, in exchange for Westinghouse 508 Motors.

Monongahela West Penn Public Service Co.
Purchasing Department
Fairmont, West Virginia

Sponges and Chamois

FLORIDA SPONGE CO.
11201 Cottage Grove Ave., Chicago, Ill.

EQUIPMENT of the latest type is frequently advertised for resale in the *Searchlight Section*. Don't let a limited budget stop you from buying modern cars, busses or equipment that will cut costs or improve your service. Modernize your lines throughout *now* by buying wisely from these equipment bargains.

Stretch your Budget to Cut Your Costs

FOR SALE

100 FAGEOL COACHES

SIX-CYLINDER, PARLOR-CAR TYPE

Priced At **$1000** And Up

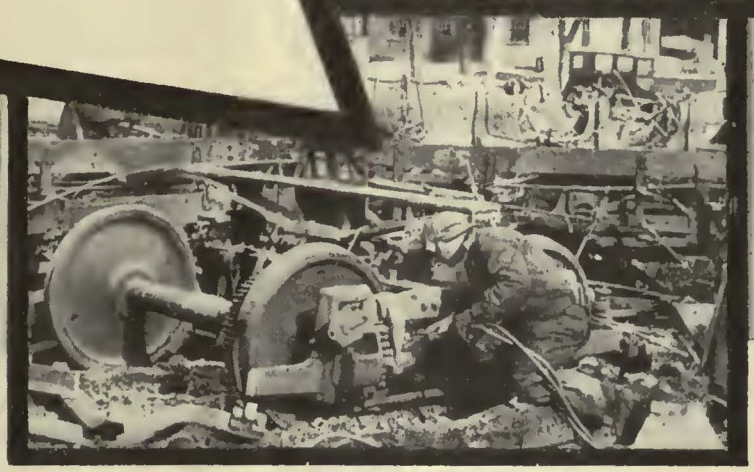
Due to standardization of equipment on the Greyhound Lines, this company offers the above equipment at prices substantially below actual value. All coaches are in good mechanical condition.

For Particulars, Address BERNARD WAHLE, *Sup't. Of Operations*

"GREYHOUND LINES"

514 E. 34th Place, Chicago

Turning Old Cars into Cash!



Here Is How We Do It!

These pictures illustrate how we make it possible for street railway companies to turn old cars into cash.

The upper picture shows a number of cars being burned—after the railway company had accepted our offer for the scrap metal in them.

The lower picture shows our crew with hammer and torch, preparing the scrap right on the spot for the steel mills. No middleman intervenes. The scrap goes directly from the railway property to the mill.

We are not Alchemists—
But—

we turn iron and steel into gold and silver.

L. Schiavone & Bonomo Bros. Inc.
Jersey City, New Jersey

TRACTION AND ELECTRIC LIGHT
PROPERTIES *for* SALE

THE Railway Properties serving the City of Binghamton and its suburbs together with Johnson City and Endicott on the west extending about ten miles from Binghamton, including Binghamton Railway Bus Lines operating a fleet of eighteen buses in and about the City of Binghamton, Johnson City and Endicott, and serving about 125,000 people and also the lighting property in Endicott and portions of the Town of Union will be sold under decree in foreclosure on Wednesday, May 15th, 1929 at 2:30 P.M., at the general offices of the Binghamton Railway Co., 375 State Street, in the City of Binghamton, N. Y.

The railroad property contains about 45 miles of single and double track. The equipment consists of 18 buses and 79 cars all in good condition together with all necessary railway and electric light paraphernalia including a plant at Binghamton.

Opportunity will be given anyone seriously interested in the property to thoroughly examine its records and the physical property.

Rate of fare is ten cents with four tokens for thirty cents.

Binghamton proper has a population of about 80,000 and Port Dickinson, Johnson City and Endicott making up the other 45,000.

PARTICULARS OF SALE may be obtained from WILLIAM H. RILEY, Special Master, 375 State Street, Binghamton, N. Y.

Saving is a good habit, BUT—
Why Save Things You'll Never Use?

WHY let Mother Nature grow grass between the wheels of replaced cars? Why pile up rails, shop equipment, power plant equipment, line equipment, car appliances, road building material, etc., etc., you will never use again?

TODAY you can turn them over at a fair price. Tomorrow they will be—JUNK. Is it not the better part of good horse-sense to dispose of them NOW?

6000 other electric railway men will see your advertisements of used or surplus equipment and materials here—in the Searchlight Section of their business paper.

Some of these men—officials or executives of other lines in other parts of the country and operating under different conditions—can use what you no longer need. For an insignificant investment you can tell these others what you have. And they will buy.

One "Searchlight" advertiser wrote, "We can cheerfully recommend the Searchlight Section as a wonderful medium for reaching buyers of rails and equipment." Another—"The strongest proof that your 'Searchlight' finds its way to many readers is shown by the numerous letters we have received in answer to our recent ad."

Let us tell you the cost of advertising your used or surplus equipment and materials in the Searchlight Section. Just address a list of what you have to dispose of to the

Searchlight Department

ELECTRIC RAILWAY JOURNAL
Tenth Ave. at 36th St., New York, N. Y.

ALPHABETICAL INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Electric Railway Journal* assumes no responsibility for errors or omissions.

Searchlight Section—*Classified Advertising*

Bus Floors of J-M MASTICOKE ...*are long-lasting*

THIS modern Bus Flooring is tough and resilient. Thousands of miles of travel and millions of footsteps leave it unaffected.

The long life and satisfactory service of J-M Masticoke Flooring have been well demonstrated by its extensive use on railroad coaches and Pullman cars. More and more, bus fleet owners are using it to reduce floor costs.

J-M Masticoke Flooring is safe and slip-proof. Its holding qualities are equally effective in any weather throughout its entire life—thus minimizing accidents.

J-M Masticoke Bus Flooring will not retain dust, dirt or germs because of its monolithic nature. It is easily cleaned by simply flushing with water. It dries quickly and is odorless. It insulates against the cold, and is, of course, fire-retardant.

Masticoke, being unaffected by water or acids, thoroughly protects and lengthens the life of the floor structure it covers.

Send in the coupon for full particulars.

Use J-M Masticoke for car floors, too

Johns-Manville

SERVICE TO BUS TRANSPORTATION

JOHNS-MANVILLE CORPORATION
Electric Railway & Motor Bus Division
New York Chicago Cleveland San Francisco Toronto

Please send me full particulars on J-M Masticoke Bus Flooring.

*Name*_____

*Address*_____

SB-115-4

Brill MASTER UNIT Cars for Porto Alegre, Brazil

20

Simplified Design

e twenty cars for Porto Alegre bify the general, sectional and d construction of Brill MASTER NIT Cars. They are the eight-heel, double-end type and embody t simplified MASTER UNIT de-sn which tends to reduce costs d the variety of replacement rts. These cars are built to with-snd the severe climatic conditions i Porto Alegre.

Rider Appeal

A trim streamline appearance is accomplished by maintaining the wide single windows and the lower edges of the windows in the vestibules and upper half of the doors on the same horizontal plane. Curved lower side girders having a single sweep inward, and a skirt below the side still are other characteristic features.

Plus Operating Economy

The comparative light weight of this type car effects a corresponding reduction in the cost of power. Furthermore, the uniformity of construction simplifies the maintenance problem. Here, then, we find our South American neighbors capitalizing the advantages of new equipment and the especially advantageous features of Brill MASTER UNIT Cars. Can anyone deny that this purchase of twenty new cars is a sound investment? Can a better suggestion he made than that other operating companies in need of new rolling stock follow the example of Porto Alegre?

These Porto Alegre cars will be on exhibition at the Brill plant in Philadelphia until April 14th.

Catalog of Brill MASTER UNIT Cars now available. Write for a copy.

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.

Pacific Coast Representative: Rialto Bldg., San Francisco

HASKELITE

World's largest bus operator again builds HASKELITE-equipped bus bodies

THE order just placed by Public Service Coordinated Transport, Newark, New Jersey, brings this company's total fleet up to 2069 buses, the largest in the world.

This is another outstanding example of the preference for HASKELITE-equipped buses by leading operators. According to a recent check, this new order makes 1596 buses of this fleet in which HASKELITE plays an important structural part.

This preference is the natural result of the experience builders and operators have had with HASKELITE in which its light weight, added strength and low cost have been conclusively demonstrated.

Ask for details of bus and street car applications of these structural panels, HASKELITE and PLYMETL, its metal-faced companion.

Haskelite Manufacturing Corporation
120 South La Salle Street, Chicago, Illinois

PLYWOOD
HASKELITE
PLYMETL

Railway Representatives:

Economy Electric Devices Co., 37 W. Van Buren St., Chicago

Grayson Bros., 600 La Salle Bldg., St. Louis, Mo.

Railway & Power Engineering Corp., Ltd., Montreal, Toronto, Winnipeg, New Glasgow

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