

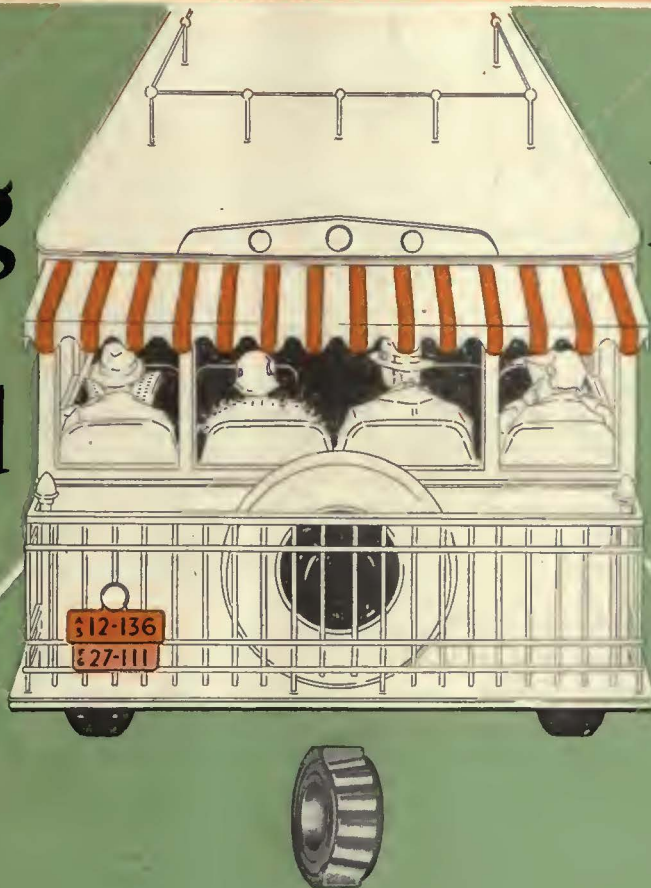
ELECTRIC RAILWAY JOURNAL

Publishing Company, Inc.

MAY, 1929

Thirty-five Cents Per Copy

Putting
Miles
Behind



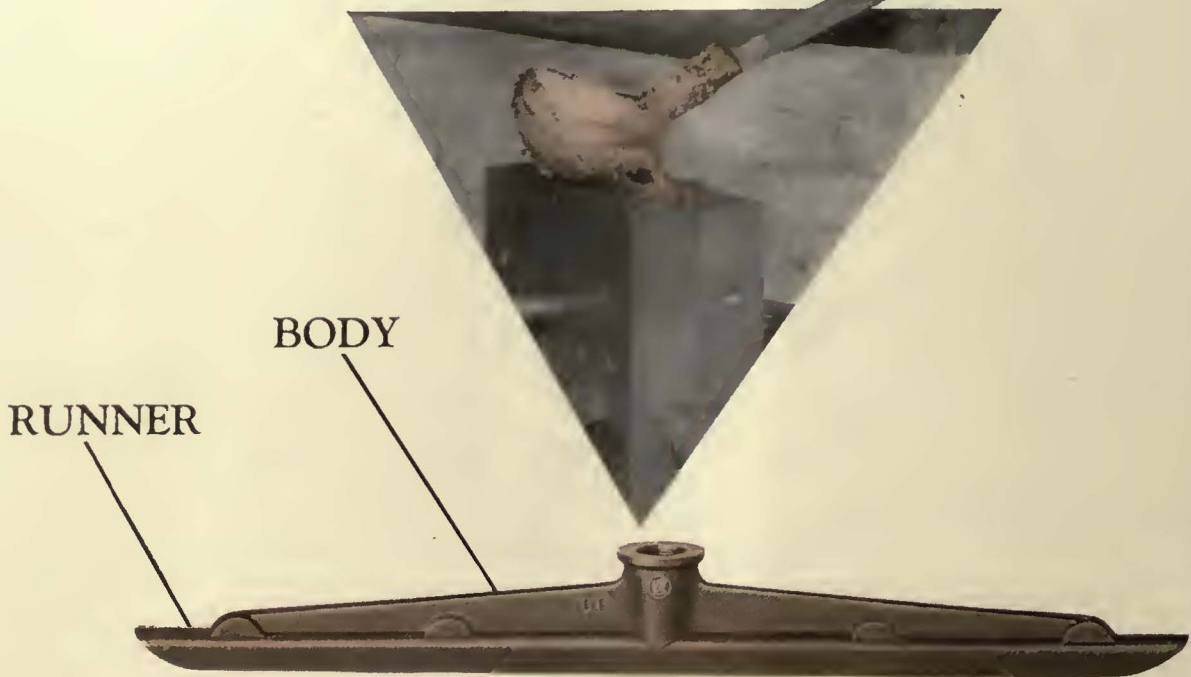
Keeping
Money
Ahead

Profitable miles are produced as long as buses keep taking in fares without a continual drain in repairs. This is where Timken Bearings take an active part . . . with their exclusive Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken electric steel, affording protection against thrust, shock, torque and speed as miles pass by and profits pile up. Here are found good and sufficient reasons for the ever lengthening list of Timken-equipped buses.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN Tapered Roller **BEARINGS**

POURED *for* STRENGTH



The "Champion" Trolley Ear

THE "Champion" consists of two parts--the runner and the body. The runner is made from a flat tough bronze sheet, blanked, punched and shaped. The body is made of a special high-strength alloy. The runner is placed in a mould and the body is moulded to it.

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- | | |
|-------------------------------------|--|
| 1 Strength | 5 Uniform thickness of lips |
| 2 Light weight | 6 Less arcing |
| 3 Easy to install; lips peen easily | 7 High conductivity of lips--
approximately 3 1/2 times
that of cast bronze ear. |
| 4 Long life | |

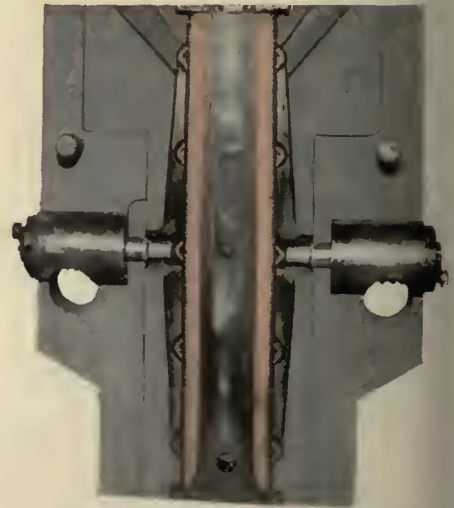


Illustration showing position of the runner in the mould, preparatory to pouring alloy.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH PENNSYLVANIA

SALES OFFICES IN ALL PRINCIPAL CITIES OF
THE UNITED STATES AND FOREIGN COUNTRIES



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Electric Railway Journal

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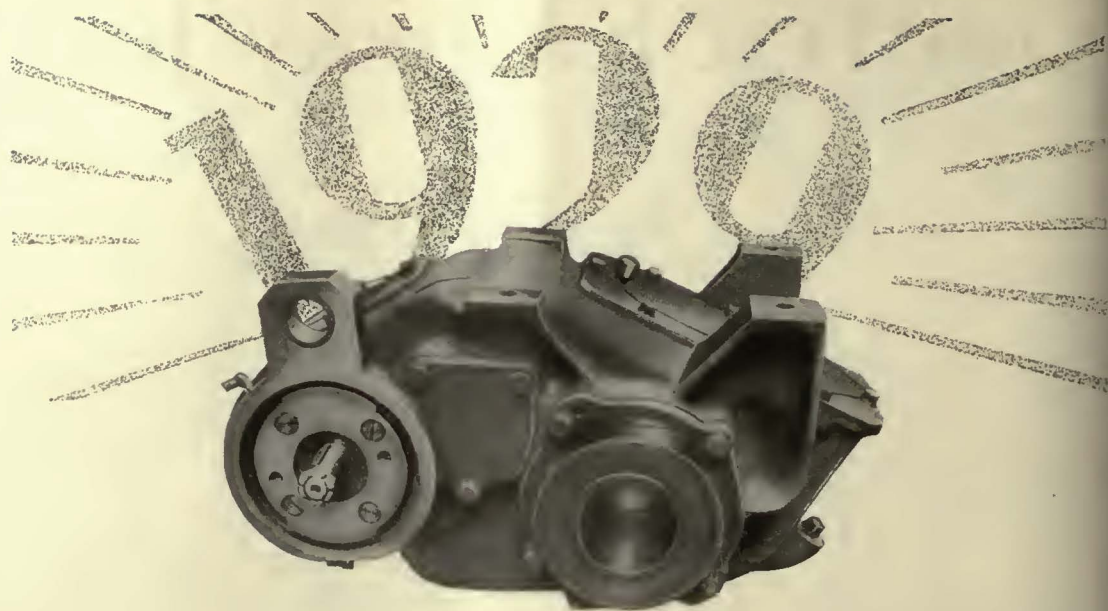
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The W-N DRIVE *in Step with the Times*

EQUIPMENT, individuals, companies, all must keep in step with the trend of the times or make way for those that do.

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For the cars of tomorrow that are being specified and built today, there is the W-N Drive, embodying the experience of the past, the requirements of the present, and designed to fulfill the demands of many years to come. The W-N Drive is the most advanced form of street car drive available to the railway industry today.

Having a self-contained double-reduction unit of helical gears revolving on Timken roller bearings in a continuous bath of oil, it provides higher ratios of speed reduction than any previous drive. This, in turn, permits the use of light-weight, high-speed, low-voltage motors with rapid acceleration, greater flexibility, and efficiency. With the W-N Drive, the motor is entirely spring-borne, which means longer motor life.

These important advantages, with many others, make the W-N Drive the logical equipment to put new cars in step with modern trends.

Have you a copy of DMF 5126, describing this drive?



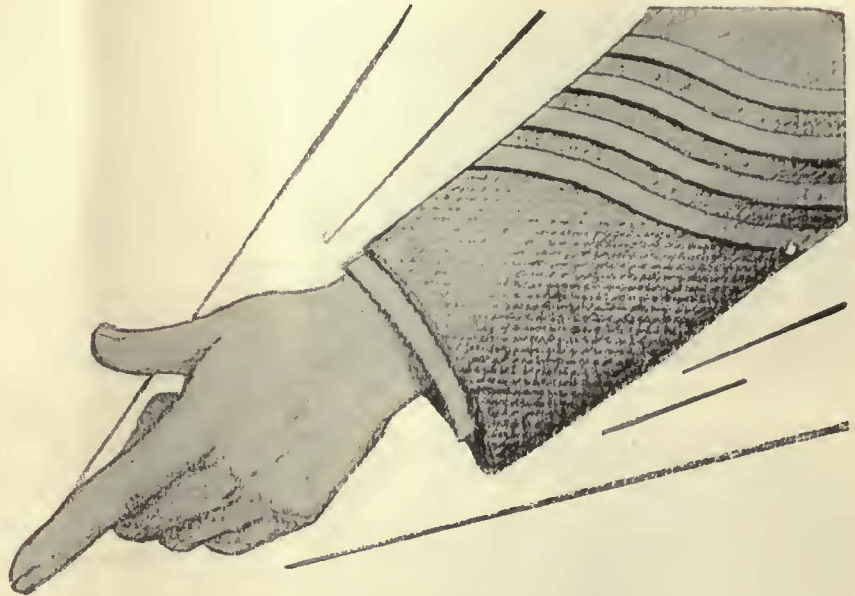
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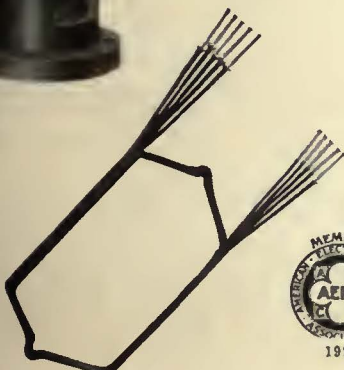
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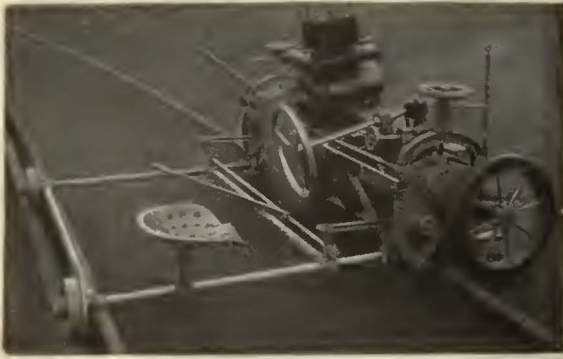
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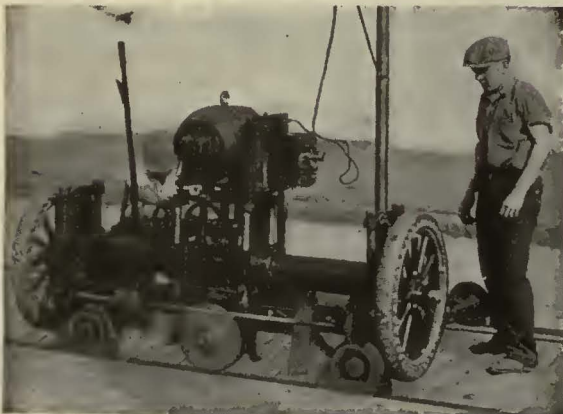




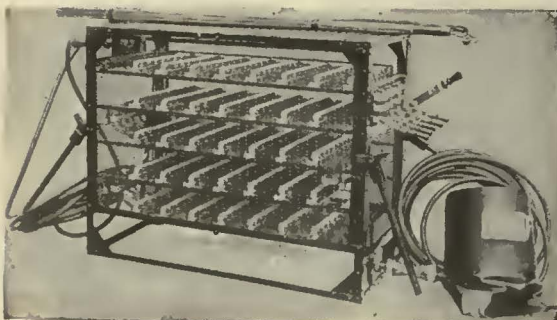
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Eureka Radial Rail Grinder



Imperial Track Grinder



Ajax Electric Arc Welder

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best
you can
with
what
you
have

The public responds to sincere effort. A road that has no money to rehabilitate its property may get it by rehabilitating its performance.

Old cars ride smoother on good track than new cars on rough track.

Rail grinding, arc welding, curve oiling are inexpensive steps toward better service... long steps.

*Bulletins on
these track
improvers?*

Railway Trackwork Co.

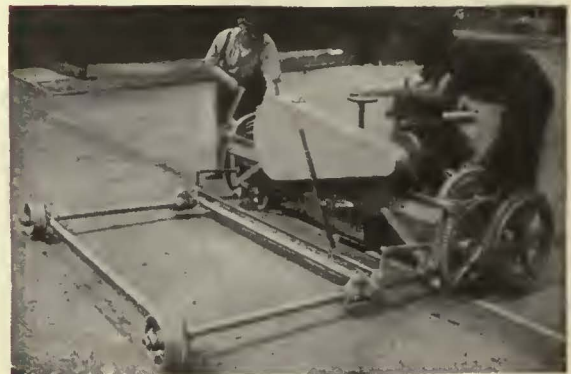
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TRANSPORTATION in Chicago presents difficulties of a most unusual nature; the needs of a larger city intensify the importance of the most serious thought and consideration in choosing equipment and supplies for the correct solution of service requirements.

Particularly is this applicable to new cars. When the Chicago Surface Lines buys new cars, they must embody the ultimate in those things vital to efficient transportation. Up-to-date design is essential. Weight is an important factor. Speed another. Rider convenience still another. Schedule maintenance—or flexibility—is vital.

The 100 new cars recently purchased by the Chicago Surface Lines fully meet all of these requirements. They are the "last word" in trolley car design—and incorporate the outstanding developments in car equipment.

That the *new* O-B Dash Illuminating Headlight; the *new* O-B Featherweight (All-Steel) Trolley Base and the time-tested O-B Trolley Catcher were chosen for the new Chicago cars is a high endorsement of the correct design and modern application of these materials.

Ohio Brass Company, Mansfield, Ohio
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NEW YORK CHICAGO PHILADELPHIA BOSTON

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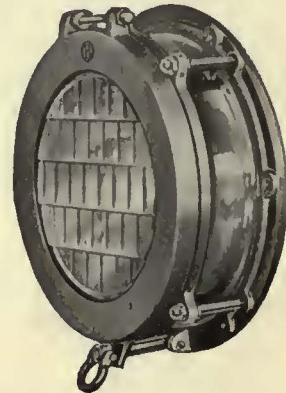
PORCELAIN INSULATORS
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The O-B Trolley Catcher, which positively prevents flying trolley poles. Selected for the new cars of the Chicago Surface Lines.

O-B Equipment



O-B Dash-Illuminating Headlight, which provides diffused track illumination as well as ample illumination of dash by use of circular side lens. Selected for the new cars of the Chicago Surface Lines.



O-B Featherweight Trolley Base, of all-steel welded construction and equipped with Timken Roller Bearings. An unusually strong base weighing only 73 lbs. Selected for the new cars of the Chicago Surface Lines.





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Large capacity buses need air brakes—for safety and economy reasons.

Adequate control, without driver fatigue, is thus assured, with the capacity to make quick stops when occasion demands.

Higher speeds may be maintained and more prompt service provided.

Street Railway Companies have proved that Westinghouse Automotive Air Brakes safeguard and promote their highway transportation.



WESTINGHOUSE AIR BRAKE COMPANY

Automotive Brake Division: WILMERDING, PENNA.

WESTINGHOUSE AUTOMOTIVE AIR BRAKES

Note the Faces of your Passengers -at the end of a long trip...



Do they look as if they would take that route again?

When a customer buys merchandise that pleases him, he will visit the same store again. "Repeat sales," they call it in commercial circles, and there are or can be "repeat sales" in railway circles too. When a passenger enjoys his trip, travelling in perfect ease of mind and body, he will *take that route again.*



H & K Rotating Chair No. 900
A comfortable seat for comfort loving travellers.

A comfortable *seat* and a comfortable *arrangement* of the

seats with respect to leg room and proximity to windows, lights, heaters and piping will do more to make a comfortable trip than any other single factor. Note the passengers alighting from a car arranged and equipped by Hale and Kilburn Seating Engineers. Their faces will disclose repose—freedom from fatigue and strain—a good omen with respect to future patronage from these same travellers.

HALE & KILBURN SEATS

"A Better Seat for Every Form of Modern Transportation"

HALE & KILBURN COMPANY

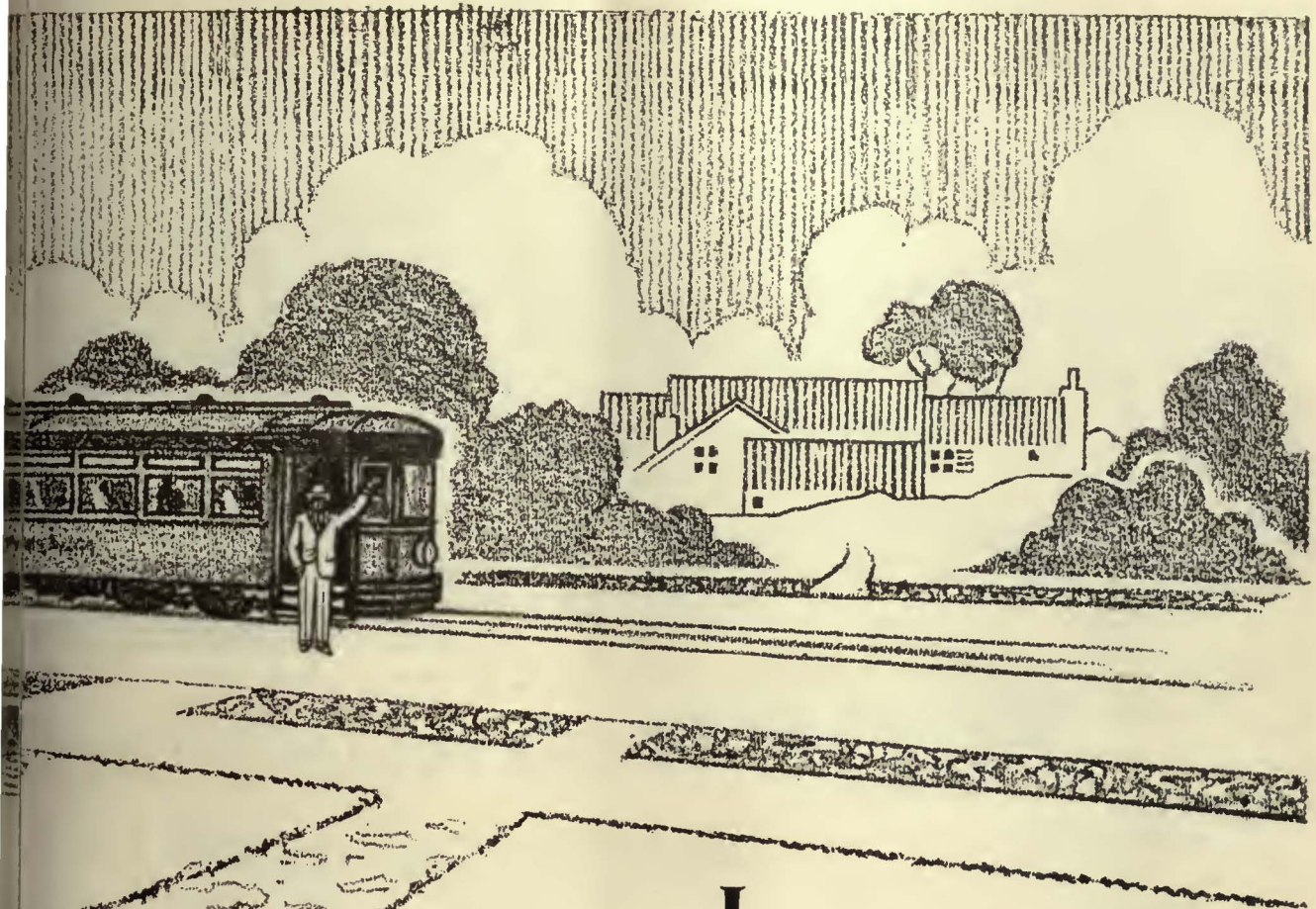
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Leave your automobile at home for your family ▲ ▲

How many of us in this electric railway industry—operators or manufacturers—executives, officers and workmen, use the electric cars as much as we should? Are we not inclined to drive our own car to work, thus depriving our family of its use?

Would it not be far better to leave the automobile at home and use the electric car to take us to work every day?

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Executive Office: Graybar Building, New York

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CHICAGO
518 McCormick Building

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Railway & Power Engineering Corp., Ltd.

We will be glad to furnish this drawing to any operator who would care to use it in his local advertising.



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Porto Alegre Buys Keystone Equipped Cars

Twenty new Keystone equipped Brill cars are en route to the Cidade Carris Porto Alegrense. This South American operator will benefit greatly by having purchased in the United States market—where advancement in design and construction of cars and equipment has increased efficiency to such a high level. This transaction is evidence of great confidence placed in the suppliers.

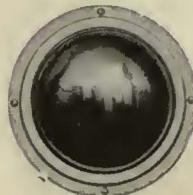
Keystone Car Equipment is completely listed in our Catalog No. 7.



KEYSTONE TROLLEY CATCHERS



TYPE T LIGHTING FIXTURES



KEYSTONE REAR LIGHTS



FARADAY SIGNAL SYSTEMS



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ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURER OF RAILWAY, POWER AND INDUSTRIAL ELECTRICAL MATERIAL

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The man in the pit sees this

This is the part of the car that gets the water, slush, dust, mud, and hard wear. Whether the man in the pit sees it often—and every time he does it costs money—depends on how thoroughly it is protected.

Car cables wound with G-E Paragon tape are prepared for long, faithful service. This tape is of sticky, waterproof material which readily absorbs varnishes and treating compounds. Its gripping quality is unimpaired by age. G-E Paragon tape is but one of the complete line of G-E insulating materials that keep cars on the line and away from the pit.

G-E insulating materials are sold only by G-E Merchandise Distributors located throughout the country who are equipped to give you prompt service. Get in touch with the G-E Merchandise Distributor near you or write to the Merchandise Department, General Electric Company, Bridgeport, Connecticut.

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PAI
DSC
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Insulating materials described in Catalog GEA-603 are identical with those made by General Electric for its own use. Send for a copy to the Merchandise Department, General Electric Company, Bridgeport, Connecticut.



800-505

GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

If Your Routes

The Best Car Equipment

It will pay you to investigate the performance of G-E motors, control, and compressors



Car Equipped with GE-265 Motors and CP-27 Compressor, Detroit Street Railway

on a few of the hundreds of properties using G-E equipment.

The Detroit Street Railways, for example.

Ever since its organization, this Company has operated G-E equipment. During this time it has received such gratifying results from this equipment that it has



GE-265 Motor

specified "G-E" again and again. Twenty separate orders have totaled 603 CP-27

compressors, and eleven orders have placed 2170 GE-265 motors on this one property alone.

The Detroit Street Railway is but one of the 86 street railway companies which have specified G-E-265 motors.

Renewal Parts

The best equipment requires the best renewal parts if it is to be kept operating efficiently.

Take armature coils, for instance.



Armature Coil for G-E Motor

The coils made by G.E. for G-E motors make your rewinding job extremely simple. They are exactly right in mechanical and electrical characteristics—perfectly suited to your G-E motors.

G-E engineers and scientists are constantly developing new devices and new materials to simplify your renewal problems.

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Require— Reliable Substation Equipment

Operators to-day are effectively reducing expenses by letting automatic switching and supervisory equipment operate their substations.

In Boston.

Two 6000-kw. G-E substations with complete automatic switching and supervisory



Two 600-volt, 3000-kw. Synchronous Converters and Control Panels, Boston Elevated Railway

control supply power to the Boston elevated and surface cars. The first of these automatic substations was installed in 1927 and the second in 1928, each containing two 3000-kw. synchronous converters.

To-day, the third automatic substation, of the same type, is being built to further the economical operation of Boston's electric traction system.

G-E automatic substations deliver power when and where it is needed.

Long-Life Buses

Operators who have used both mechanical and gas-electric buses are finding that the gas-electrics last 50 to 100 per cent longer than mechanical buses of the same type and in the same service. As a result, they have been able to decrease their depreciation charges a corresponding amount.

The longer life of the gas-electrics is due to lower average engine speed, absence of gear shifting with its jerking and straining, less vibration, and reduced possibility of accident.

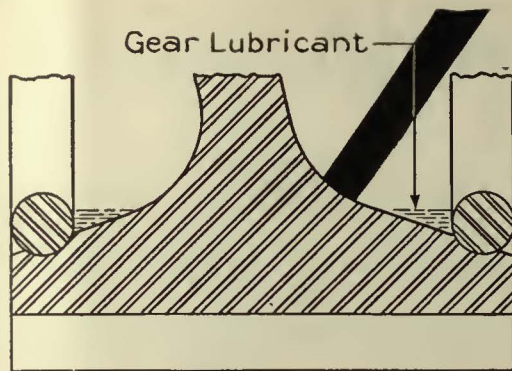
This saving in reduced depreciation, together with the greatly reduced maintenance costs and the lessened accident costs, adds greatly to the favor won for the gas-electric by its high earning power.

Let the G-E transportation engineers analyze your service and make recommendations for the best type of equipment

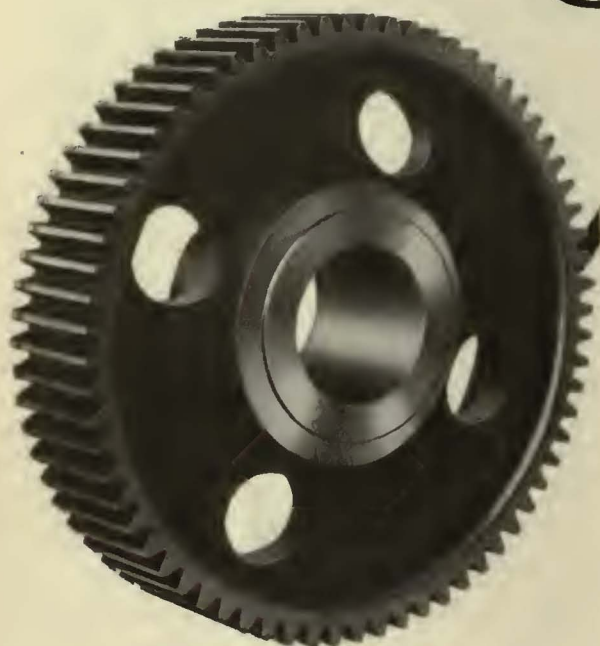


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ELECTRIC HOUR, BROADCAST
EVERY SATURDAY AT
8 P.M., E.S.T. ON A NATION-
WIDE N.B.C. CHAIN

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Quiet street cars create good will



Progressive companies everywhere are trying to eliminate car noises—to give their patrons comfort as well as transportation. Quiet gears do much to strengthen the invitation to ride.

In the new G-E non-resonant gear, a simple principle is employed to obviate ringing. The gear is constructed with annular rings which provide a pocket for the gear grease and which effectively deaden the objectionable ringing inherent in metal gearing.

The nearest G-E sales office will give you complete information.

GENERAL ELECTRIC

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

330-104

Electric Railway Journal

Consolidation of
Street Railway Journal and Electric Railway Review

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CHARLES GORDON, Editor

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Volume 73

New York, May, 1929

Number 14

Transportation Problems a Challenge to Economists

GRAVE questions of economics and public policy confront the entire transportation industry of the country—railroads as well as local carriers. And since their correct solution is vital to American business, and in fact to the welfare of the entire nation, there is increasing need for attention to fundamentals. The situation grows in complexity. The present era is one in which invention and the development of natural resources have carried us forward faster and faster, and have imposed constantly changing economic conditions.

As a whole the total passenger traffic on all forms of local common carriers is standing still. This is well known. During the last eight years similar traffic on the steam railroads has declined 33 per cent. This is, perhaps, not so well known by local transportation men. No close parallel is presented by the situation which confronts these two branches of transportation, but it does suggest a number of thought-provoking analogies. The loss of less-than-carload shipments by the railroads to motor trucks, their loss of passenger business to automobiles and buses, the present public pressure for the development of inland waterways and the recent order by the Interstate Commerce Commission for joint through tariffs between railroads and barge lines; the mounting costs of terminal facilities for both passengers and freight in large cities, and the probable future competition of the airplane, have their parallels in the effects of transportation over publicly-built highways upon the interurbans, the growth of street congestion in cities, the distorted view which city planners and the public take concerning the provision of facilities for private transportation as compared with public transportation, and the many expedients that are vainly being tried in the attempt to finance adequate local rapid transit with public funds. Finally, the problems of the railroads and of local transportation become very closely associated indeed, when the physical and economic questions involved in the co-ordination of railroad terminals with the local transportation facilities of large cities are encountered.

It is not easy to foresee fully the future course of transportation development and co-ordination. The physical problems do not appear insuperable. When the question is considered from the viewpoint of economics and public policy, however, it becomes complicated indeed in its many ramifications. Despite all this there is no excuse for inaction, heated partisanship, or helpless bewilderment. The difficulties that present themselves really constitute a challenge to our ability intelligently to solve them by so directing economic forces that they shall not destroy us.

Of course, mere reiteration of the issues raises more questions than it answers, but unless the questions are

both raised and clearly defined, they will not be answered. Above all, there can be no compromise with progress. The public demand for more and better and faster and cheaper transportation cannot be thwarted. At the same time there must be a clearer understanding of fundamentals in the effort to achieve results. Any tendency to dally in the consideration of principles must inevitably result in collapse of the nation's transportation facilities regardless of how brilliant may be the conception of those who plan them. Upon the economists of the nation rests the responsibility for detecting present weaknesses in our economic conceptions and for laying down as well, sound principles as the foundation upon which to rear our present and future transportation structure. Not only to the men in all branches of the industry, but to the economists as well, the country's transportation problems present a grave challenge.

Skillful Management Improves Railway Position in 1928

GREATER net income secured in the face of declining traffic and lower revenues is the outstanding result of operations revealed in the returns of 182 electric railroads to the American Electric Railway Association for the calendar year 1928 as compared with 1927. Improved maintenance methods, higher average car speeds, adjustment of service to meet the traffic, development of new sources of revenue, increase of income from outside investments, use of the bus to reduce the drain of non-paying railway routes, readjustment of the capital structure, reduction of capitalization or elimination of fixed charges have all been used to offset a loss in passenger traffic and to convert a decrease of about 2 per cent in gross revenue into an increase in the net corporate income.

Not all of the companies, of course, have been equally successful in accomplishing such results. The interurbans, in particular, as a class have been able to make little if any headway against the adverse conditions which menace them. On the other hand some of the lines in the smaller cities which a few years ago were believed to have little chance of survival are now found to be holding tenaciously to their traffic and by the most intensive efforts are developing economies and working out improvements in methods that give promise of enabling them to pay a fair return.

General conditions in 1928 were not particularly favorable to the electric railways, although there have been worse years. At the beginning of the year business was slightly depressed and employment somewhat under normal, a condition that held over from the fall of 1927. As the year progressed business picked up but in certain sections, notably the southeast, the northwest and parts of New England, conditions were below normal through-

out the year. Automobile registrations increased a million over 1927, and in the fall a mild epidemic of influenza had an adverse effect on street railway traffic.

Inspection of the bus figures shows that the electric railways are making long strides forward in the development and improvement of this transportation means, although from other sources it appears that as a whole the railway-operated buses are still a long way from paying all of their carrying charges. This is due, of course, to the use made of buses by electric railways to act as stop-losses on non-paying routes and to extend transportation into lean and undeveloped territory.

Of the three groups into which the statistics are divided, city properties, interurban properties and properties comprising both city and interurban service, the third classification shows up the best. The improvement made in its net revenue was great enough to produce a similar improvement in the combined total for the properties. Furthermore, it appears from the figures that the improvement effected in this group was produced entirely by the skill of the managements without any assistance from favoring circumstances. In fact it was in this group that the reduction in operating revenue was greatest. But by intensive managerial efforts, by adapting service to the demand for it, by speeding up the cars, by more economical maintenance and by better financial management these lines were able to show a substantial improvement in the net for the year. The gains in this group, with its relatively small receipts, were sufficient to overcome in the totals the losses in the other groups. Had equal skill been possible throughout the entire industry, a still better statement would have been presented for the year's work.

Improved Maintenance Equipment Needed

EQUIPMENT for electric railway maintenance is far below the standards found in other industries. Maintenance forces are laboring under a disadvantage in this respect, and much can be done to improve equipment to lighten the labor, speed up work, reduce costs and insure more accurate workmanship. The need for improvement of maintenance tools, fixtures and machines has long been apparent, and recommendations to this effect have repeatedly been included in committee reports of various American Electric Railway Engineering Association committees. Moreover, in recent issues of *ELECTRIC RAILWAY JOURNAL* there have been a number of suggestions from maintenance executives regarding the need for improved maintenance equipment. Manufacturers should welcome the opportunity to enter this discussion and avail themselves of the opportunity for broadening their market for maintenance machinery.

In railway shops most of the machining operations are performed on odd-shaped pieces. As there are sometimes only a few of each class to be machined, the provision of special jigs and fixtures may not be warranted. Machine tools may, however, be improved by providing ready means of clamping the work and holding it securely. Overhead line maintenance is handicapped considerably due to the nature of the structure used. When a worn part must be renewed, it is sometimes necessary to disturb a considerable part of the supporting overhead. There is an opportunity for improvement. Likewise, there is an excellent opportunity for the development of improved tools and fixtures to eliminate hand work in the field and to speed up repairs or replacements. In

the track department a large part of maintenance cost is attributable to the removal and replacement of pavement when making joint repairs. Certainly, the simplest remedy is to use the best type of joint construction available. But when bad joints do develop, attention should be directed toward ideas for cutting the cost of pavement removal.

The Clang of the Fire Bell Finally Aroused Baltimore

BALTIMORE has at least got started in the right direction on parking. It has put on the ban in certain downtown streets during business hours. The circumstances, however, are peculiar—so peculiar that they seem worthy of special attention. Traffic experts have long said that this was a step Baltimore needed to take; the railway officials have insisted that prohibition of parking on certain congested streets was necessary to prevent the convenience of a relatively small number of automobile users from interfering with the rights of all other users of the public streets; the newspapers sensed the evil of parking and the doughty Mr. Mencken, whose pen drips vitriol when he goes crusading, said in the *Baltimore Sun* recently that the use of congested public streets as free garages is a reflection on the intelligence of modern Americans. But Baltimore remained adamant; that is, the selfish had their way.

It was the clang of the fire bell that finally aroused Baltimore. Engines racing to the scene of a conflagration were able to get through the streets only after the usual traffic difficulties, but when they reached the fire the way of the crews to the fire plugs was obstructed with parked cars. The firemen had of course long recognized the parked car as an incipient menace. Now it became a real one. As Grover Cleveland used to say, it was a condition not a theory that confronted them. They put out the fire, and then they let out a roar that quickly brought action in Baltimore. It is too bad that nothing short of a threat of public catastrophe could arouse the city to exercise its common sense. The menace of the parked car is not Baltimore's alone. It exists in every city of any size.

Detroit's Subway Vote Disturbing

DETROIT voters went on record on April 1 against the \$91,000,000 subway proposal submitted to them at that time. This provided for a plan of assessment that would have affected the owners of the property adjacent to the new lines. Whether or not that was the real cause for rejection does not appear, but fear of assessment does seem to have played a large part in the adverse vote. The assumption is that those vitally interested in defeating the proposition voted, while those who favored it remained at home.

As the *Free Press* sees it, men prominent in the political life of the city believe that the public will never approve a subway plan unless it is to be financed by the issue of general bonds of the community. Others are said to believe that bonds of this kind should be issued, but that the revenues of the system against which the bonds are issued should be sufficient to meet the interest and the sinking fund charges. Of course, full accord on the method to be used is hardly to be expected, but the assessment plan is the only sound one, despite the fact that it is difficult for the layman to understand.

s for the future, added means of transportation are vital to the well-being of Detroit. In fact, the city's future is inextricably bound up in what is done about it. As matters stand now the Mayor has memorialized the Street Railway Commission and the Rapid Transit Commission to draw up plans for a series of short subway routes for the downtown district to be used by the street car lines. This plan on its face would appear to throw into the discard much of the work of the Rapid Transit Commission, finally joined by the Street Railway Commission in the proposal recently rejected. Presumably the plan which the Mayor now has in mind will be completed in time for its submission to the voters in the fall, since he is irrevocably committed to securing some kind of transit relief for the city. It is to be hoped that, to accomplish his objective, the assessment plan of financing—the most important single feature of the proposal of April 1—will not be eliminated.

Under the Detroit plan it was recommended that 17 per cent of the total cost be raised by an ad valorem tax on the city at large; 51 per cent on the benefited property adjacent to the subway, and 32 per cent to pay for tracks and other equipment, raised by a 10-cent fare. The Council was to fix the exact proportions, and the assessors were to determine the enhancement in property values due to the subway during the five-year construction period. At the end of the five years, the assessments were to be levied to retire the bonds. Of course, the 13-mile subway included in the plan before the voters was only part of the larger scheme upon which the Rapid Transit Commission has been at work. Despite the need to start at once on transit improvements in Detroit, this equitable proposal was defeated at the polls. The conclusion seems inescapable that the majority of voters had little understanding of the fundamentals of the question before them.

Humanitarian Impulse Grows in Modern Business

CONCRETE evidence that large enterprises in the United States are run along humanitarian as well as utilitarian lines is furnished by the annual reports of many companies, but no more convincingly, perhaps, than in the annual statement of the General Electric Company. There one finds tangible instances of the practical application of the precepts which on occasion Owen D. Young, chairman of the company, has reiterated.

The General Electric Company is prosperous. It has been prosperous over a long period of years. And in its accounting policies the company is conservative almost to a fault. Its patents are carried at a dollar and its furniture and appliances, other than in the factories, are carried at a similar figure. In addition, a general plant reserve in excess of normal depreciation is set aside to permit buildings or equipment to be replaced whenever it is found that new facilities would permit increased efficiency or economy.

But concern is here not so much with the business men that has produced consistent profits, as with the forward-looking policy that has been followed with respect to employee relations and the degree to which the management of this vast industrial organization has recognized that even its lowliest worker is entitled to recognition as a factor in its success. This has been put into

tangible form by encouraging stock ownership by employees; through the provision of old age retirement funds, and directly through increases in the average annual earnings of employees of 126 per cent since 1914—a period in which the cost of living increased only 62 per cent.

New York State Courts to Decide

EVENTS incident to the remanding of the Interborough Rapid Transit fare case by the United States Supreme Court to the lower court will take their course again during May after the lower court has been formally apprised of the ruling of the upper court. Just what these events will be it is difficult to say. Spokesmen for the city have been voluble, but the company has kept its peace. It is to be expected that the city will enter a plea for the dismissal of the federal court injunctions that prevent the prosecution of the city's fight in the state courts to enforce the 5-cent fare clause. City officers, as might be expected, hold that the Supreme Court's decision banning the 7-cent fare petition makes a dismissal of the injunction virtually mandatory. Even in the state court the issue may, of course, be lost, but that is by no means certain. The verdict of the Supreme Court was not unanimous.

On the probable course of events it is idle to speculate, but it is not idle to reiterate, as was pointed out in the *ELECTRIC RAILWAY JOURNAL NEWS* for April 13, that issues bound up in the case would appear to differentiate it from other rate actions that on their face may seem to be similar to the one in New York. The company advanced the issue that inadequate returns were shown on the combined subway and elevated properties which it operates—the former being leased from privately-owned companies, and the latter having been built largely with city funds—but the court held that the subway and the elevated systems must be treated separately. It did not, however, elaborate on the reasons for this finding.

That the Supreme Court did more than merely remand the issue to the lower courts for decision without an opinion, as sometimes is customary, is ascribed to the nature of the pleading. In so doing it did say some things that appear to offer surcease to the representatives of the city, but that is by no means certain, even though the officers of the city were quick to accept them as such. The court's rejection of the plea of the company that the fare should be adjusted to provide an 8 per cent return upon both the company and the city investment in the subways—to be divided according to the terms of the contract—was tempered with the statement that while the claim was unprecedented it "ought not to be accepted without more cogent support than the present record discloses."

As brought out previously in the *ELECTRIC RAILWAY JOURNAL*, matters as they now stand are best stated in the words of Justice McReynolds to the effect that the Transit Commission of the state of New York has long held to the view that it lacks power to change the 5-cent rate established by contract between the city and the company, but that "it is intended to test this point of law by an immediate, orderly appeal to the courts of the state." This purpose, the United States Supreme Court ruled, should not be thwarted by an injunction secured by the company to prevent the city from interfering with an increase in fares.

Signals Should

MOVE Traffic

By J. ROWLAND BIBBINS
Consulting Engineer
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Associate

—Not STOP

"VANITY FAIR" recently printed a forceful story of "The City That Died of Greatness." "We are on our way; nothing can stop us," warbled the 42nd Street realtor. "Yes, but where?" exclaimed the long-suffering one. "Truly on your way, but at the dizzying rate of 1 m.p.h." Thus we of the provinces are constrained to exclaim, "So *this* is New York." All of which is merely by way of observing that our dynamic metropolis has thus far contented itself with the most obsolete traffic-signal system of any large city.

The harassed traffic head of another large city echoes: "We must immediately spend \$1,000,000 for signals." But this city apparently has made no adequate engineering study to determine the right design, the exact needs, or the probable result of signaling perhaps 1,000 street intersections. Many other communities are nervously spending and experimenting, with no clearly defined objective in mind and with little intensive study of the problem before making heavy expenditures for what, in the last analysis, are strictly engineering projects.

There are 30,000,000 people today dwelling in a total metropolitan area of 10,000 square miles (cities over 200,000 population). Roughly speaking, the total riding habit within these communities has steadily increased. But the demand for speed and comfort has diverted perhaps one-third of the present total volume of riding from public transportation agencies to private automobiles. The public is moving into the suburbs and demanding faster transportation. Time rather than distance has become the measure of transportation, and the 30-minute time zone still measures, in a general way, the limit of convenient residence and maximum population density. Beyond the 30-minute zone the tendency to use automobiles increases except in unusual cases like Manhattan, where "necessity riding" and lack of cheap auto storage encourage people to use the rails.

Thus speeding up the mass carriers, upon which most people have to depend, at the same time decreasing

Observations of the performance of typical signal installations indicate in a striking way the serious delay to traffic movement that results from makeshift signalling. The authors develop a series of traffic flow profiles that illustrate exactly what happens at a crossing, under variable conditions, after the "Go" indication flashes

downtown motor congestion by moving some of the causes, has become an outstanding problem of public interest. Express buses appear most hopeful where rapid transit cannot be financed by reasonable fares or benefit subsidies. But express buses are subject to defects in street planning and much the same delays as street cars. To make matters worse, inadequate signaling and traffic controls have become an epidemic throughout the country, distinctly menacing speedier transportation and efficiency which the industry is struggling to achieve through its modernization program.

But this situation can be met if approached as a problem of engineering analysis and design rather than politics or "safety" policing alone. In the accompanying Table I, there is shown a definite example of the results which may be accomplished by proper signal control in comparison with present obsolete methods. By timing signals for proper sequence traffic moved one-third faster, there was an increase in street capacity for stop traffic amounting to more than twice the number of automobiles that could get through formerly with stopping, and transportation speeds were increased 50 per cent.

SIGNALS SHOULD MOVE TRAFFIC—NOT STOP IT

So long as both public transportation vehicles and automobiles occupy the same streets, any adequate system of control should have for its purpose both safety and time-saving for the greatest number of people. Unfortunately, almost the entire consideration in signal installation has generally been concentrated upon expediting automobile traffic with little regard to the total number of people carried by various agencies. Contrary to this practice, the requirements of mass transportation should be the starting point. To handle the rush-hour loads of our 22 largest cities, registered nearly 4,000,000 automobiles, about 2,500,000 of them carrying an average of 1.7 persons, would be required (assuming a riding habit as low as 250 rides per car

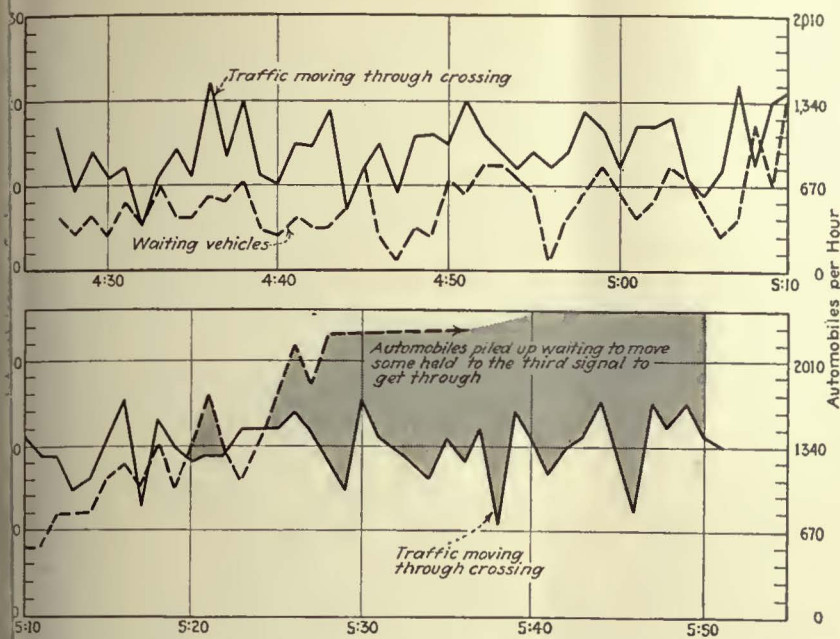
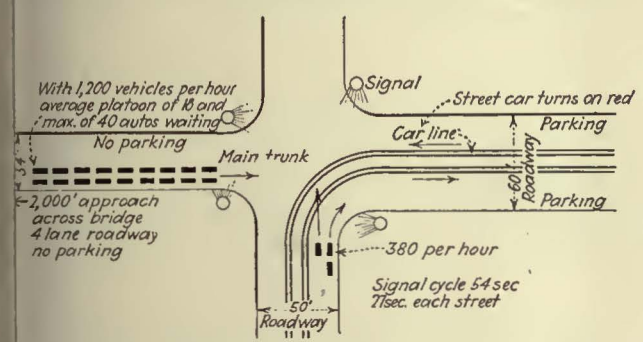


Fig. 1—Log of vehicular movement (two-lane) through first signal of alternate-group, synchronous system on heavy traffic artery, based upon observations taken at five-second intervals and showing pile-up of delayed vehicles during rush-hour peak



Observations for Fig. 1 were taken at this intersection

year). In comparison, modern railway equipment, designed for handling city surface transportation and operating either as single cars or articulated units, has the equivalent actual passenger-carrying capacity of from 40 to 100 automobiles.

The starting point, therefore, in designing a signal system for a public street carrying passengers in both public and private vehicles, is to obtain the highest average speed, including passenger stops, that it is possible to make by cars or buses through a signal district during rush hours. To expedite the movement of automobiles as well as that of public transportation vehicles, a two-speed wave system can generally be discovered which will accommodate both public vehicles and automobiles most efficiently, so that the "set-back" of cars or buses due to loading stops can be best fitted into successive signal "wave bands" to avoid the present time loss waiting for signals, which is so seriously slowing down public transportation rather than speeding it up. For non-rush hours, a short signal cycle permits advantage to be taken of the shorter loading time and decreased traffic interference during these hours. The commendable increased speed of all traffic through the Chicago Loop district, following the installation of a scientifically-designed, progressive signal system, illustrates what can be accomplished by proper skillful design. When the requirements of mass transportation are thus adequately

considered, the advantages accrue not alone to public transportation riders, but to all traffic using the streets.

NEED FOR FASTER SCHEDULES IMPERATIVE

Surface transportation in public vehicles needs to be speeded up during rush hours along main trunk line streets to 12 m.p.h. average running speed, and even faster during non-rush hours. Express buses, with minimum stop time, should approximate average automobile speeds. As street car headways are seldom closer than 30 seconds, and buses 60 seconds, even on heavy traffic arteries, it rarely becomes necessary to pass more than one or two mass transportation units across an intersection during each signal cycle. Consequently, while other traffic may accommodate itself to quite a wide range in cycle time, mass transportation vehicles need the shortest possible cycle to minimize waiting time for stop signals. But rarely indeed are these transit needs

adequately considered in present signal installations. Yet it is entirely practicable when signal cycles are kept short to accommodate two classes of traffic moving on the same street at different speeds, with minimum stoppage and delay to either class of vehicles.

On the usual transit system of a circular city, an increase in speed of 1 m.p.h. will expand the 30-minute rush-hour time-zone more than 25 per cent in area. But if then a system of signals is installed, for example, along a 5-mile transit artery of ten blocks per mile, which is improperly timed so that street cars are held up by a red light for 30 seconds every five blocks, this would result in ten delays, adding 16 per cent to the running time of the line, thus absorbing all of the assumed speed increase. The cost of providing transportation service is also materially increased to no good purpose, to say nothing of the delay experienced by the public during the 300 or 400 rides per year required by the average citizen. It is idle to figure money losses, but it is very important to recognize that a large part of this economic loss can be avoided through proper signal design timing.

SIGNAL ENGINEERING INVOLVES MANY FACTORS

The technical problem of properly designing and timing signals so as to co-ordinate the effects of many shifting variables, differing in proportion for every city, street and intersection and changing for various times in the day, involves proper recognition of the following factors:

- Complexities and defects of the street plan itself.
- Number of blocks per mile and variable block lengths.
- Width of streets, number of roadway lanes available.
- Effectiveness of regulations with respect to parking.
- Reasonable wave speeds safe for traffic and transit in particular districts.
- Length of cycle best suited to these block lengths and speeds.
- Split of cycle best suited to cross traffic and turns.
- Type of traffic (classes of vehicles and density) for various periods of the day.
- Volume of through traffic, cross traffic and turns at various intersections.
- Pedestrian movement at critical points.
- Operating characteristics of car and bus lines as to acceleration

rates, running speeds and time of passenger stops to accommodate the passenger interchange at various points and periods of the day. Car-bus density or headways required at various periods.

It is no exaggeration to say that any comprehensive signal installation which overlooks these considerations will tend to slow down traffic movement instead of expediting it and will constitute a serious economic burden on the community.

Further, we must challenge the viewpoint too often expressed or implied that if the movement and speeds of traffic and transit are not reduced by a new signal system below what they were before the installation, satisfactory results have been secured. The time has now come to demand positive rather than passive or negative results or else change the system.

Average street speeds are now too slow. The result of properly designed signals should be to increase the average speed rather than the maximum or crest speed of moving traffic. There is a certain moderate average speed which passes the maximum volume of traffic; above and below this, less traffic gets through a given artery in a given length of time. When speeds are very high, this situation is obviously due to the physical necessity for "stringing out" of the line of traffic for increased safe braking distance. Within the limits of permissible city traffic speeds, the factor of greatest importance in determining the volume of traffic that will get through a given artery is signal efficiency and not high crest speeds.

This efficiency may best be measured in terms of either the ratio of the width of the through "time band," during which traffic moves through a signal system without stopping, to the total "Go" time at the controlled intersection, or else by a percentage of the hour given to through movement. In other words, those signal installations are most efficient which permit the largest proportion of traffic to get through without stopping. Every signal stoppage of traffic represents a "pile-up" and "set-back" to succeeding "Go" signals.

In the first column of Table I under the "alternate-group, synchronous" signal system, the time band for through, non-stop traffic at present amounts to only thirteen seconds, due to the fixed equal timing at each intersection, and the inherent characteristics of the system, although the "Go" time for the artery under observation was 40 seconds. Thus the efficiency of the system from the viewpoint of through, non-stop traffic is 32.5 per cent. The proportion of total time devoted to non-stop through traffic is only 16.3 per cent. In the same table under the "progressive non-stop wave" signal system, the efficiency of the through traffic band may be raised to 83.5 per cent and the proportion of the total hour, available for non-stop through traffic movement, is 41.7 per cent.

INEFFICIENT SIGNALS CUT TRAFFIC CAPACITY

Signal installations group themselves roughly into five classes: (1) Isolated signals; (2) simple synchronous; (3) alternate-group synchronous (2 or more blocks); (4) alternate-synchronous (single blocks); and (5) full progressive wave systems.

Except in very special cases all of the first four are inadequate to the requirements of a heavy main line artery carrying both automobile and public transportation vehicles. The simple, isolated, automatic "go-stop" signal, with no timing relation to other signal installations on the traffic artery, is entirely unsuited to expedite traffic movement. It merely stops the traffic stream periodically for the purpose of allowing cross traffic to

move through. The simple synchronous or "hit run" system encourages over-speeding. In this system all signals on a master time circuit show "Stop" or "simultaneously. When electric cars are controlled such a system, a serious power problem is developed the simultaneous starting of all cars along the street.

The alternate-group synchronous or "stagger" system requires a rigid 50 per cent split of the signal. This is usually arranged to show successively "Stop-Stop," and "Go-Go-Go," etc., along a given street. Obviously there must be an excessive wastage in space, time and capacity and the signals permit only a very small percentage of time for non-stop through-traffic movement. The alternate (one block) synchronous installation is best adapted for uniform block lengths of six or eight blocks per mile. But this also requires a rigid

TABLE I—COMPARISON OF ALTERNATE-SYNCHRONOUS AND PROGRESSIVE SYSTEMS

	Alternate-Group Synchronous	Progressive Non-Stop Wave
Two-Mile Main Trunk—Skip Signalled (30 per cent—9 minor crossings on main trunk)		
Length of cycle, seconds.....	80	40
Cycle split along the street, seconds.....	Fixed 40-40	Variable
Width of through-traffic band, seconds.....	13	32.5
Efficiency of through-traffic band, per cent.....	32.5	83.5
Proportion of hour available for through traffic, per cent.....	16.3	41.7
Bus operations northbound:		
Speed through lights, m.p.h.....	11	5
Total running time, seconds.....	680	5
Running time, including passenger stops but excluding light delays, seconds.....	565	5
Delays due to lights only, seconds.....	115	
Proportion of time held by lights, per cent.....	20.4	
Bus operations southbound:		
Speed through lights, m.p.h.....	9.2	6
Total running time, seconds.....	854	6
Running time, including passenger stops but excluding light delays, seconds.....	643*	6
Delays due to lights only, seconds.....	211	
Proportion of time held by lights, per cent.....	33	
Automobile speeds (moderate traffic flow):		
Northbound, first car, entering signals, m.p.h.....	18.6	
last car, entering signals, m.p.h.....	14.1	
Southbound, first car, entering signals, m.p.h.....	18.6	
last car, entering signals, m.p.h.....	14.1	

Advantages of progressive system—Bus speed increased 20 per cent; time reduced four minutes (round trip). Useful street capacity for non-stop traffic increased three times. Average traffic speeds increased one-third.

*Due to more loading and fare collections southbound.

per cent split of the cycle time, and there is no wastage of time and street capacity due to individual signal timing.

NON-STOP PROGRESSIVE WAVE SYSTEM MOST EFFICIENT

The full progressive wave system represents the most efficient plan for the control of heavy traffic movement and provides the most uniform speed, maximum capacity and non-stop traffic flow. Such installations operate on a four-wire master control circuit with adjustable timers at each intersection and local power supply. The green "Go" signal moves along a street at predetermined speeds just ahead of the moving vehicles, and the vehicles have been separated into moving platoons. For traffic on main arteries outside heavily congested districts, this system may be installed with signals only at main intersections and with "Stop-Enter" boulevard signs to protect intervening points where only light cross-traffic occurs. This might be called the "skip-signal progressive wave system." It is especially adapted to meet the condition of very irregular block lengths which would otherwise make impossible a true progressive system at a reasonable wave speed. If put into effect with reasonable spacing so that each successive signal ahead is visible, it is usually adequate for all practical needs.

Observations made of typical signal installations indicate in a striking way the difference between good and bad signaling in its effect upon traffic movement. This effect is shown by breaking down the signal performance into five-second intervals. Only then is the full situation at a signal really revealed. Data covering full rush-hour periods, or an entire day, are totally inadequate for such an analysis in that they obscure the direct effect of the signals themselves upon vehicular movement. It is important to bear in mind that the time-unit of one second is the basic unit for studying signal performance, because a few seconds added to the timing

sents, by the solid line, a log of the number of automobiles passing through the signal in each cycle from 4:30 p.m. to 5:50 p.m. The scale at the right indicates the rate per hour of vehicular flow per hour represented by this movement through each signal cycle.

STOPPED VEHICLES REPRESENT DELAY

The dotted line on the chart represents the number of automobiles stopped at each signal cycle, waiting to proceed through the crossing. The relatively fixed capacity of the signal, regardless of the pile-up of waiting vehicles, is of particular interest. This occurred to an

extent which represented serious congestion after 5:25 p.m. Before 5:20 about one-third to one-half of the automobiles on the street were held up by this signal. But during the period of maximum congestion one-third more were held up than were put through in each signal interval. The fixed capacity limit of the signal, regardless of the number of automobiles waiting to pass the crossing, shows the effect of the cumulative delay resulting from the necessity of accelerating a stopped platoon of automobiles. In other words, the efficiency of a signal is automatically reduced when the system is such that the majority of vehicles is required to stop before proceeding through the crossing. For the signal under observation during the normal maximum movement, the automobiles already waiting for the "Go" signal just cleared the crossing. Consequently, practically every motor on the street was required to stop at this signal during this period.

The normal maximum movement was about 20 cars per "Go" signal of 27 seconds (two-lane). This represents a limiting rate of traffic flow amounting to about 1,340 cars per hour of elapsed time. Obviously, the main street needed more "Go" time, which it was impossible to provide in the alternate-synchronous system with equal divisions of the cycle time. The cross-time wastage of this installation amounted to at least 15 per cent of the cycle or 30 per cent of the total time given to the cross street. This, of course, could have been largely eliminated with a progressive system and the time then used effectively to clear the congestion on the main thoroughfare.

ISOLATED SIGNAL IMPROPERLY TIMED DELAYED TWO-THIRDS OF VEHICLES

In Fig. 2 are shown the effects of improper timing of an isolated signal on a similar heavy rush-hour traffic movement at a T street intersection. In this instance the cycle time was 55 seconds, split 33-22 seconds. A street car line stop on the heavy traffic artery interfered somewhat with the movement of traffic in two lanes. At the upper part of the chart, the solid line indicates the number of automobiles that passed the intersection per signal cycle. The scale at the right indicates the hourly rate of traffic flow per cycle and the dotted line the number of motors left waiting at the crossing when the main artery signal changed from green to red; i.e., the number stopped and "piled-up" beneath each "Go" signal. During two 10-minute periods, the waiting cars piled up

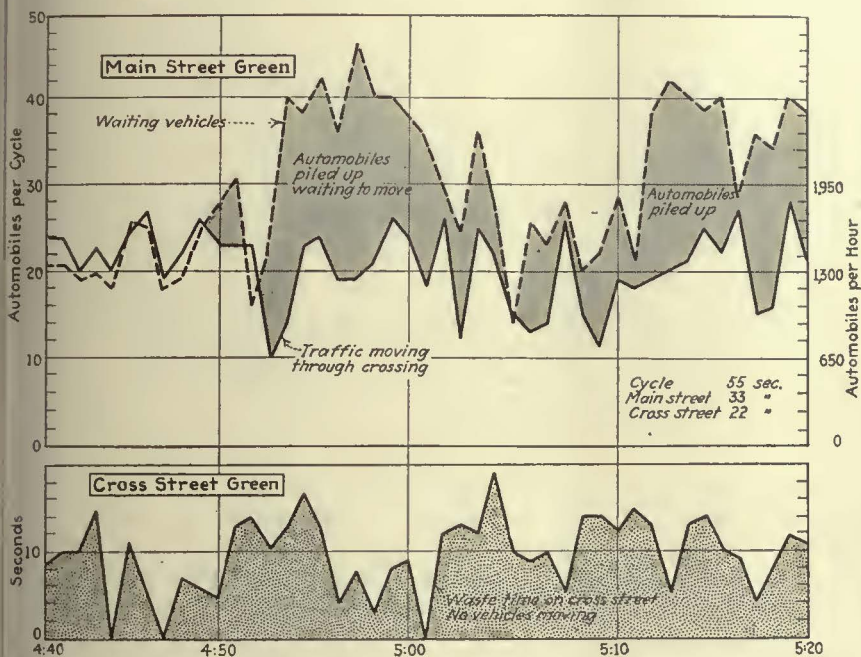
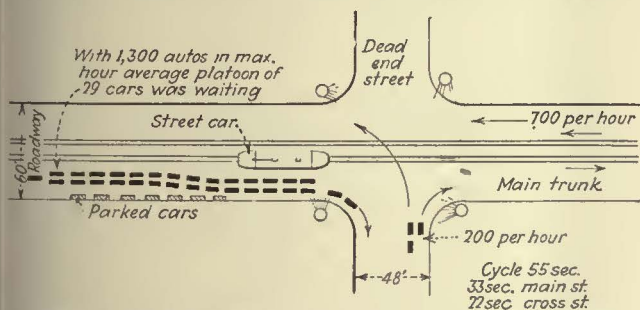


Fig. 2—Log showing effect of improper timing of isolated signal at a "T" crossing on a heavy traffic artery. The delay to through traffic and waste time on the cross street was subsequently eliminated by re-timing the signal



Observations for Fig. 2 were taken at this intersection

here or taken off there may mean the difference between blockades and free movement. Wasted time through improper signaling is always cumulative. This is brought out clearly in the accompanying charts showing the serious pile-up that may occur.

The data plotted in Fig. 1 were taken at the first signal of an alternate-synchronous system on a heavy traffic artery with a clear approach of 2,000 ft. The observations were made for a two-lane, outbound, rush-hour movement with a signal cycle of 54 seconds split equally for stop-go, 27-27 seconds. The vehicular traffic approaching the signal had been broken into platoons by previous isolated signals located 2,000 and 4,000 ft. ahead of the signal under observation. The chart repre-

to more than twice the number passing the signal at each "Go" period.

The highest points on the solid line in the upper part of the chart measure the limit of capacity for this signal; i. e., about 25 automobiles per cycle of 55 seconds (33 seconds of "go" indication), or about 1,640 automobiles per hour. Prior to the location of the automatic signal at this point, a manual semaphore operated by a skilled officer passed as high as 400 autos in fifteen minutes or at a rate of 1,600 vehicles per hour, because he was able to vary the length of the signals with the traffic flow. The cumulative congestion indicated in Fig. 2 was thus avoided.

The waste time on the cross street is observed by the lower curve in Fig. 2. Here the solid line shows the number of seconds in each cycle, with the cross street light showing green, but during which "Go" time was no cross-traffic moving. Most of the time allotted to this cross street was for left turn movements; necessary, but relatively small in number. This wastage averaged more than one-half of the total cross street "Go" time of 22 seconds per cycle. Since the observations in Fig. 2 were made, the hold-over to succeeding cycles at this point has been practically eliminated by changing the main artery "Go" period from 60 per cent of the total cycle to 70 per cent, illustrating the sensitiveness of signal timing.

COMPARATIVE ANALYSIS OF THREE TYPES OF SIGNALS

An illuminating analysis of the volume of traffic which is actually passed by various types of signal installations for varying conditions of traffic movement, is given in Fig. 3, which shows graphically a series of profiles of the traffic flow by five-second intervals. Curves A, B, and C, are plotted for the same signal and crossing as the traffic log in Fig. 1. These observations were taken at the entrance throat of an alternate-synchronous system. Curve A represents the normal rush-hour profile. After ten seconds of "Go," the traffic tapers off to the "straggler" movement at the end. Curve B shows the condition at the same point after 5:25 p.m. (see Fig. 1), when saturation had been reached and more automobiles arrived at the signal per cycle than could be passed. It will be noted here that the delay resulting from the need for waiting automobiles to accelerate, after the signal flashed green, had the effect of retarding the movement so that it was not until six seconds after the "Go" signal flashed that those motors were able to clear the intersection. As the traffic stream got under way, the rate of flow rose to four cars per five-second interval at the end of fifteen seconds. Then, the delay again resulting from the "stringing out" of motors farther back in the platoon of waiting vehicles, caused the rate of flow past the signal to drop again to about $3\frac{1}{2}$ cars per five-second interval at the end of 25 seconds. Finally, as the traffic got well under way, cars crowded through fast enough by "running the amber" to raise the five-second rate of flow sharply to about $4\frac{3}{4}$ cars in the last interval, whereupon the signal flashed "Stop" and those unable to get through were forced to pile up waiting for the next green signal.

Curve C is for selected large platoons averaging sixteen waiting autos during the period of observation. This represents the rate of flow when cars were moving freely through the crossing without congestion, and nevertheless in sufficient volume so that there was less waste of "Go" signal time. It will be noted that the curve here is fairly flat topped, but there will always be some delay

in flow at the beginning of the cycle because of the slow acceleration of stopped vehicles. The rate of flow after ten seconds, however, holds fairly uniform at four to 4.5 cars per five seconds.

Similar studies were made for the isolated signal in Fig. 2. Curve D shows the rate of flow of selected maximum platoons for this signal, which is also a flat topped curve. Here, the average rate of flow was 1.5 autos in 40 seconds, or about 1.5 seconds per vehicle. With 70 per cent of the time given to the main street, this signal has an output of 1,700 autos per hour, for two-lane movement and an average pile-up of twenty autos.

ALTERNATE-SYNCHRONOUS SYSTEM INEFFICIENT FOR HEAVY FLOWS

Curve E is the profile of traffic flow in the middle of an alternate-group, synchronous system and at the second signal of a two-block group timed in unison. Here the platoon peak, moving up from the first signal of the group, arrives late, and practically one-half of the "Go" time and street use is wasted, only stragglers or turns from cross streets appearing in the first fifteen seconds. There is no help for this wastage in this staggered arrangement. It is likewise obvious from the profile that the cycle is too long for the traffic.

These studies indicate the capacity of signaled intersections where traffic flow is stopped. This "throttling" effect occurs at the first signal of any signaled zone and every isolated signal and is the cause of the slow average speed and low capacity of the synchronous and alternate-synchronous systems in which the flow of traffic is interrupted many times during its passage through the signaled section. Only when signals are progressively timed so that traffic can flow through at a predetermined rate of speed without stopping, can this wastage of time at street capacity be largely eliminated. On account of the throttling effect shown here, the first or entering signal should always be at a fairly light traffic intersection, at least a block or so preceding the first heavy point. Then there will be a smooth flow in uniform moving platoons instead of the usual hit-and-run or caterpillar-like action of the traffic streams.

When the signal cycle time and split are fixed and inflexible, it is quite clear that the volume of traffic that can pass is automatically limited and is not increased by increased pile-up or pressure of vehicles. In fact, the congestion thus caused actually tends to cut down the volume that can pass in a given time, due to the delay resulting from the need of accelerating waiting groups of cars that have been stopped. Any signal system, to be most effective on heavily traveled arteries, should be capable of timing adjustment for the heavy traffic rush-hour conditions and speeded up during non-rush

LONG CYCLES A COMMON EVIL

Since any type of signal system has the effect of cutting the traffic stream into groups of cars or platoons, that cross traffic can pass during the intervals, it is quite evident that the groups or platoons and the tendency to pile up and delay these platoons will be decreased in size as the signal cycle is shortened. Disregarding the delay to cross traffic from long cycles, it is the confusion of the pile-up and the extra acceleration time required, when a large number of cars is held up, that slows down the main line movement. Short cycles are also a distinct hazard to street cars and buses in making time.

Stragglers are the bane of efficient street usage. T

chief cause of unnecessary delay of traffic under manual regulation by police is the holding of a crossing open for stragglers. In general, the shorter the cycle, the less this wastage, but it can be entirely eliminated only by intensive training of traffic men.

Possibly an entirely new system of combined automatic, manual-progressive wave will have to be developed; that is, a wave system with superimposed manual controls to vary the cycle division slightly at any time

of green signal, pedestrians walking at the rate of 4.5 ft. per second should clear comfortably the widest six-lane street—54 ft. roadway—and have three seconds green-amber for additional safety. With wider roadways, center safety zones should be provided. From a practical point of view this separate period is usually out of the question. Pedestrians must be educated and, if necessary, constrained to move with the "Go" traffic. But their patience should not be overtaxed by long cycles compelling them to wait—in exaggerated cases well illustrated in New York—three or four minutes at a single crossing. A considerable proportion will not obey any signal.

WHEN TO BEGIN SIGNALING

While much depends upon the traffic characteristics, volume and hazard at each intersection, it appears that today many signals have been installed long before they are really needed, except perhaps in rush hours. Once installed, they are continued in operation, usually without change in timing, from dawn to late evening. The maximum hour or half-hour traffic should control signal operation, measured in terms of the heaviest traffic in any given direction, as well as the total traffic of the intersection. The analysis of the time-unit data herein presented and street conditions observed seems to point to a minimum limit in very round numbers of 500 to 1,000 vehicles in one direction per hour, two lanes, at normal intersections. This is a much higher density than observed in many new signal installations, even during rush hours.

The sensible plan, in starting a signal installation, would appear to be to signal a heavy traffic street only at critical crossings where vehicles or pedestrians find difficulty in crossing the main traffic, i.e., the skip signal plan. The street should be so waved with a signal ahead

always in sight so that additional intersections could later be "cut in" upon the same control circuit.

It appears entirely indefensible to install signals merely to save policemen, especially signals of an obsolete or inefficient type which must inevitably react upon and depress city transportation speed. The full-wave system or none seems imperative today for heavy arteries.

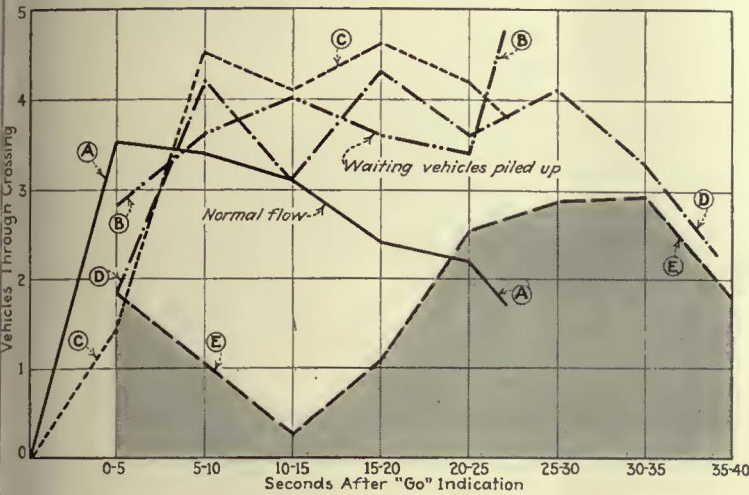
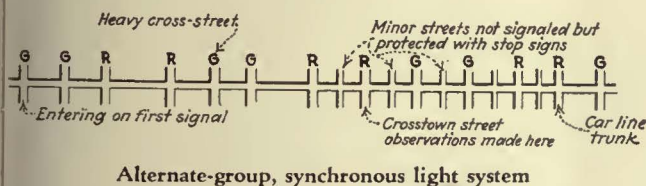


Fig. 3—Profiles of traffic flow by five-second intervals for various types of signals and traffic conditions

Curves A, B, C are based upon observations at the first signal of an alternate-synchronous system, timed 27-27 seconds (54-second cycle). "A" is the traffic flow during normal rush from 4:27 to 5:22 p.m. "B" represents the flow through the crossing when waiting platoons were larger than the signal could pass. Curve C is plotted from selected maximum observations under conditions where all waiting vehicles cleared the crossing. Curve D represents selected maximum results at an isolated signal on a heavy trunk street, timed 39-18 seconds (57-second cycle). Curve E illustrates the situation at the second intersection of an alternate-synchronous system on a heavy traffic street, with the signal timed 40-40 seconds (80-second cycle).



that this becomes necessary to relieve impending jams. It is quite probable that in central district traffic control, a combination of both wave signals and highly trained officers will continue to be needed, particularly when a great number of pedestrians require control. This seems both logical and necessary under certain conditions of traffic.

SEPARATE PEDESTRIAN SIGNALS UNNECESSARY

It is quite common, particularly in small cities, to provide separate periods on the signal system for pedestrian movement. In the great cities there is constant conflict between the consideration of safety on the one hand and the pressure of traffic on the other.

From the time analysis presented here, however, it seems quite clear that street time is too valuable, and the necessity of expediting the movement of mass transportation vehicles is too great, generally, to justify the reservation of a separate period for pedestrian movement. This would need to be at least fifteen seconds or 25 per cent of a normal 60-second cycle. With twelve seconds

Do High Buildings Cause Traffic Congestion?

One hundred and fifteen years ago the traffic problem was troubling London!
An outstanding English jurist, in a now famous decision, said:

"The King's highway is not to be used as a stable yard."

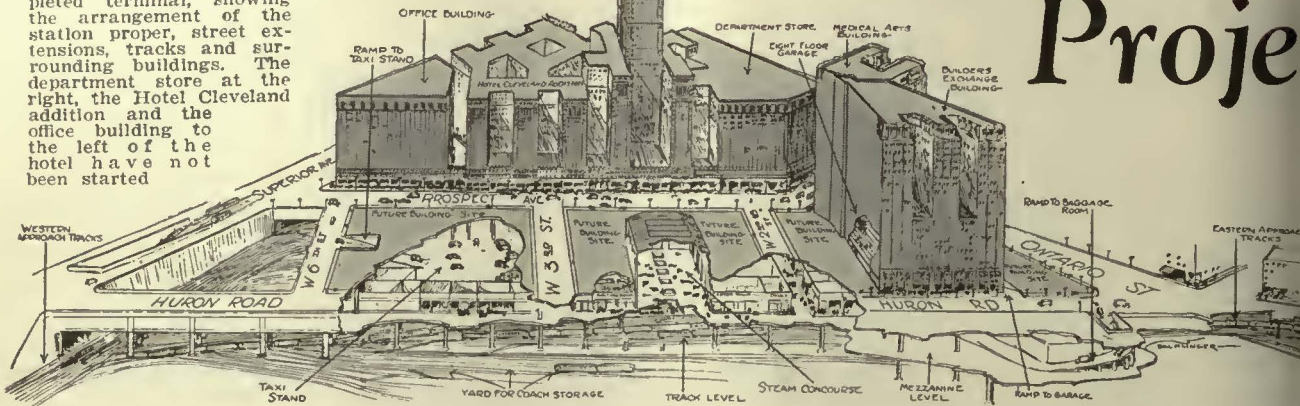
One of the industry's outstanding transportation engineers and traffic experts presents amazing new facts on the traffic problem.

Read This Remarkable Article Next Month

Cleveland Terminal

Proje

Phantom view of the completed terminal, showing the arrangement of the station proper, street extensions, tracks and surrounding buildings. The department store at the right, the Hotel Cleveland addition and the office building to the left of the hotel have not been started



LONG handicapped by its inaccessible, ill-appearing railroad stations and by the lack of rapid transit facilities, the city of Cleveland soon will be able to boast of one of the largest and finest railroad terminals in the country. It may also have, in the metropolitan area, a completely co-ordinated transportation system, including steam railroads, rapid transit lines, interurban railways, street cars and motor buses. The Cleveland Union Terminal and 17-mile electrified right-of-way are rapidly nearing completion and will be in service at the beginning of next year. The co-ordinated transportation system, however, is still very uncertain. A number of proposals have been made and one, the proposal of the Van Sweringen interests, is before the Cleveland Railway stockholders for their approval and the deposit of stock.

Although the Terminals Company has designed the station to accommodate commuter trains and has allowed for extra tracks along the electrified line, they have made no definite announcement of an extensive rapid transit plan. It is known that they will operate into the terminal the line to Shaker Heights, which at present reaches the Public Square over city streets, and that another line is being projected along the Nickel Plate right-of-way, but even the details of these two lines relative to stations, service, etc., have been withheld. The Van Sweringen proposal now before the Cleveland Railway calls for the co-ordinated ownership and operation of the Cleveland Railway's property and the rapid transit facilities, existing and proposed. This would be effected through the formation of a holding company, known as the Metropolitan Utilities, Inc., which would acquire ownership of the Cleveland Railway, the Cleveland Traction Terminals Company, the Traction Stores Company, the Cleveland Interurban Railroad and the Cleveland & Youngstown Railroad. The Cleveland Traction Terminals Company holds a lease from the Cleveland Union Terminals Company, giving it exclusive rights in the

Development includes union station, designed for rapid transit lines as well as steam roads, 17-mile electrified right-of-way and 52-story building. Co-ordination of all transportation facilities in metropolitan area through new holding company proposed

electrified terminal zone and also the concession area in the terminal. The plan, which would give the Van Sweringen interests complete control of all the local transportation services in greater Cleveland, has been approved by the directors of the Cleveland Railway, but will not become effective unless 50 per cent of the stock of the railway is deposited with the Cleveland Terminal Company.

Should the plan go through Cleveland will have a completely co-ordinated system of transportation facilities,

including street cars, motor buses and rapid transit lines. The advantages of such a system to both citizens of the city and the transportation company can be fully estimated. It would enable the combined interests to serve the public in the most economical and efficient manner and would give the public a maximum of service. It has been clearly demonstrated in the transportation field that competition is extremely destructive of the operating companies and that eventually the public suffers from poor service.

Before the Van Sweringen proposal was made to the Cleveland Railway, the railway engaged the services of Parsons, Klapp, Brinckerhoff & Douglas to make an intensive study of transportation requirements in the metropolitan area of Cleveland. The firm recommended a comprehensive system of rapid transit embracing the entire area, and in addition recommended that the street railway cars in the congested areas of the city be placed beneath the surface and operated into an underground terminal in the Public Square, appropriately connected to the rapid transit terminal in the Union Station. The routes, all of which terminate at Public Square Terminal, are as follows: (1) The Nickel Plate right-of-way from Dille Road; (2) The Nickel Plate right-of-way from Rocky River; (3) The Shaker Heights line from Brainard Road; (4) Euclid Avenue from Euclid 120th Street, or as an optional route, Euclid Boulevard from its intersection with the Nickel Plate right-of-way

By **CLIFFORD A. FAUST**

Assistant Editor
Electric Railway Journal

Nearing Completion

to Euclid Avenue, and thence via Euclid Avenue; (5) St. Clair Avenue, from Woodworth Avenue and the Nickel Plate right-of-way along Woodworth Avenue to St. Clair Avenue and thence via this avenue; (6) Big Four Railroad right-of-way from Linndale; (7) West 25th Street from Brook Park Road, and (8) Erie Railroad right-of-way from Warrensville Center Road.

The Brinckerhoff report recommended that the costs of subways or elevated structures, along the routes similar to those indicated by items 4, 5 and 7 in the schedule of rapid transit routes, should be borne approximately as follows: one-half by a special assessment upon the property benefited, one-fourth by general taxation and one-fourth by the riders using the facilities. The cost of

the other routes should be borne by the Van Sweringen interests, according to the report. The cost of equipment necessary to operate, including track structures, electrical conductors, power facilities, etc., should be borne by the operating company, it states. The report recommended that the Nickel Plate right-of-way to the east, which is about ready for the operation of rapid transit, be selected as the first route and that the Nickel Plate route from the west to the east be made the backbone of the system. The plan described in the report was developed for a single unified system of rapid transit, surface cars and buses, with convenient interchange of passengers at transfer points.

No action will be taken on the proposed routes in this report until the Cleveland Railway stockholders indicate whether or not they wish to accept the Van Sweringen proposal. Van Sweringen executives have declined for the present to comment on the proposed routes.

ANOTHER COMPANY OFFERS SUBWAY PLAN

Opposition to the formation of the Metropolitan Utilities, Inc., has been offered by the Cleveland Subway Company, backed by the Equitable Trust Company of New York. Raymond T. Cragin, spokesman for the company, has offered to build subways to be owned by the city of Cleveland and operated by the Cleveland



The electrified zone extends from Collinwood on the east to Linndale on the southwest, a distance of 17 miles. The present routes of the New York Central, Nickel Plate, Big Four, Baltimore & Ohio, Erie and Wheeling & Lake Erie and how these roads will or will be able to tie into the new right-of-way are shown

Railway. He advised Cleveland banks to delay the deposit of trusted Cleveland Railway stock under the Metropolitan Utilities offer, claiming that terms more favorable to the stockholders may be made by the Cleveland Subway Company. The proposal of Mr. Cragin has been ignored by the City Council, and probably will not gain much favor over the other proposals, even though he is backed by powerful monied interests to carry out his plans.

While proposals are being made for rapid transit systems, subways, etc., the Cleveland Union Terminals Company is making rapid



Work is progressing rapidly on the Union Station proper. This view shows a portion of the station construction with its two levels below the street



View of the terminal area from the west

This view shows the Public Square at the left, the Cleveland Hotel, the Terminal Tower Building, the 100-ft. Prospect Avenue extension, the roof of the station proper and the steel work for the Huron Road extension on the right. The raised part of the station is the roof of the main steam concourse.

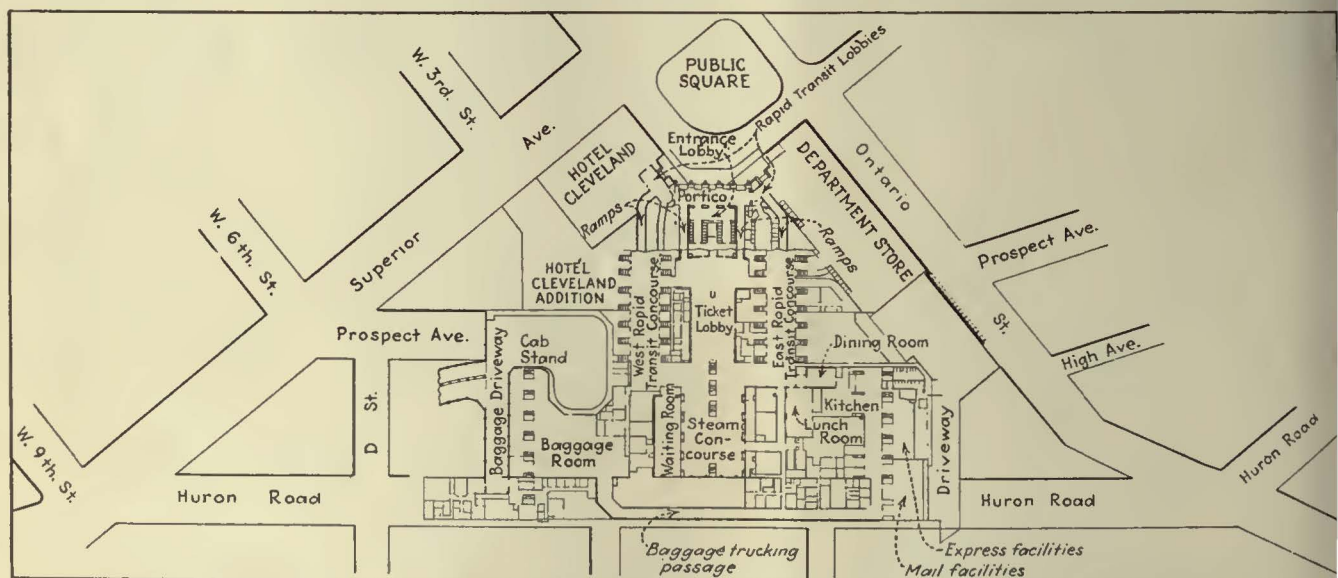
progress on its terminal project and electrified right-of-way. The New York Central Railroad, the New York, Chicago & St. Louis Railway (the Nickel Plate) and the Cleveland, Cincinnati, Chicago & St. Louis Railroad (the Big Four) will be the guarantor users of the station, while three others are likely to come in as rental users.

abandon its station and if successful will come in. With these six railroads using the Union Station, only one other passenger steam railroad in the city would not be in—the Pennsylvania.

The importance of having these six railroads using the station adjacent to the Public Square of Cleveland is

It has been reported that both the Baltimore & Ohio Railroad and the Erie Railroad will come in and though no official announcement has been made it is almost a certainty that they will enter the new station.

The Wheeling & Lake Erie is the third railroad which no doubt will use the terminal. It has petitioned the Interstate Commerce Commission for the right to



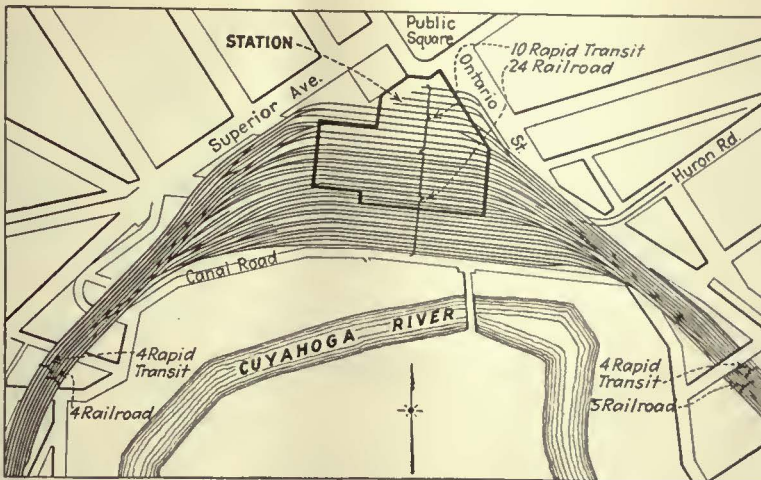
Floor plan of the station, showing how the steam railroad and rapid transit passengers are to be segregated

difficult to estimate in its true proportion. The city has long been compelled to use inadequate stations, located at inaccessible points and not convenient to the business section of the city. The new development is certain to create a new industrial growth in Cleveland and will help to establish its prestige as one of the foremost cities in the country.

PRESENT ROUTES

Passenger trains of the New York

Central now operate over the Lake route from the eastern part of the city to the Union Station, continue for a short distance along the lake after leaving the station and then go in a southwesterly direction through the city. The freight trains, however, are shunted over the Short Line, which joins the main line in the southwest part of the city and at Collinwood on the east. Under the new plan passenger trains from the East will change locomotives at Collinwood, and then proceed over the new electrified right-of-way to the union terminal. They will then continue to Linndale, where they will change to a steam locomotive again. Trains in both directions will use one locomotive between the easterly limits of the electrified zone and the westerly limits.



The initial track layout at the station calls for six rapid transit tracks and 22 steam railroad tracks, twelve of which will be used for the station, one for a by-pass and nine for a yard. The final layout will have ten rapid transit tracks and 24 steam road tracks

each train will pass over the present line of the railway and wait for its train at the westerly power changing point, 2.40 miles from the station.

The Big Four, which terminates its line at Cleveland, will continue over the same route as at present and will change from steam to electric power at Linndale, 5.84 miles southwest of the station. Should the other three railroads come in to the terminal, the Baltimore

& Ohio, the Erie and the Wheeling & Lake Erie, the physical connections can be made quite easily. All three roads come into Cleveland from the south and pass near the easterly approach of the electrified right-of-way.

The electrified zone is 16.58 miles long, extending 10.74 miles on the east to Collinwood and 5.84 miles on the southwest to Linndale. It uses the tracks of the New York Central and the Cleveland Short Line, the freight line of the New York Central, from Collinwood to the juncture with the Nickel Plate at East 105th St. It then uses the Nickel Plate right-of-way to the easterly terminal limits near East 40th Street. The easterly approach to the station of the terminal zone proper passes to the southwest of Pittsburgh Avenue, Broadway, Orange Avenue and Ontario Street. The terminal zone extends on the west to West 37th Street, making a total distance between the limits of approximately 4 miles. The westerly approach is made through a cut in the



The station is approached from the west by a viaduct two-thirds of a mile long, extending completely over the Cuyahoga flats

The Nickel Plate route at present leaves the lake east of Cleveland, goes inland approximately 2 miles and then follows the Cuyahoga River to its station. Going west the route approaches the lake front again. When the new terminal is in use, the Nickel Plate westbound trains will change locomotives at a point 2.26 miles east of the station. The steam locomotive for



The easterly approach to the station is located at the immediate left of the street shown in this view. This required a deep cut and the construction of high retaining walls

bluff overlooking the Cuyahoga flats and over a viaduct two-thirds of a mile long, passing over the Cuyahoga River and flats. The Big Four right-of-way is used from the westerly terminal limits to Linndale on the south. Additional tracks are being added on the Short Line, Nickel Plate and Big Four rights-of-way to handle the increase in number of trains over the new route. This work required a number of cuts and fills and also the widening of several bridges. The elimination of all grade crossings along the Nickel Plate between Kinsman Road and East 93rd Street required the construction of eight bridges.

OVERHEAD CATENARY TO BE USED

Power will be purchased from the Cleveland Electric Illuminating Company and delivered from two independent sources to two semi-automatically controlled substations, one located $3\frac{1}{2}$ miles west of the terminal and the other $7\frac{1}{4}$ miles east of the terminal. These substations



Portion of the Culberson cut, part of the easterly approach to the station. It was necessary to make several large cuts and fills for the electrified right-of-way

will supply 3,000-volt direct current to an overhead catenary construction. In order to equalize potential, circuit-breaker houses are provided at six points.

Substation No. 1, located west of the terminal, will contain three 3,000-kw. synchronous motor-generator sets. Each set is driven by a 3,600-kva., 11,000-volt, 60-cycle synchronous motor, running at 360 r.p.m. On either side is a ten-pole, 1,500-kw., 1,500/3,000-volt generator, the two generators being connected in series to supply 3,000 volts to the outgoing feeders. Six 11,000-volt, three-phase, incoming lines are provided for this station and six 3,000-volt, 2,000-amp. direct-current feeders for the outgoing lines.

Substation No. 2 will contain two motor-generator sets, with provision for installing a third later. It will have four incoming lines and six outgoing 2,000-amp. direct-current feeders. Both substations will be of the unattended type and will be equipped with complete automatic control for the motor-generator sets and all of the auxiliary apparatus. The supervisory control system will be centered in the power dispatcher's office. The electrical equipment for the substations and circuit-breaker houses will be supplied by the General Electric Company.

The locomotives selected for handling trains in and out of the terminal have a total weight of 204 tons with 150 tons on the driving wheels. They are 80 ft. long, inside the knuckles, and 13 ft. 2 in. high, from rail to cab roof. The rigid wheelbase is 15 ft. and the total

wheelbase 69 ft. A total of 22 locomotives of this type are to be built for the initial operation. The electrical equipment will be supplied by the General Electric Company and the mechanical parts by the American Locomotive Company. Commonwealth Steel castings will be used for the running gear and cab underframe.

The service calls for the handling of Pullman trains weighing as much as 1,275 tons trailing, the equivalent of seventeen 75-ton cars. The six twin-g geared driving motors using 3,000-volt direct current will have a total rating of 2,900 hp. at the one-hour rating and 2,465 hp. continuously. The tractive effort at the one-hour rating will be 29,200 lb., and 23,600 lb. continuously. The locomotive will have a maximum speed of 70 m.p.h.

Although no details of the rapid transit equipment have been made known as yet, it is almost certain that multiple-unit motor cars will be used. Third rail probably will be used for supplying the current to the trains.

The standard A.R.A. signal system will be installed in the terminal area. The signals will be controlled from a building near the station, which will house the control relays, the interlocking system and other equipment.

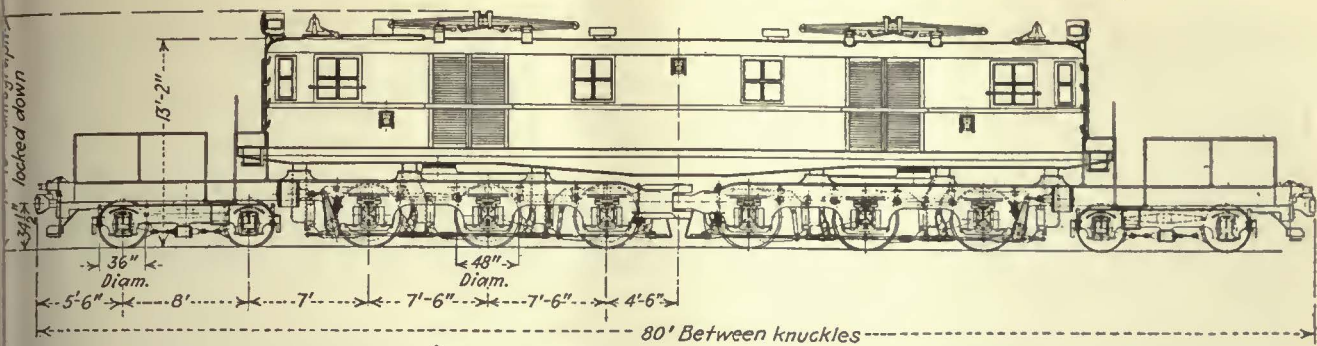
ADVANTAGEOUS SITE SELECTED FOR STATION

Aside from the great advantage of being near the center of the city and adjacent to the business district, the new station site holds other distinct advantages. The principal one is the securing of a station on high ground, approximately at the level of the main business section. This is not only more convenient for steam railroad passengers but almost necessary for rapid transit use. Locating the station on high ground required the building of a long viaduct over the Cuyahoga flats, but this gave a more direct route to the Big Four right-of-way and also provided a bridge over the river high enough to permit passage of all boats. The station area, which comprises 35 acres, is bounded by Public Square, Ontario Street, Superior Avenue, Columbus Road and Canal Road.

The station is so designed that rapid transit passengers and steam railroad passengers are completely segregated. The steam passengers enter the central part of the station, by way of two ramps from the portico of the Terminal Tower Building, while the rapid transit passengers use a concourse on either side of the central section, each concourse being reached by a ramp from a separate lobby in the front of the building. By this arrangement there is no confusion between the two classes of passengers, and each section can be reached from the outside without passing through the other. The two rapid transit concourses are 59 ft. wide and approximately 320 ft. long.

The central section for steam road passengers is 450 ft. long and varies in width from 91 to 175 ft. It is divided into three principal sections: a lobby at the foot of the ramps, 154 ft. wide and 75 ft. long, a ticket lobby, 91 ft. wide and 103 ft. long, and a concourse, 120 ft. wide and 235 ft. long. Adjacent to the concourse is a large waiting room, 163 ft. long and $55\frac{1}{2}$ ft. wide.

On the west side of the main part of the station are the cab stand and baggage room, both having ramps to the street. On the east side are facilities for handling express and mail, with suitable passages and drives to the street. A number of service shops, including a barber shop, lunch room, dining room and parcel room, are located on this side also. The entire station is designed to give a maximum of shop space, so that a large number of stores will be located in the terminal.



A total of 22 electric locomotives of this type are to be built for the initial operation

The platforms for steam trains are reached by stairways in the center of the main concourse, while those for the rapid transit trains are reached by stairways from the side concourses. The final track layout at the station will include ten tracks for rapid transit, four of which will terminate at the station, and 24 for steam trains. However, for the initial layout only six rapid transit tracks will be laid, and of the 24 steam tracks, only twelve will be in the station. One of the other tracks will be used as a by-pass track, while the others will be used as a coach yard. As the station is expanded the tracks in the coach yard will be pressed into service. On the rapid transit side only one track will be laid between adjacent platforms, giving a platform for each track. On the steam side two tracks will be laid between adjacent platforms.

Initially there will be two rapid transit and two railroad tracks on the east approach and two rapid transit and two railroad tracks on the west approach. The final layout, however, will have four rapid transit tracks and five steam railroad tracks on the east approach and four rapid transit tracks and four steam railroad tracks on the west approach.

The district surrounding the terminal is rapidly becoming a busy commercial and business center. The Terminal Tower Building, which is constructed over the station proper, is an imposing 52-story structure, with a total rentable floor space of 560,000 sq. ft. Adjacent to it is the Cleveland Hotel with its 1,000 rooms. An addition to this hotel to give 700 more rooms is being planned, and another site is available at the intersection of Superior Avenue and Prospect Avenue Extension for another building. On the east side of the Terminal Tower Building another large site

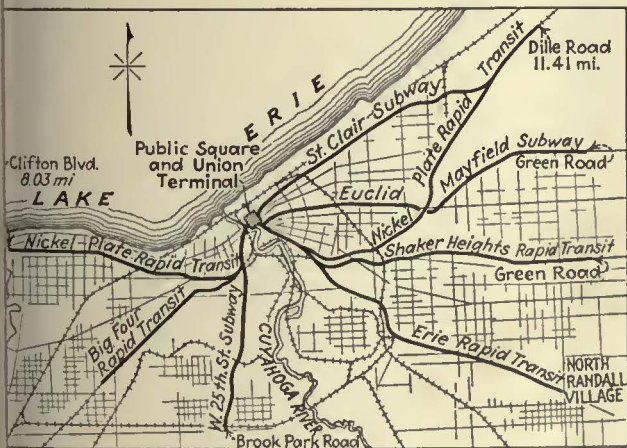
is available, for which a department store is being planned. The terminal is so designed that two 100-ft. boulevards will pass over the station. One of these, Prospect Avenue Extension, joins Superior Avenue with Prospect Avenue. The other, Huron Road Extension, joins Superior Avenue at West Ninth Street to Huron Road. Three streets, West Second, West Third and West Sixth, will join the two extensions. By this arrangement maximum use can be made of air rights over the terminal.

Two buildings are nearing completion between the two extensions and a third will be started soon. The two that have been started are the Medical Arts Building of eighteen stories, for those engaged in the medical or allied professions, and the Builders Exchange Building, also an eighteen-story structure. The lower nine floors of this building are a garage with suitable floor sections to the Medical Arts Building which adjoins it. The building to be started soon is the Midland Bank Building, also to be eighteen stories high.

FIRST TRAIN TO USE TERMINAL IN JANUARY

The work has advanced to a point that it is expected to operate the first train through the terminal in January, 1930. At the present time all retaining walls between Collinwood and East 105th Street are completed, work is well underway on the bridges being built, and the work of widening the right-of-way is progressing rapidly. From East 105th Street to East 40th Street the work on the bridges is being hurried, while the grading is practically all completed. The east approach, between East 40th Street and the station, is almost finished. In this section will be three bridges, to span Broadway, Central Avenue and Eagle Avenue.

The west approach also is practically finished. All the steel has been erected on the Cuyahoga viaduct, and the work of laying the concrete deck to support the track ballast is well along. The station proper is largely completed, all the framework having been erected and the actual finishing being well under way. All major contracts have been let, including those for the tracks, the platforms, etc. Prospect Avenue Extension is actually completed, and practically all of the steel for Huron Road extension has been erected. The Terminal Tower Building has been in use for some time, and all excavation has been completed for the department store to adjoin it. The steel has been finished on the Medical Arts Building and the stone is rising. The steel for the Builder's Exchange Building also is almost all in place. By the end of 1929, practically every part of the terminal development, including the electrification system, will be completed.



An extensive rapid transit system was proposed in the Brinkerhoff report to the Cleveland Railway, the lines reaching in several directions from the Public Square and new Union Terminal

Industry Fundamentals Discussed by Mid-West Executive

DURING two days of spirited discussion, executives of properties in the Mid-Western and Southwestern sections of the country, meeting in the second group conference held under the auspices of the Advisory Council at St. Louis, Mo., on April 22 and 23 addressed themselves earnestly to the broad and basic economic, technical, political and operating problems with which the local transportation industry of the country is confronted.

In utmost good humor and in the spirit of interchanging frankly ideas regarding the industry's general situation and outlook, but nevertheless with an apparent determination to dig to the bottom of some of the fundamental questions presented, debate at times waxed warm as those in attendance entered fully into the purposes and spirit of the conference. Practically all of those in attendance participated in the discussion of subjects under consideration, or asked questions of speakers presenting their several points of view. The topics of primary interest which were thus covered spontaneously, with no prepared program or addresses arranged in advance, included competition in local transportation with particular reference to various forms of taxicab operation; rates of fare and the general problem of developing a scientific rate structure for local transportation service; fundamentals of local transportation franchises and the principles which should govern the relations between a local transportation company and the community it serves; relation of transportation to other forms of utility service; taxation, paving charges and other forms of imposts levied upon local transportation companies; and the importance of speed and frequency as elements determining the character of service and its attractiveness to the public; skip stops; express operation and combination services with cars and buses as means of improving service to the community; one-man operation of cars with respect to its effect upon the cost and quality of service; advantages of new cars in attracting patronage and decreasing operating costs.

CHAIRMAN CITED NEED FOR STUDY OF FUNDAMENTALS

"If nothing more comes out of this meeting than the crystallization of thought upon the need for serious study of many fundamental phases of local transportation economics and the industry's relation to the communities which it serves, the St. Louis conference will go down in the history of the industry as one of the great milestones in its rehabilitation." In these words J. N. Shannahan, chairman of the Advisory Council, who presided, summarized and characterized the breadth and significance of the views presented during the meeting. Those who participated in the discussion included J. P. Barnes, president of the American Electric Railway Association; Chairman Shannahan; Jeff Alexander, Houston; W. W. Holden, San Antonio; R. F. Kelker, Jr., Chicago; M. B. Lambert, New York; F. G. Buffe, Kansas City; G. W. Welsh, East St. Louis; Leo Bozell, Omaha; Samuel Riddle, Louisville; Charles Gordon, New York; R. J. Lockwood, St. Louis;

Electric railway executives of properties in Mid-Western and Southwestern states participated in two-day conference at St. Louis, during which the value to the entire industry of these new group conferences under the auspices of the Advisory Council was clearly demonstrated.

C. D. Porter, Omaha; P. Groner, Kansas City; Sta. Clark, St. Louis; Leslie Vick, New York; A. J. Fink, St. Louis; S. W. Greenland, St. Louis; E. B. Meissner, St. Louis; C. Birney, St. Louis.

"Pessimism among electric railway executives is just only," said President Barnes. "It leads to closer analysis of

business. The primary concern of the entire industry he explained, "and the focal point toward which all discussion of other problems leads, is the disturbing trend of gross receipts of local transportation properties. Toward overcoming this primary threat to the future as well as the present financial status of the industry, all efforts should be concentrated." President Barnes outlined the development of zone-fare taxicab service in Louisville and urged the need for a close study of this development by electric railway men.

SCIENTIFIC RATE STRUCTURE NEEDED

Mr. Alexander discussed the development and experience with the fare structure in Houston and other Texas cities, consisting of a 10-cent cash fare, 10-cent tokens for 25 cents, and 5-cent weekly passes sold for a small sum per week to permit wholesale users of transportation service to obtain an attractive rate. In the discussion on this question, Mr. Holden added a description of the zone system in effect in San Antonio which is superimposed upon a similar fare structure to provide for a special combination of street car and taxicab service designed to appeal to the public desire for special transportation service of high quality. Mr. Holden called attention to the advantages of small units in rendering this character of service.

Need for concentrated study and more general agreement upon the fundamental principles of transportation franchises, and particularly upon the proper division between the community and the operating company responsibility as to the financial results of operation was advanced by Mr. Kelker. Ensuing discussion brought out many phases of the relation between operating companies and the communities they serve and of the relation between transportation service and the development of cities. A note of caution was sounded regarding the evidence in the industry of a tendency to lean toward the idea of subsidy as a solution of the industry's economic problems. There was general agreement, however, upon the justification of demanding relief from those forms of special taxation which impose a severe burden on transportation operation, and from burdensome taxation out of all proportion to that imposed on other industries. It was suggested that the industry has shown some evidence of inferiority complex in approaching the admittedly difficult task of obtaining relief from these unequal economic burdens. Discussion of one-man operation brought out several divergent points of view, but a general agreement seemed to be reached that one-man operation, skip stops and all other similar measures should be adopted with a primary view toward improvement of service rather than as measures to conserve economy in operation.

New Car Survey

Shows Increased Net on Many Properties

This is the first of three articles giving results of a industry-wide survey of electric railways which have been outstanding purchasers of new rolling stock during the past seven years. The financial status of 41 properties has been improved materially with the purchase of 5,514 cars, or less than one-third the total operated on them

turning a deficit into a surplus and keeping the road in operation. To determine just what has been accomplished and what may be expected a survey has been completed by this paper. Where new cars have been on the properties a sufficient time, results of operation show a definite improvement in comparison with other roads all with the period immediately preceding the introduction of new cars on the same roads.

The survey has been conducted in two ways. An analysis of the returns to the American Electric Railway Association for the years 1927-28 was made to determine if there was any difference in financial results between those roads that are known to have bought a considerable number of new cars in recent years and other properties which have few new cars. A discussion of the figures is given in the present article. Then inquiries were sent

to a number of representative roads that have shown marked progress in modernization. From the detailed results have been obtained, giving the comparison of roads with new cars wherever it was possible to segregate the records. Some of the results are included in this article and the results will be analyzed in a future article.

By
MORRIS BUCK
Engineering Editor
Electric Railway Journal

EVIDENCE continues to accumulate that new cars are not only paying their way, but are of immense benefit to those electric railways that have installed them. To many systems they have been the means

of turning a deficit into a surplus and keeping the road in operation. To determine just what has been accomplished and what may be expected a survey has been completed by this paper. Where new cars have been on the properties a sufficient time, results of operation show a definite improvement in comparison with other roads all with the period immediately preceding the introduction of new cars on the same roads.

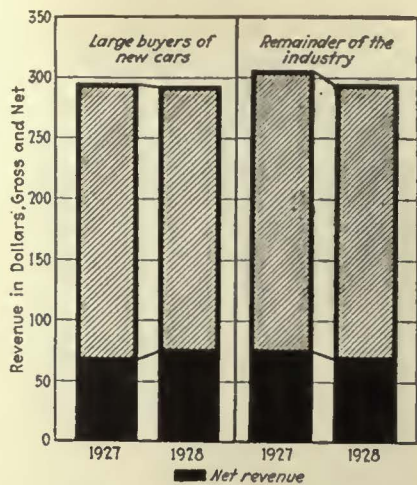
The survey has been conducted in two ways. An analysis of the returns to the American Electric Railway Association for the years 1927-28 was made to determine if there was any difference in financial results between those roads that are known to have bought a considerable number of new cars in recent years and other properties which have few new cars. A discussion of the figures is given in the present article. Then inquiries were sent

Actual results obtained in both studies indicate that the new cars are a good investment. With reduced industrial employment in many sections, shorter working hours and elimination of much Saturday and Sunday work, there has been a downward trend in riding in some communities. Though this has masked the gain in revenue, the traffic in many cities has been materially greater than it would have been without the new cars to attract passengers.

As to the cost of operation, there is complete agreement that the use of new, light-weight rolling stock reduces expenses. Since the new cars are almost invariably lighter than those they replaced, and the new motors are more efficient, the power costs are reduced correspondingly. Effects on track are less directly apparent, although there is no question that a well-constructed, light-weight car causes less damage to a track than a heavy, old one. When one operator replaces two men there is also a material saving in the cost of transportation.

There also is complete agreement that the effect on public relations obtained by new, modern and attractive rolling stock has been most advantageous. Even though there may not be any immediate gain in changing franchise conditions or making fare adjustments, the new cars give visible evidence that the company is doing its best to provide good service. Practically the only difficulty experienced is that all the districts in a community desire the new cars, and if they are scattered all over the system most of the advantages obtainable with segregation on separate routes are lost.

The analysis made of the companies included in the annual statistics of the American Electric Railway Association for 1928 was based on the purchases of cars over



The combined returns of 41 companies which have been consistent buyers of new cars over a period of years show an increased net for 1928 while the balance of all companies reporting to the A.E.R.A. show a decrease in net.

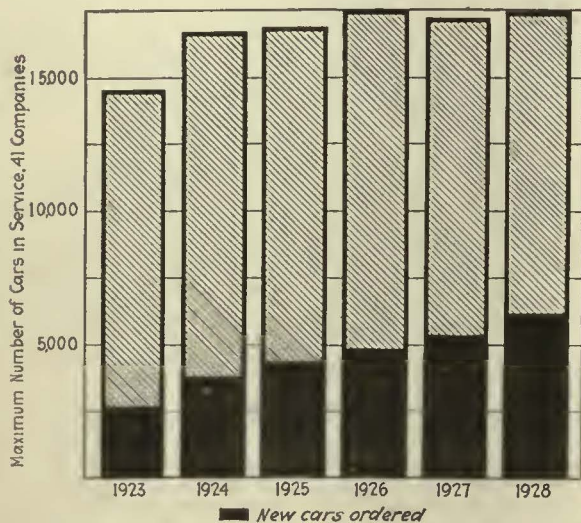
Comparison of Operating Results, With New and Old Cars

I—Companies Which Made Substantial Purchases of New Cars			
	Year 1928	Year 1927	Difference
Railway operating revenue	\$282,850,910	\$284,169,950	\$1,319,040
Railway operating expense	208,087,100	211,372,270	3,285,170
Net operating revenue	\$74,763,810	\$72,797,680	\$1,966,130
Operating ratio, per cent.....	73.57	74.38	0.81
II—Companies Which Have Purchased Few New Cars			
	Year 1928	Year 1927	Difference
Railway operating revenue.....	\$294,503,969	\$304,869,986	\$10,366,017
Railway operating expense.....	225,028,553	231,368,989	6,340,436
Net operating revenue	\$69,475,416	\$73,500,997	\$4,025,581
Operating ratio, per cent	76.49	75.85	0.64

Italics denote decrease.

a period of seven years, 1922-1928 inclusive. A total of 41 companies whose complete returns were available for five consecutive years, were selected because they were known to have purchased a considerable number of cars within this time. This gave a chance to determine the effect of the cars on operations over an extended period. Of course, a considerable number of the companies thus included have been consistent purchasers of cars for many years, so that even in the earlier years of the survey the operating records are better than for some of the other roads. These 41 companies, however, purchased 5,514 cars from 1922 to 1928, the orders being as indicated in the chart and table. The largest purchases made by this group were in the first three years under consideration, 3,707 having been ordered by the end of 1924.

The total number of active cars on these 41 properties



Additions of new cars on these 41 properties have totaled 5,641 from 1922 to 1928, as cumulated in black. The total cars in service have changed correspondingly less on account of destruction of the old cars which the new ones replaced

is approximately 17,000. On nearly every property there are additional cars owned which are practically out of commission but are carried on the books. These, however, are not included. It will be noted that this figure varies from year to year, reaching a maximum in 1926. The principal reason for this is that the more progressive companies have written off the oldest cars on the receipt of the new ones, some even going to the extent of celebrating the advent of the new cars with public bonfires in which the obsolete and worn-out cars were entirely destroyed.

GOOD RESULTS SHOWN ON 41 PROPERTIES

It is significant that while the 41 companies included in the survey as purchasers of new cars kept the revenues in 1928 practically up to the level of 1927, the remaining companies which made returns to the American Electric Railway Association suffered a decrease of more than \$10,000,000 in railway operating revenue for the year. The 41 companies were able to reduce operating expenses an amount more than twice the reduction in revenue, while the remaining companies were not able to make up for the loss in revenue by more than \$4,000,000. As a result, while the combined operating ratio for the 41 companies fell from 74.38 per cent to 73.57 per cent, a decrease of 0.81 points, the operating ratio of the other companies rose from 75.85

to 76.49 per cent, an increase of 0.64 points. For 1928 the operating ratio of the 41 companies was 2.92 per cent lower than that for the other companies. The figures are given in the accompanying table.

The difference in operating ratio, 73.57 per cent for the group of modernized properties against 76.49 per cent for the others, or 2.92 per cent, is equivalent to a total value to \$8,260,000. This represents the advantage for the year 1928 of the better operating conditions. While not all of the gain is due to the use of the new cars, they are one of the major factors in the difference. These companies purchased 5,514 new cars in the year 1922-28, which can be considered as having a major influence on the reduction of operating ratio. At an average cost of \$12,000 the total investment in the new cars was approximately \$78,600,000. Hence the saving is equivalent to 10.5 per cent on the cost, without allowing anything for the salvage value of the old cars or the accrued depreciation on the old cars which permitted their retirement during the period.

CONSISTENT PURCHASES OF CARS SHOWN

The companies included in the survey have been consistent purchasers of cars. The record has been carried back to 1922. It is seen from the table that up to the end of 1928 a total of 5,514 cars in use, or on order, out of a total of 17,488 active cars needed to fill out the maximum schedules were ordered subsequent to 1922 or within the past seven years. This is 31.5 per cent of the total. Naturally many of the cars ordered in the length of time were not of the type that today can be considered modern. In fact, few of them conform to the standards that have been set up within the past few years as constituting up-to-date equipment. Developments that have been made in the past two years are not reflected to any extent in these cars. The show-up made is thus the more remarkable in that the results have been attained with less than one-third of the rolling stock modernized even to this limited extent. When a greater proportion of the rolling stock has been bought in recent years even more striking results can be shown. This is apparent from a study of individual properties.

INDIVIDUAL PROPERTIES MAKE GOOD RECORDS

Replies to inquiries sent out by this paper to individual companies have shown that managements are all enthusiastic as to the value of new rolling stock. Some of the replies are condensed and are included in the following paragraphs. The remainder will appear in future articles.

NUMBER OF CARS PURCHASED BY THE 41 COMPANIES INCLUDED IN THE SURVEY, 1922-1928, INCLUSIVE

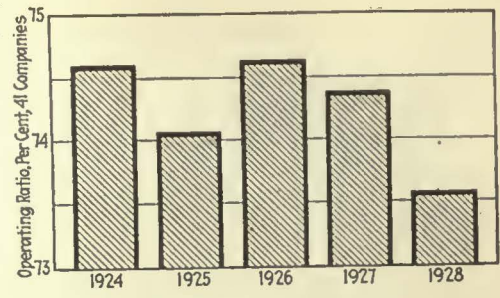
Year	Maximum Number of Cars in Active Service	Number of Cars Ordered During Year	Cumulative of Purchases 1922-1928
1922	.....	1,364	1,364
1923	.....	1,242	2,606
1924	16,611	1,103	3,709
1925	16,856	482	4,191
1926	17,500	537	4,728
1927	17,236	537	5,265
1928	17,488	249	5,514

Georgia Power Company, Atlanta, Ga.—When present management took charge in 1921 it immediately began the purchase of new cars. A total of 243 cars was bought over a period of seven years. In the same period 218 old cars were retired, so that on Dec. 31, 1927, 46 $\frac{2}{3}$ per cent of the cars were less than 10 years old.

EFFECT OF NEW CARS ON LINE EARNINGS, GEORGIA POWER COMPANY, ATLANTA, GA.

Route	Date New Cars Installed	Earnings of Route			Car-Miles on Route			Per Cent Increase System Earnings First Six Month
		First Six Months New Cars	Same Six Months Previous Year	Per Cent Increase	First Six Months New Cars	Same Six Months Previous Year	Per Cent Increase	
3	Oct. 1, 1926	\$114,536	\$101,228	11.61	186,440	168,856	10.40	1.41
5	Mar. 1, 1925	206,772	179,129	10.78	419,865	407,871	2.93	2.63
7	Jan. 1, 1926	87,555	88,160	0.68d	211,424	208,699	1.31	1.13
11	Jan. 1, 1926	89,250	83,769	6.14	240,105	260,063	7.68d	0.89
12	Jan. 1, 1926	43,798	46,537	5.88d	118,526	150,407	21.20d	1.19
13	Oct. 1, 1926	33,705	29,705	11.86	71,066	60,573	1.73	1.74
14	Apr. 1, 1926	52,834	51,180	13.47	106,407	105,828	0.55	1.33
15	Dec. 1, 1926	77,899	79,585	2.12d	263,911	238,307	10.73	1.52
19	Jan. 1, 1927	32,593	28,000	16.40	169,888	131,477	29.25	1.13
21	Dec. 1, 1925	61,326	50,511	17.66	176,462	170,031	3.76	2.06
22	Jan. 1, 1927	47,424	51,390	7.72d	149,585	155,139	3.58d	1.51
23	Nov. 1, 1926	87,659	83,803	4.60	309,217	261,988	18.05	1.68
Total and average		\$929,357	\$872,997	6.45	2,422,896	2,319,239	4.46	.....

d Indicates decrease.

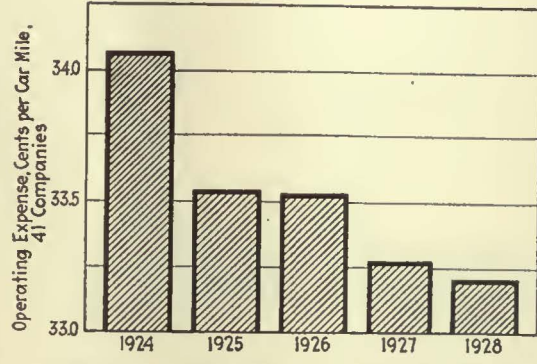


Operating ratios have shown a reduction on the properties using large numbers of new cars

Revenues showed a downward trend from 1922 to 1925, but there has been a sharp upward trend in the return on the investment since then. On twelve lines in Atlanta where obsolete cars have been replaced by new cars there was an average increase in patronage of 5.45 per cent within six months following the installation, with an average increase of 4.46 per cent in car-miles. On two of the lines where service was reduced when new cars were installed, the loss in revenue was very much less than in proportion to the cut in service, and on one line where service was reduced there was an actual gain in riding with the new cars. Headways on all lines have been changed constantly to meet the actual riding requirements. Schedule speed has been increased from 9.21 m.p.h. in 1921 to 9.85 m.p.h. in 1927. Due to the construction of two viaducts in the center of the city the schedule speed dropped in 1928 to 9.7 m.p.h., but when these viaducts are opened this spring the schedule speed will become equal to or higher than it was.

Maintenance of equipment costs for the system have decreased in the past three years, being 2.153 cents per car-mile in 1925, 1.999 in 1926, 1.845 in 1927 and 1.7905 in 1928. This decrease is attributable in large measure to the new cars. At the same time the pull-ins were reduced to 1.39 per day in 1926 compared with 13.2 in 1921.

Without question the use of new cars in Atlanta improved relations with the public and enabled the company to get increases in fares in December, 1927, with practically no opposition.



Operating expenses per car mile have had a steady trend downward for the past five years where new cars have been employed.

able to maintain schedules with increased loads and with more stops per mile.

Before the cars were ordered it was estimated that they would bring in \$10,000 additional revenue and cut operating expenses \$30,000 a year, a total annual advantage of \$40,000 on an investment in the new equipment of \$168,000. An increase in wages on Jan. 1, 1927, absorbed a considerable part of the saving, leaving \$17,327, not including

any reduction in the accounts of way and structures. The increase in revenue, however, was \$18,966, so that the total gain for the first year the new cars were in service was \$36,293. In 1928 there were additional savings in way and structures, power, and equipment, so that while there was a reduction in the gross passenger revenue the net is above that for 1927.

Eastern Massachusetts Street Railway, Boston, Mass.—When this company, which serves a number of cities in the eastern section of the state, as well as running interurban lines between them, was placed under public control about ten years ago, the service had almost broken down and the equipment and track were in deplorable condition. Following the change in control, the company purchased 75 double-truck, light-weight, low-level modern cars. Some of these were fitted for de luxe service, having Spanish leather seats with deep individual cushions, floor covering of linoleum, enclosed piping in the vestibules, and improved trim. Cars of this type proved so satisfactory that the company purchased 50 more in 1926 and remodeled 50 older cars along similar lines.

The purchase of the new cars was predicated on studies that showed annual savings of \$1,527 per car per year, based on reduced car maintenance and energy saving only. The method of calculation is shown in the accompanying table.

PURCHASES OF NEW CARS BY YEARS, GEORGIA POWER COMPANY

Year	Total Cars in Service	New Cars Purchased	Cost of New Cars
1923	432	20	\$263,840
1924	441	20	261,911
1925	441	60	853,090
1926	425	60	870,000
1927	446	40	590,000
1928	446	..	.....

SAVINGS WITH NEW CARS, EASTERN MASSACHUSETTS STREET RAILWAY

Annual saving in maintenance per car over old equipment.....	\$1,072
Annual saving in energy per car.....	455
Total.....	1,527
Interest at 6 per cent on \$15,000.....	\$900
Depreciation at 5 per cent compounded.....	405
Amortization of 20 per cent of original value of old car over eight years.....	150
Net annual saving for each new car.....	\$72

Chicago & Joliet Electric Railway, Joliet, Ill.—This railway, operating an interurban between Chicago and Joliet, placed ten new cars in service in September, 1926. They weigh 39,000 lb. as compared with 62,000 lb. for the old cars, being equipped with four 35-hp. motors as against four 100-hp. motors. The new cars have been

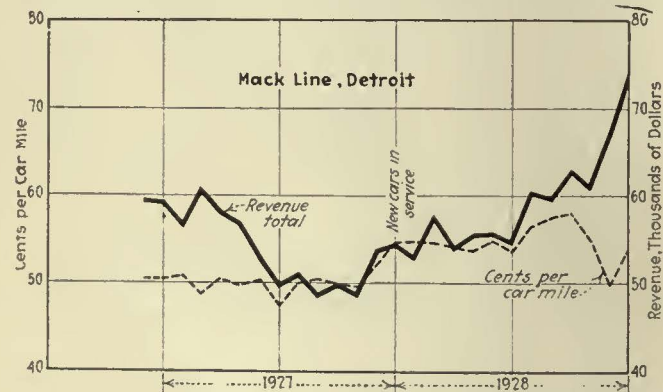
COMBINED OPERATING FIGURES FOR 41 COMPANIES BUYING NEW CARS DURING THE YEARS 1922-1928

	1928	1927	1926	1925	1924
Railway operating revenue.....	\$282,850,910	\$284,169,950	\$288,222,930	\$285,273,910	\$285,946,740
Railway operating expense.....	208,087,100	211,372,270	215,054,250	211,183,820	213,327,200
Net operating revenue.....	\$74,763,810	\$72,797,680	\$73,168,680	\$74,090,090	\$72,618,540
Operating ratio, per cent.....	73.57	74.38	74.62	74.03	74.6
Car-miles operated.....	626,641,880	535,228,290	641,211,010	629,710,370	625,968,150
Per car-mile:					
Railway operating revenue, cents.....	45.14	44.75	44.95	45.30	45.6
Railway operating expense, cents.....	33.20	33.27	33.53	33.54	34.0
Net operating revenue, cents.....	11.94	11.48	11.42	11.76	11.6

On this basis alone the savings are more than paying for the change, even though sufficient depreciation was not written off previously to retire the old car. No allowance has been made for other important economies, such as reduction in cost of general carhouse labor and material, including brakeshoes, lubrication, armature maintenance, etc., and in the maintenance of track; nor has an allowance been made for reduced costs in the transportation department due to elimination of many pull-ins due to defects. That this policy has been justified is seen from the annual report of the company for 1928. Expenditures for equipment maintenance were smaller than in any previous year. Including expenditures for automotive equipment and also depreciation and retirement it represents 2.92 cents per car-mile, as compared with 3.23 cents per car-mile in 1927. During 1928 the passenger cars operated 38,071 miles per failure, as compared with 1,550 miles per failure in 1920 before the modernization program was begun. Derailments from all causes are now only 17 per cent of the number in 1922.

The effects of the new equipment on revenue are quite difficult to evaluate. The industrial depression in the entire district due to closing of many cotton and woolen mills has caused a reduction in riding. There is evidence, however, that the new cars have been instrumental in preventing further reductions in revenue.

Department of Street Railways, Detroit, Mich.—This system has purchased a number of new cars within the past few years, the most recent order being for 125, placed in 1927. Two lines have been completely equipped with new cars, the Hamilton line, which was changed over in August, 1925, and the Mack line, which was changed over in January, 1927. The results before and after the new cars were put on these lines show that while the earnings did not go up immediately, the revenue per car-mile did increase while the revenue per car-mile on the entire system was going down. In other words it was possible to make the gain in revenue with less increase in service than the average for the



When new cars were used to equip the Mack line in Detroit there was a steady gain in revenue. That this was not due to excess service is shown by the increase in revenue per car-mile which took place when the new cars were installed

city. Furthermore, the lines have held this proportion of the business during the period since the new cars were put on. The gain is not due to increasing the service, as the revenue per car-mile has also gone up.

According to the management, it is rather difficult to evaluate the degree of good will obtained by the new cars, but many favorable comments have been received from patrons of the lines on which they have been placed and numerous requests have been received from the public expressing a desire to have some of the new cars serve particular sections of the city.

As to the cost of maintaining cars in Detroit, figures compiled by the Department of Street Railways give the following comparison:

Type of Car	Number of Seats	Average Age, Years	Cost of Car Maintenance Per Car-Mile, Cents	Per Seat-Mile, Cents
Birney.....	32	7	1.53	0.0478
Peter Witt.....	52	4½	2.62	0.0504
Double-truck.....	40	10	3.41	0.0711

In this comparison it should be noted that the Birney cars weigh 16,000 lb., or 500 lb. per seat; the Peter Witt cars 36,500 lb., or 721 lb. per seat; and the miscellaneous double-truck cars average 37,800 lb., or 945 lb. per seat. The lower cost of maintenance may thus be seen to come from two elements, comparative newness and lower weight.

Cincinnati, Hamilton & Dayton Railway, Dayton, Ohio.—The annual financial statement of this road for 1927, the first year the new management was in full control, showed good results despite a general recession in business activity in the entire Miami Valley and employment only 81.5 per cent of 1926. Despite this the passenger revenues of the interurban lines in 1927 were 2.1 per cent more than in 1926, while the total tons of freight in 1927 were 26.2 per cent in excess of that tonnage in 1926.

On May 6, 1927, the company introduced new modern, de luxe, suburban type equipment on its Dayton city lines and increased the frequency of service approximately 25 per cent. As a result there was a very substantial and immediate increase of traffic on these lines and a marked reduction in operating expense. Similar cars were introduced between Dayton and Miamisburg. The total revenue passengers carried on the Dayton city-Dayton-Miamisburg lines were 14.6 per cent greater in 1927 than in the preceding year.


**Casual Observations of
Transportation Systems in European Cities,
outlined interestingly—
in the June Number**

Selling Bus Rides SCIENTIFICALLY

By

EDWARD A. KEENAN
Advertising Manager
Philadelphia Rapid Transit Company

GO by BUS!



Deluxe MOTORBUS SERVICE
between
PHILADELPHIA
and
ATLANTIC CITY
NEW YORK
WASHINGTON
WILMINGTON
BALTIMORE
DOYLESTOWN
EASTON

International Points in Interstate
Tourist
Special Sightseeing Tours
PHILADELPHIA, NEW YORK,
VALLEY FORGE
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Greyhound Lines

MITTEN TOURS

People's Rapid Transit Co.
Broad and Locust Sts. 12th Market St.
Phone Pennsylvania 400
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ATLANTIC CITY

PHILADELPHIA RAPID TRANSIT COMPANY
PHILADELPHIA, PA.

**Mitten
Tours**

De Luxe Bus Service
TO
VALLEY FORGE
ATLANTIC CITY
WILMINGTON - WASHINGTON
NEW YORK
NIAGARA FALLS - BUFFALO
connecting with
BOSTON - CONNEY ISLAND
GETTYSBURG
SYRACUSE - OSWEGO
THOUSAND ISLANDS
WEST POINT
WINCHESTER VALLEY
ENDELSER CAVERNS

MITTEN TOURS

Philadelphia Mitten Service
137 S. Broad Street, Philadelphia
Pennsylvania 2630



will unquestionably become advertising's greatest allies. Advertising is the life blood of the business in its present state, and since it is not being supplemented to any great extent by personal selling of rides, it must be developed to the highest degree.

Several fundamental questions must first be solved before advertising can begin:

1. What shall be the size of the budget?
2. What mediums shall be used and how shall they be used?

3. How can the results of the mediums used be checked?

The problem of a budget, its size and disposition, is the chief worry of any bus advertiser. Mitten Management has separated its intercity bus business from its city business by the incorporation of two subsidiaries of the Philadelphia Rapid Transit Company, the Philadelphia Rural Transit Company, which has the city lines, and the Peoples Rapid Transit Company, known under the trade name of "Mitten Tours," which handles the interstate travel. Most of the bus advertising efforts are confined to the latter, as this type of business best adapts itself to merchandising. The Mitten Tours advertising budget is based on anticipated gross receipts, a plan which has proved to be entirely satisfactory. The estimated gross for 1928, for example, was \$762,000, and the advertising budget called for 3.9 per cent of this

Mitten Tours uses great variety of advertising mediums. Constant experimentation is needed to develop most effective sales methods

COMPETITION from other kinds of transportation, particularly the private automobile, is too keen for any bus operator to believe that business will come to him without effort. There is no chance today for the operator who frowns on advertising. Being aware of this need to sell rides, how should the bus operator proceed to organize his selling campaign? Of course, the same basic principles of salesmanship which make a successful clothing, paint or drug business can be applied to the transportation field, but the elaboration of the selling details can only come by experience. The selling of bus rides is a science all its own and only through years of experimenting can it be brought to a high point of efficiency.

Advertising has been linked so inseparably with the history of bus-ride selling that little attention has been paid to any other means of merchandising. However, in the next few years, personal solicitation and the telephone call, guided by a systematic prospect file system.

"Go by Bus," "Ride in Comfort by Gas-Electric Motor Bus" and similar ride-selling slogans are very effective when carried on attractive folders like these

amount, or \$30,000. This amount was divided as follows:

1. Newspaper advertising..... \$14,000
2. Folders and literature..... 4,500
3. Signs in street cars..... 4,000
4. Magazines and telephone books 3,500
5. Billboards 600
6. Window displays..... 400
7. Miscellaneous 3,000


Total \$30,000

Although the advertising is concentrated on the six above-named mediums, occasional experiments are made in new fields where a special appeal is needed, such as the radio, movies, exhibits, etc.

The largest part of the appropriation is expended on



New York




MITTEN Tour routes between Philadelphia and New York offers a frequent service for both business and pleasure for those who desire a comfortable and thoroughly interesting trip. Buses carry passengers to the Waldorf Astoria, 14th St. and Fifth Ave., in the heart of the business district, convenient to Broadway.

Not only has this service been extensively used by vacationists, but many commercial men are discovering its advantages and using it to the exclusion of other forms of travel.

The New York route makes stops at Trenton, Princeton, Kingston, New Brunswick, Elizabeth and Newark, N. J., picking up or discharging passengers in interstate travel only. This route is equally interesting in either winter or summer. It offers a delightful day's outing or an ideal week end in either Philadelphia or New York. At Newark, N. J., connections can be made at the Public Service Terminal for other points in New Jersey. This terminal is a very short distance from the Hudson Tube Terminal in Newark.


The route lies over the Lincoln Highway, which permits the smoothest possible operation.



The trip offers a variety of country for the traveler interested in American landscapes. Part of the journey is through a section rich in Revolutionary history.

A great many visitors to Princeton, N. J., have been using Mitten Tours buses. This stop is particularly popular while the University is in session.

New York's Sky Line



Montreal-Quebec

(Operates during summer months only)



The Gibraltar of the New World, Montreal, is a memorial to a stirring epoch in history. Today, unspoiled, it draws thousands of tourists from all over the world, who fall in love with its old buildings, its quaint customs, its magnificent surrounding scenery. And near by stands Montreal, largest Canadian city, with its curious mixture of American, English and French customs, one of the most interesting spots in North America.

Now these two quaint cities can be visited by motorbus.

A 7-day all-expense motorbus trip from Philadelphia to Montreal and Quebec and return through a magnificent trail up the east bank of the Hudson and down the west bank is being operated by Mitten Tours. In these seven days of intense enjoyment are such fascinating spots as the Assault Chateau, Tarrytown, the Green Mountains of Vermont, Montreal, an overnight boat ride to Quebec, the Shrine of Ste. Anne de Beauport, Cyclorama of the Crucifix, Montmorency Falls, across Lake Champlain by ferry, Saratoga Battlefield, the Adirondacks, Catskills, Lake George, West Point and Palisade Park.

Beginning July 1 and ending September 9, the tour starts each Sunday morning at 8 o'clock, from the terminal at Broad and Locust streets, Philadelphia. One or two stops are made during the morning, with an hour and a half for lunch. There is no night bus travel. Bus arrives between 5 and 6 o'clock every afternoon, and after dinner the travelers are free to do as they please.

The Hotel Montmorency-Quebec, which includes all expenses—bus fares, meals, hotel accommodations, and transfers—costs \$100.00 from New York, \$110.00 from Philadelphia. Reservations can be made at address: Mitten Tours, 1000 Market Street, Philadelphia, Pa.

Chateau Frontenac—Quebec

High-grade folders are prepared to advertise the special tours. The examples above illustrate the excellent character of the make-up in these folders

newspapers. Here no effort is made to tell the story of the joys of riding buses, or of the efficiency of the gas-electric, but rather to furnish a constant reminder and a ready reference for those who desire to go from one place to another. Out of the appropriation of \$30,000 for 1928, \$14,000 was allowed for newspaper advertising. Of this amount, \$550 was set aside for type composition, drawings and engravings. The remaining \$13,450 for space was divided into monthly allotments of \$1,100 and \$1,000, the smaller amount being used in the summer months. Statistics show that the circulation of Philadelphia newspapers increases slightly during the winter months, hence the placing of the greater part of

Go by Mitten Tours Bus to
Atlantic City \$1.25
 ROUND TRIP, \$2.25

Stopping at Berline, Hammonton, Elwood, Eda Harbor, Absecon

Mitten Tours Leave Broad & Locust St. 7, 9, 11 A.M., 1, 3, 5, 7 P.M. Write for Schedule and Booklet D Daylight Saving Time. Phone, Pennysaver 6100.

Summer Bus Schedule

To Philadelphia \$.85
 Round Trip, \$1.50


To Easton \$.80
 Round Trip, \$1.50

Big, safe, easy-riding Buses operated on strict schedule by courteous drivers. Daylight Saving Schedule.

For Phila., leave Terminal Court Inn: Telephone 2811.
 A. M. 9.32, 12.42—P. M. 3.52, 7.02, 10.12.
 Returning leave Broad & Locust, Phila. A. M. 6.09, 11.19—P. M. 2.30, 5.30, 8.46.
 Leave Doylestown for Easton, A. M. 6.20, 9.30, 11.05—P. M. 12.60, 2.15, 5.50, 8.25, 7.35, 10.18.

Write to Mitten Tours, Broad & Locust, Phila., for Schedule and Booklet A

MITTEN TOURS



At the left are samples of newspaper advertising carried. They give the destination, the schedule and the fares, serving principally as reminders

very best way to spend the appropriation in both large cities and small towns, it was decided to confine the advertisements to frequent, small insertions, attempting to have the ads placed in the motor-bus section, the amusement section or the sport page.

The bus-riding public wants to know the following facts about the service:

1. Destination.
2. Fares, both one-way and round trip.
3. Name of the company, its address and telephone number.
4. The schedule.
5. The fact that the trip is by bus.

Feeling that destination and fares are of the greatest importance, this matter is set in heavy black type. By careful

aining a space only 1 column wide by 14 lines, 1 in. in height, has been found sufficient for the city papers. In the small-town papers, where the cost per line is not so high, 52-line ads, 2 columns wide by 2 in. high, are run. Many of the towns have weekly papers only. There the ads are inserted every week.

With the opening of new routes, larger copy and considerably more art work are used. Good drawings or photographs, where space permits, are very effective. In some of the 52-line ads, therefore, a photograph of a bus is inserted. In the smaller ads it is impossible to include illustrations, so that extra space is used around the type to avoid the appearance of crowding.

FOLDERS AN EFFECTIVE MEDIUM

The Philadelphia Rapid Transit Company has at its disposal 40,000 metal boxes or racks for holding folders.



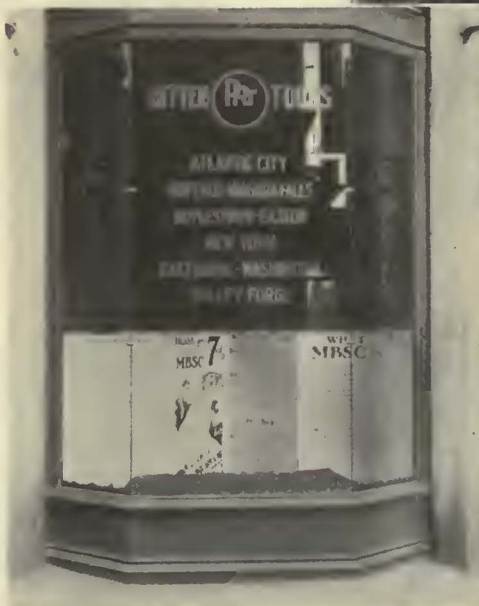
At left — Metal racks on the backs of street car and bus seats are an aid in distributing folders

At right—Clever window displays secure the attention of prospective customers. Here are two typical displays of Mitten Tours



These racks are screwed to the backs of all seats in the trolley cars, and are located also in the elevated trains, the buses and on the subway-elevated platforms. In the buses the boxes are fastened to the wall between the seats, directly under the window. The folders also are placed in waiting rooms, in hotels, and on agency counters and racks, and are sent out as direct mail inclosures. The effectiveness of this method of giving out literature was demonstrated last year when 250,000 four-page folders, advertising special tours, were distributed in about 3½ days.

Folders for this distribution are 37½x7½ in., have either two or four pages, and are printed in one-color ink. An attractive art head with an interesting title is employed to induce the rider to take the folder from the box. For a folder of more lasting value, the conventional highly-colored tourist folder, so beautifully done today by the steamship companies, is used. Two mistakes which should be avoided are the use of crowded text matter and the use of small photographs. Folders should be laid out with all the skill of a good typographer, using plenty of white space. No typographer will crowd his pages. Drawings are used in the folders instead of photographs, because no scenic photograph is worth



one hanging from the ceiling. The buses contain a rack in the bulkhead at the front for a card 6½x28 in. About \$4,000 a year is spent on these cards with excellent results.

Given a fine location and excellent, well-painted copy, a billboard can be of great value to the bus operator, but to buy a number of boards in an attempt to cover the city, disregarding the all-important factor of loca-

while unless it is 8x10 in. in size, or more, and because interesting photographs are difficult to secure. A good artist's sketch of a building or a scene adds a dignity to copy that cannot be obtained by a photograph.

Recently the problem presented itself of publishing a high-grade folder to cover both summer and winter business. It was solved by preparing a basic eight-page folder containing the permanent tours, and printing a four-page insert containing the summer tours and schedules, the inserts being stitched in as many basic copies as needed during the summer months. The chartered bus business is a distinct activity and is treated, therefore, in a separate folder.

Metal frames to hold a card 25½x28 in. are installed on the front of all P.R.T. street cars, on the sides of the buses and on the elevated stations. These signs are an excellent advertising medium for carrying a short message to the public. Visualize 4,000 signs on white cardboard printed in red, blue, green or brown ink, moving up and down the streets of a city all hours of the day and night for an entire week. The signs are of twelve-

ply cardboard, printed with waterproof ink. The size of the frame and the distance from which the cards must be read limit the wording. If all the frames on the system are used, the cost of printing and installing these signs is from \$300 to \$500.

There are two racks within the cars for signs, one in the bulkhead and

tion, is an expensive proposition. Outdoor advertising is a good medium to supplement the other mediums like newspapers and folders, but it should not be used for an entire program. The best use for outdoor copy is in converting automobile owners and riders to bus riders. The P.R.T. has a number of small boards, the 4x6-ft. size, along a well-traveled motor bus route for this purpose. Once or twice a year the company uses fifty or sixty 24-sheet paper billboards.

Mitten Tours is a firm believer in the value of window display and its art department spends much of its time in developing attractive signs for the waiting room and ticket agent windows. Wooden frames, finished with a mahogany stain, have been built to hold 25½x28-in. cardboard posters. Attractive show cards can be inserted in these frames and the copy changed at frequent intervals. Local copy is developed for certain ticket agents and when it is completed it is sent to them by bus. The card and frame are sent together, the card being already inserted. The agents keep these signs in their windows for several weeks while new ones are being developed for them. They then send the old ones back by bus in exchange for the new posters and frames. This is an excellent good-will builder among the agents and it is about the cheapest form of publicity that the company has been able to develop.

NOVEL ATTENTION-GETTER CONSTRUCTED

While experimenting with a window card idea, a novel way to make an inexpensive imitation of a stained-glass window was discovered. A 25x25-in. wooden box was built and wired for two electric lights. A cut-all saw then was secured and the design for the window sign laid out on heavy compo board. A pattern was cut in the

Newspaper ad, telling of the hourly service between Baltimore and Washington. The ad is given character by the symbols of the two companies

cardboard with the saw, and colored paper was pasted back of the holes. The finished product gave a startling effect and proved to be a real attention-arrester for passers-by.

ANOTHER GOOD-WILL BUILDER DEVELOPED

Within a circle of 50-mile radius around Philadelphia there is a population of more than 5,000,000. Many of these people come to Philadelphia at frequent intervals to shop or visit, or to attend some amusement. In an effort to reach these potential customers, the company publishes a miniature house organ, *Phillybound*, which is mailed weekly to a selected list, free of charge. The aim of this organ is to interest out-of-towners in Philadelphia, by giving them a weekly review of the best show in town, a calendar of theatrical events and movie series of suggestions on what to visit such as the art galleries, historical shrines, exhibits, picnics, convention parades, sports, etc., and a page of advertising matter for Mitten Management and its subsidiaries, written in light vein.

The cost of this pamphlet, which is approximately cents per person per week, is carried jointly by the electric railway, the bus companies, the taxicab company and the bank, as all the units profit. Every time a sporting event, a show, or an exhibit is mentioned, full directions are given on how to get there by bus, street car or taxicab.

A list of subscribers was developed by sending to each prospect with the first issue a small application card with the question: "What means of transportation do you use in coming to Philadelphia?" and also a blank for questions that they might desire to ask. The medium has proved a big aid in selling trolley rides, chartered bus service, tours and bank stock, and has brought in

Outdoor advertising is effective for converting automobile owners and riders to bus riders

flood of questions to be answered. The medium has been particularly effective in interesting prospective customers in bus tours, and many inquiries regarding trips are stimulated by the copy contained in the *Phillybounds*. Special effort is made in the late spring and summer months to develop this type of business.

DEPARTMENT FOR DEVELOPING NEW BUSINESS INSTITUTED

Bus merchandising has been developed very rapidly under the direction of the P.R.T. new business department. Working in conjunction with the advertising department, this department has followed up by personal solicitation, telephone calls and direct mail, the leads secured by advertising. So far, the greatest effort has been in the chartered bus field, but gradually the organization is spreading to include the intercity service. Men are always available for conventions. Booths are installed in the convention headquarters and an information man, with a knowledge of the system and having a supply of all types of the company's literature, is kept on duty at all times.

Part of the work of the new business department is to develop a prospect file. An effort is made to obtain the names of people purchasing tickets, as well as those who make inquiries by mail. Every person taking the Niagara Falls tour last year is a prospect for the Montreal-Quebec tour this year, and before the season for tours opens they are solicited.

Contact with the ticket agencies is maintained through the new business department also. One man is kept busy supplying agencies with literature and calling on them at frequent intervals to impart enthusiasm, to hear their complaints and commendations and to watch the effect of the advertising in that locality.

MEASURING THE RESULTS OF ADVERTISING IS POSSIBLE

The bus advertising man's problem is becoming increasingly difficult. No longer can he say "This campaign should produce such and such a result, if properly applied." The bus operator is demanding to be shown more and more just what advertising can do. This is a healthy condition and should be encouraged. Advertising can be measured and there is no reason why an advertiser should not know how much money he should spend to obtain a certain result.

One method of checking the results is by keying the ads, such as "Write for Booklet A," "Write for Booklet B," etc. Although the response does not accurately measure the complete effectiveness of the ad, for many people to ride and never write in, it does give a relative measurement, which, when compared with other results, shows the selling ability of this particular ad. It is an excellent thing never to announce a new service, a new price, or a new schedule until it can be advertised. After the first ad appears it is a good idea to check the telephone calls, personal calls and letters. Several companies have reservation blanks attached to their folders, a plan which is effective also.

The history of bus advertising runs parallel with automobile advertising. In the beginning, the automobile was looked upon as an experiment and somewhat of a novelty. It required many years to convince the public that the motor car was a necessity. It will be recalled that several years ago the industry set out to eliminate the phrase "pleasure car" and to encourage the use of "passenger car" instead. Many bus companies are still back

in this first stage of advertising. It is a mistake to give the public the impression that the industry is still an experiment, and advertising now should tend toward establishing the bus as a proven means of travel.

Bus companies must advocate the use of clean, truthful copy, carefully and attractively prepared; they must continue their experiments with every type of advertising medium, collecting data on results and checking these results by keying the advertising; and, finally, they must supplement the advertising with sound, systematic merchandising.

The Readers' Forum

Advantages Cited for Railroad-Owned Power Plants

THE NEW YORK, NEW HAVEN AND HARTFORD
RAILROAD COMPANY

NEW HAVEN, CONN., March 23, 1929.

To the Editor:

I should like to take exception to certain statements appearing in an editorial on electrification of railroads in the March 16 issue of *ELECTRIC RAILWAY JOURNAL*, in which the statement is made that

"When purchased power is used it is possible . . . to adjust schedules so that train movements, particularly of freight and certain long-distance passenger trains, are made at such times that the additional power does not add in full value to the industrial and lighting peak."

This statement is contrary to the operating requirements of most railroads, which must handle the traffic when and as offered, without regard to the requirements of neighboring power and lighting loads. While certain traffic must be delayed to suit the occupancy of track and terminal facilities by other preferred traffic, most railroad operating officials would not tolerate a further delay because of lack of power to move the business. In fact, a normal surplus of motive power is one of the best arguments used in the solicitation of traffic, and to have such a surplus reduced by electrification would be to prejudice the minds of railway operating officials against electrification.

Indeed, this is one of the strongest reasons in favor of railroad-owned power plants, since, in general, the tendency in making power contracts has been to penalize the consumer for unusual and abnormally high demands, which would be required to handle certain periodic peak business. While it is true that purchased power reduces initial investment and fixed charges of electrification, it is equally true that railroad-owned plants may and, in the few cases where they have been built, do reduce operating expenses by eliminating the penalty of a higher rate caused by the occasional peak business, as well as furnishing the "surplus motive power" equivalent of steam locomotives.

This is a factor which is of great importance in the negotiation of power contracts for electrification; and one which has been largely responsible for the initial investment in railroad-owned power plants, as well as for their continued maintenance in an up-to-date operating condition by their owners, in spite of the growth in the same territory of large power producing companies.

H. F. BROWN,
Assistant Electrical Engineer.

Electric Railway Statistics for 1928

Show Continued Stability

WHILE little change was experienced by the electric railways in the United States in their operations during 1928 from those in 1927, they made an excellent showing in the face of adverse conditions. This is evident from a study of the returns of the companies made to the American Electric Railway Association and compiled in its statistical department under the leadership of Edmund J. Murphy, chief statistician. In all, 244 electric railways and 160 bus undertakings controlled by them rendered comparative reports for the two years. The railway lines alone showed total operating revenues of \$577,354,879 for the past year as compared with \$589,039,936 for 1927, a decrease of 1.98 per cent, in a year of unsettled industrial employment. When bus operations are included the revenue is seen to have held up even better. For the entire group of companies and their subsidiary bus lines the total operating revenue was \$613,570,305 as compared with \$620,626,243 in 1927, or only 1.14 per cent off, indicating that in a number of instances bus extensions and substitutions have been made to serve the railway patrons and hold the revenue.

In the matter of expenses the companies also made a good record. Total operating expenses were \$433,115,653 for the rail lines, a decrease of \$9,625,606 from the preceding year. Including the bus lines, the expenses were \$467,653,613 against \$473,860,512 in 1927, a reduction of 1.31 per cent. The operating ratio fell accordingly for the rail lines from 75.16 per cent to 75.02 per cent. Including the bus lines, the operating ratio fell from 76.35 to 76.22 per cent.

The figures cited above, contained in the first two tables in this article, give a comparison of the operations of the railway lines alone with the total rail and bus business conducted by the industry. It will be seen that the bus revenue, amounting to \$36,215,426, was \$4,629,119 higher than in 1927. This was an increase of 14.66 per cent. Bus operating expenses were \$34,537,960, an increase of \$3,418,707, or 10.96 per cent. The net operating income of the controlled bus lines accordingly showed an increase from \$467,054 in 1927 to \$1,677,466 in 1928, an increase of 159.16 per cent. In order to gain this revenue, the bus lines carried 365,465,316 revenue passengers, an increase of 15.61 per cent, and ran 145,944,800 bus-miles, an increase of 12.24 per cent over 1927. Railway-controlled bus lines now cover 6,989.9 miles of road.

Returns to American Electric Railway Association indicate that both the gross revenues and expenses have been reduced. Combined city and interurban properties make best showing, while city systems hold their own and interurbans suffer a loss. Controlled bus lines make material gains

Not all of the companies furnishing returns were able to give complete figures covering the details necessary for thorough analysis. Many of them are combined with electric light, gas or other utilities, and the capital structure is not separated for each branch of the business. However, the companies furnished information from which a study could be made in detail. The results are given in Tables I to X, inclusive. In general they follow the same trends as those for the 244 companies. Railway operating revenues were \$442,303,214, or 2.07 per cent less than in 1927, while operating expenses were \$332,622,058, or 2.38 per cent less than in 1927. This was reflected in the net operating income which was \$109,681,156, or only 1.15 per cent below 1927.

In Table I the disposition of net operating revenue is shown. There was an increase in net revenue from auxiliary operations of \$78,255 and in non-operating income of \$1,051,439, along with a reduction in total operating expense of \$766,326. These changes resulted in an increase in gross income from \$91,964,266 to \$92,582,768. Dividends were increased slightly in the total, although

COMBINED OPERATIONS OF 244 ELECTRIC RAILWAYS AND CONTROLLED BUS UNDERTAKINGS
Compiled by American Electric Railway Association

	1928	1927 (a)	Increase or Decrease
			Total Per
Railway operating revenue.....	\$613,570,305	\$620,626,243 (d)	\$7,055,938 (d)
Railway operating expenses.....	467,653,613	473,860,512 (d)	6,206,899 (d)
Net operating revenue.....	\$145,916,692	\$146,765,731 (d)	\$849,039 (d)
Operating ratio (per cent).....	76.22	76.35 (d)	0.13 (d)
Miles of track and bus route (b).....	(c) 32,146.44 (c)	31,228.57	917.87
Revenue passengers.....	(d) 7,369,559,334	7,509,508,327 (d)	139,948,993 (d)
Total passengers.....	(d) 9,796,416,185	9,927,364,292 (d)	130,948,107 (d)
Car and bus-miles.....	1,493,068,587	1,419,241,969	1,826,618

(b) Miles of road. (c) 154 bus undertakings. (d) 148 bus undertakings.
(e) 159 bus undertakings.

COMBINED OPERATIONS OF 244 ELECTRIC RAILWAYS
Compiled by American Electric Railway Association

	1928	1927	Increase or Decrease
			Total Per
Railway operating revenue	\$577,354,879	\$589,039,936 (d)	\$11,685,057 (d)
Railway operating expense	433,115,653	442,741,259 (d)	9,625,606 (d)
Net operating revenue.	\$144,239,226	\$146,298,677 (d)	\$2,059,451 (d)
Operating ratio (per cent)	75.02	75.16 (d)	0.14 (d)
Miles of track.....	25,159.54	25,187.38 (d)	27.84 (d)
Revenue passengers.....	7,004,094,018	7,193,394,381 (d)	189,300,363 (d)
Total passengers.....	9,358,810,297	9,553,504,164 (d)	194,693,867 (d)
Car-miles (revenue).....	1,347,123,787	1,361,210,095 (d)	14,086,308 (d)

COMBINED OPERATIONS OF 160 BUS UNDERTAKINGS CONTROLLED BY 244 ELECTRIC RAILWAYS

Reporting to American Electric Railway Association

	1928		1927		Increase or Decrease (d)	
	Total	Per Cent	Total	Per Cent	Total	Per Cent
Operating revenue.....	\$36,215,426		\$31,586,307		\$4,629,119	14.66
Operating expense.....	34,537,960		31,119,253		3,418,707	10.96
Net operating revenue.....	\$1,677,466		\$467,054		\$1,210,412	159.16
Operating revenue (per cent).....	95.37		98.52		(d) 3.15	(d) 3.19
Miles of bus route(1).....	(2) 6,989.90		(2) 6,041.19		945.71	15.65
Revenue passengers.....	(4) 365,465,316		316,113,946		49,351,370	15.61
Total passengers.....	(4) 437,605,888		373,860,128		63,745,760	16.19
Car-miles.....	145,944,800		130,031,874		15,912,926	12.24

(1) Bus-mileage is miles of road. (2) 148 bus undertakings.
 (3) 154 bus undertakings. (4) 159 bus undertakings.

increase in the average speed as measured in car-miles per car-hour from 9.44 to 9.54 the revenue per passenger car-hour shows an increase from \$4.05 to \$4.09. Besides the higher speed in the latter year more service was rendered per car, the annual mileage going up from 37,917 in 1927 to 37,963 in 1928.

CITY-SUBURBAN LINES MAKE BEST SHOWING

Comparative figures on the city, interurban and combined city and interurban lines are given in Tables V-X. It is interesting to note how the companies succeeded

TABLE III—OPERATING STATISTICS

	1928		1927		Increase or Decrease (d)	
	Total	Per Cent	Total	Per Cent	Total	Per Cent
Passenger car-miles.....	969,791,204		982,127,973		(d) 12,736,769	(d) 1.30
Total revenue car-miles.....	1,003,962,072		1,015,128,401		(d) 11,166,329	(d) 1.10
Revenue passengers(1).....	5,209,538,966		5,370,599,111		(d) 161,060,175	(d) 3.00
Transfer passengers(2).....	1,357,461,681		1,392,313,863		(d) 34,852,182	(d) 2.50
Total passengers(3).....	6,604,126,041		6,792,430,980		(d) 192,304,939	(d) 2.83
Passenger revenue.....	\$412,377,746		\$417,703,938		(d) \$5,326,192	(d) 1.28
Revenue car-hours(4).....	87,872,452		89,684,254		(d) 1,811,802	(d) 2.02
Passenger car-hours(5).....	86,757,181		88,455,212		(d) 1,698,031	(d) 1.92
Miles of single track.....	19,165.05		19,247.99		(d) 82.85	(d) 0.43
Passenger cars operated(6).....	23,674		23,949		(d) 275	(d) 1.15

(1) Reported by 181 companies. (2) Reported by 131 companies. (3) Reported by 165 companies. (4) Average maximum number of passenger cars in service daily; reported by 162 companies.

only 38 companies paid dividends last year as compared with 42 companies the year before.

On a car-mile basis the changes from 1927 have been minor. While there was a slight reduction in the number of car-miles run, the operating revenue per car-mile was slightly lower, being 44.06 cents against 44.49 cents in 1927.

Operating expenses are analyzed by primary accounts in Table II. There was a saving in each of the departments except traffic. The largest saving, \$1,985,937, or 5 per cent, occurred in the maintenance of equipment, while power showed a saving of \$1,280,768, or 2.83 per cent. These figures reflect greater attention to these accounts and also the increased number of new, light-weight cars in service. The amount spent on track was almost as great as in 1927, being 0.65 per cent less in the total and 0.43 per cent more on a car-mile basis.

That there has been an increase in average fares during the year is seen by reference to Table IV, in which derived ratios are presented. The passenger revenue per revenue passenger was 7.76 cents in 1928 against 7.62 cents in 1927, or 1.84 per cent more. Revenue per passenger car-mile and per car operated were most identical in the two years. On account of an

increase in net income despite the decline in traffic. Reference to Table V shows that the increase was confined to the group of combination lines. While this group suffered the greatest loss in traffic and gross revenue, this loss was more than offset by a reduction in operating expenses. While revenues declined 4.0 per cent the reduction in expense was 5.07 per cent, so that the net operating revenue was slightly higher.

Actually the service given by this group of properties was greater in proportion last year than previously, as the reduction in passenger car-miles, 2.06 per cent, is much less than the reduction in traffic, 5.49 per cent. The greater relative amount of service given was probably due in part to the difficulty of gaging the

Part I—Combined Operating Reports of 182 Electric Railways for the Calendar Year 1928 Compared with 1927

Compiled by American Electric Railway Association

TABLE I—COMBINED INCOME STATEMENT

	1928		1927		Increase or Decrease (d)		Cents per Car-Mile	Cents per Car-Mile	Increase or Decrease (d)	
	Total	Per Cent	Total	Per Cent	Total	Per Cent			Total	Per Cent
Railway operating revenue.....	\$442,303,214		\$451,674,670		(d) \$9,371,456	(d) 2.07	44.06	44.49	(d) 0.43	(d) 0.97
Railway operating expense.....	332,622,058		340,715,996		(d) 8,093,938	(d) 2.38	33.13	33.56	(d) 0.43	(d) 1.28
Net operating revenue.....	\$109,681,156		\$110,958,674		(d) \$1,277,518	(d) 1.15	10.93	10.93	.....	.....
Net revenue, auxiliary operations.....	1,606,860		1,528,605		(d) 78,255	(d) 5.12	0.16	0.15	(d) 0.01	(d) 6.67
Taxes.....	27,688,473		28,454,799		(d) 766,326	(d) 2.69	2.76	2.80	(d) 0.04	(d) 1.43
Operating income.....	\$83,599,543		\$84,032,480		(d) \$432,937	(d) 0.52	8.33	8.28	(d) 0.05	(d) 0.60
Non-operating income.....	8,983,225		7,931,786		(d) 1,051,439	(d) 13.26	0.89	0.78	(d) 0.11	(d) 14.10
Gross income.....	\$92,582,768		\$91,964,266		(d) \$618,502	(d) 0.67	9.22	9.06	(d) 0.16	(d) 1.77
Deductions from gross income.....	70,011,747		69,477,433		(d) 534,314	(d) 0.77	6.97	6.84	(d) 0.13	(d) 1.90
Net income.....	\$22,571,021		\$22,486,833		(d) \$84,188	(d) 0.37	2.25	2.22	(d) 0.03	(d) 1.35
Dividends.....	(3) \$15,693,680		(3) \$15,681,665		(d) 12,015	(d) 0.08	.....	.....	.....	.....
Operating ratio (per cent).....	75.20		75.43		(d) 0.23	(d) 0.31	.....	.....	.....	.....
Ratio: net income to operating revenue (per cent).....	3.55		3.47		(d) 0.08	(d) 2.31	.....	.....	.....	.....

(3) Reported by 38 companies. (4) Reported by 42 companies.

TABLE II—OPERATING EXPENSES BY PRIMARY ACCOUNTS

	1928		1927		Increase or Decrease (d)		Cents per Car-Mile	Cents per Car-Mile	Increase or Decrease (d)	
	Total	Per Cent	Total	Per Cent	Total	Per Cent			Total	Per Cent
Way and structures.....	\$46,582,718		\$46,889,062		(d) \$306,344	(d) 0.65	4.64	4.62	(d) 0.02	(d) 0.43
Equipment.....	42,098,442		44,084,379		(d) 1,985,937	(d) 4.50	4.19	4.34	(d) 0.15	(d) 3.46
Power.....	44,012,941		45,293,709		(d) 1,280,768	(d) 2.83	4.38	4.46	(d) 0.08	(d) 1.79
Conducting transportation.....	144,342,477		148,347,519		(d) 4,005,042	(d) 2.70	14.38	14.61	(d) 0.23	(d) 1.57
Traffic.....	2,011,704		1,899,392		(d) 112,312	(d) 5.91	0.20	0.19	(d) 0.01	(d) 5.26
General and miscellaneous.....	51,047,119		51,574,329		(d) 527,210	(d) 1.02	5.09	5.08	(d) 0.01	(d) 0.20
Transportation for investment-credit.....	-172,806		-233,190		(d) -60,384	(d) 25.49	-0.02	-0.02	.....	.....
Total operating expense.....	(3) \$332,622,058		(3) \$340,715,996		(d) \$8,093,938	(d) 2.38	(3) 33.13	(3) 33.56	(d) 0.43	(d) 1.28

(3) Includes \$2,699,463 undistributed expense.
 (4) Includes \$2,860,796 undistributed expense.

(3) Includes 0.27 cent undistributed expense.
 (4) Includes 0.28 cent undistributed expense.

demands from day to day, but in greater degree was dictated by the conviction that good service is needed to prevent further loss in riding.

The decrease in operating expenses in this city-interurban group was distributed over all the primary accounts except traffic. This is seen in Table VI. The reductions ranged all the way from 1.95 per cent for power to 10.16 per cent for maintenance of equipment. The second largest reduction in expense was 7.24 per cent in maintenance of way and structures. On a car-mile basis, as given in Table X, the relative changes are similar, although the per cent savings per car-mile are slightly less on account of the relatively small reduction in car-miles operated for the year.

When this group of combined city and interurban properties is compared with the city properties and the interurbans the showing is all the more remarkable. The city companies, of course, have the greatest revenue and have shown the least loss in traffic. They were not, however, able to reduce expenses enough to prevent a reduction in net operating revenue. They did save enough to reduce the operating ratio slightly. Operating revenue decreased only 1.34 per cent, al-

TABLE IV—SIGNIFICANT RATIOS DERIVED FROM TABLES

	1928	1927	Increase or Decrease Per Cent
Railway operating revenue.....	\$442,303,214	\$451,674,670	(d) 2.1
Per mile of single track.....	23,079	23,461	(d) 1.6
Gross income.....	92,582,768	91,964,266	(d) 0.7
Per mile of single track.....	4,831	4,777	(d) 1.1
Passenger revenue.....	412,377,746	417,703,938	(d) 1.3
Per revenue passenger.....	(1) 7.76c	(1) 7.62c	(d) 1.8
Per total passenger.....	(1) 6.12c	(1) 6.08c	(d) 0.7
Per mile of single track.....	(1) \$21,517	(1) \$21,701	(d) 0.8
Per passenger car-mile.....	(2) 42.54c	(2) 42.53c	(d) 0.0
Per car operated.....	(2) \$15,733	(2) \$15,725	(d) 0.0
Per passenger car-hour.....	(2) \$4.09	(2) \$4.05	(d) 1.0
Revenue passengers.....	(3) 5,209,538,966	(3) 5,370,599,141	(d) 3.1
Per mile of single track.....	(3) 281,164	(3) 288,886	(d) 2.7
Per passenger car-mile.....	(3) 5.47	(3) 5.57	(d) 1.8
Per car operated.....	(3) 199,596	(3) 202,968	(d) 1.6
Per passenger car-hour.....	(3) 5.58	(3) 5.58	(d) 0.0
Total passengers.....	(4) 6,604,126,041	(4) 6,796,430,980	(d) 2.9
Per mile of single track.....	(4) 356,432	(4) 365,582	(d) 2.5
Per passenger car-mile.....	(4) 6.94	(4) 7.01	(d) 1.0
Ratio: transfer passengers to revenue passengers (per cent).....	(5) 28.59	(5) 28.52	(d) 0.0
Revenue car-miles.....	1,003,962,072	1,015,128,401	(d) 1.2
Per mile of single track.....	(6) 52,385	(6) 52,740	(d) 0.7
Per car operated.....	(6) 37,963	(6) 37,917	(d) 0.1
Per car-hour.....	(6) 9.54	(6) 9.44	(d) 1.1
Car-hours.....	(7) 87,872,452	(7) 89,684,254	(d) 2.0
Per car operated.....	(7) 3,911	(7) 3,952	(d) 1.0

(1) Reported by 180 companies. (2) Reported by 163 companies. (3) Reported by 181 companies. (4) Reported by 131 companies. (5) Reported by 161 companies. (6) Reported by 165 companies. (7) Reported by 164 companies. (8) Reported by 147 companies. (9) Reported by 160 companies.

Part II — Division of Statistics of the 182 Electric Railways into Separate Statements for City, Interurban and Combination City and Interurban Companies

TABLE V—INCOME STATEMENT

	—City Lines, 101 Companies—		Increase or (d) Decrease, Per Cent	Interurban Lines, 37 Companies		Increase or (d) Decrease, Per Cent	Combination Lines, 44 Companies		Increase or (d) Decrease, Per Cent
	1928	1927		1928	1927		1928	1927	
Railway operating revenue.....	\$318,953,403	\$323,285,916	(d) 1.34	\$21,362,469	\$22,147,952	(d) 3.55	\$101,987,342	\$106,240,802	(d) 4.1
Railway operating expenses.....	234,165,128	237,481,018	(d) 1.40	18,539,999	19,053,338	(d) 2.69	79,916,933	84,181,640	(d) 5.1
Net operating revenue.....	84,788,275	85,804,898	(d) 1.18	2,822,470	3,094,614	(d) 8.79	22,070,411	22,059,162	(d) 0.0
Net revenue; auxiliary operations.....	626,894	728,088	(d) 13.90	153,915	151,431	1.64	826,051	649,086	(d) 21.1
Taxes.....	20,972,031	21,623,509	(d) 3.01	1,169,525	1,160,193	0.80	5,546,917	5,671,097	(d) 2.2
Operating income.....	64,443,138	64,909,477	(d) 0.71	1,806,860	2,085,852	(d) 13.38	17,349,545	17,037,151	(d) 1.9
Non-operating income.....	1,199,094	5,620,143	10.30	613,145	701,898	(d) 12.64	2,170,986	1,609,745	(d) 33.7
Gross income.....	70,642,232	70,529,620	0.16	2,420,005	2,787,750	(d) 13.19	19,520,531	18,646,896	(d) 4.7
Deductions from gross income.....	47,454,398	46,643,482	1.74	6,382,448	6,286,391	1.53	16,174,901	16,547,560	(d) 4.1
Net income.....	23,187,834	23,886,138	(d) 2.92	*3,962,443	*3,498,641	(d) 12.6	3,345,630	2,099,336	(d) 37.4
Dividends.....	(1) 12,778,350	(2) 12,903,692	(d) 0.97	(3) 197,373	(4) 271,795	(d) 27.38	(5) 2,717,957	(6) 2,506,178	(d) 8.3
Operating ratio (per cent).....	73.42	73.46	(d) 0.05	86.79	86.03	(d) 0.88	78.36	79.24	(d) 1.1
Ratio: net income to operating revenue (per cent).....	7.27	7.39	(d) 1.62				3.28	2.36	(d) 38.3

* Deficit. (1) Reported by 28 companies. (2) Reported by 30 companies. (3) Reported by 3 companies. (4) Reported by 4 companies. (5) Reported by 8 companies. (6) Reported by 8 companies.

TABLE VI—OPERATING EXPENSES BY PRIMARY ACCOUNTS

	—City Lines, 101 Companies—		Increase or (d) Decrease, Per Cent	Interurban Lines, 37 Companies		Increase or (d) Decrease, Per Cent	Combination Lines, 44 Companies		Increase or (d) Decrease, Per Cent
	1928	1927		1928	1927		1928	1927	
Way and structures.....	\$30,132,001	\$29,368,627	2.60	\$3,166,642	\$3,199,146	(d) 1.02	\$13,284,075	\$14,321,289	(d) 7.0
Equipment.....	29,890,865	30,599,681	(d) 2.32	2,204,006	2,349,375	(d) 6.19	10,003,521	11,135,323	(d) 10.1
Power.....	29,276,393	30,155,257	(d) 2.91	3,107,511	3,278,019	(d) 5.20	11,629,037	11,860,433	(d) 1.9
Conducting transportation.....	107,784,107	110,315,349	(d) 2.29	5,968,893	6,133,966	(d) 2.69	30,589,477	31,898,204	(d) 4.1
Traffic.....	789,016	677,206	16.51	324,961	365,139	(d) 11.00	897,727	857,047	(d) 4.7
General and miscellaneous.....	33,688,663	33,646,326	0.13	3,771,178	3,749,373	0.58	13,587,278	14,178,628	(d) 4.1
Transportation for investment-credit.....	-87,205	-140,962	(d) 38.14	-11,368	-22,944	(d) 50.45	-74,232	-69,284	(d) 7.2
Total operating expense.....	(1) 234,165,127	(2) 237,481,016	(d) 1.40	(3) 18,539,999	(4) 19,053,338	(d) 2.69	79,916,933	84,181,640	(d) 5.1

(1) Includes \$2,691,287 undistributed expense. (2) Includes \$2,859,532 undistributed expense. (3) Includes \$8,176 undistributed expense. (4) Includes \$1,264 undistributed expense.

TABLE VII—OPERATING STATISTICS

	—City Lines, 101 Companies—		Increase or (d) Decrease, Per Cent	Interurban Lines, 37 Companies		Increase or (d) Decrease, Per Cent	Combination Lines, 44 Companies		Increase or (d) Decrease, Per Cent
	1928	1927		1928	1927		1928	1927	
Passenger car-miles.....	723,195,267	729,281,768	(d) 0.83	35,203,881	37,414,645	(d) 5.91	210,991,556	215,431,560	(d) 2.1
Total revenue car-miles.....	724,792,180	730,932,505	(d) 0.84	47,355,280	48,068,369	(d) 1.48	231,814,612	236,127,527	(d) 1.8
Revenue passengers.....	4,331,220,007	4,442,139,260	(d) 2.50	57,675,329	60,096,530	(d) 4.03	(1) 820,643,630	(1) 868,361,351	(d) 5.7
Transfer passengers.....	(2) 1,205,777,220	(2) 1,231,821,359	(d) 2.11	(3) 1,183,601	(3) 1,257,842	(d) 5.90	(4) 150,500,860	(4) 159,234,662	(d) 5.8
Total passengers.....	5,558,794,467	5,691,493,550	(d) 2.33	60,416,859	62,860,239	(d) 3.89	(5) 984,914,715	(5) 1,042,077,191	(d) 5.4
Passenger revenue.....	(6) 313,120,871	(6) 313,577,627	(d) 0.15	13,013,114	13,855,475	(d) 6.08	86,243,761	90,270,836	(d) 4.6
Revenue car-hours.....	(7) 67,341,035	(7) 68,598,984	(d) 1.83	2,017,900	2,026,382	(d) 0.42	(8) 18,513,517	(8) 19,058,888	(d) 2.9
Passenger car-hours.....	(9) 62,273,689	(9) 68,505,981	(d) 1.80	(10) 1,252,863	(10) 1,301,778	(d) 3.76	(11) 18,230,629	(11) 18,647,453	(d) 2.2
Miles of single track.....	9,006.87	9,027.05	(d) 0.22	2,876.87	2,898.81	(d) 0.76	7,281.31	7,322.04	(d) 0.5
Passenger cars operated (a).....	18,915	19,043	(d) 0.67	593	594	(d) 0.17	(14) 4,166	(14) 4,321	(d) 3.5

(a) Average maximum number of cars in service daily. (1) Reported by 14 companies. (2) Reported by 36 companies. (3) Reported by 43 companies. (4) Reported by 96 companies. (5) Reported by 81 companies. (6) Reported by 96 companies. (7) Reported by 28 companies. (8) Reported by 41 companies. (9) Reported by 43 companies. (10) Reported by 28 companies. (11) Reported by 41 companies. (12) Reported by 32 companies. (13) Reported by 92 companies. (14) Reported by 37 companies.

TABLE VIII—DERIVED RATIOS

	City Lines, 101 Companies			Interurban Lines, 37 Companies			Combination Lines, 44 Companies		
	1928	1927	Increase or (d) Decrease, Per Cent	1928	1927	Increase or (d) Decrease, Per Cent	1928	1927	Increase or (d) Decrease, Per Cent
Way operating revenue.	\$318,953,403	\$323,285,916	(d) 1.34	\$21,362,469	\$22,147,952	(d) 3.55	\$101,987,342	\$106,240,802	(d) 4.00
Per mile of single track.	35,412	35,813	(d) .12	7,426	7,640	(d) 2.80	14,007	14,510	(d) 3.47
Gross income.	\$70,642,232	\$70,529,620	0.16	\$2,420,005	\$2,787,750	(d) 13.19	\$19,520,531	\$18,646,896	4.69
Per mile of single track.	7,843	7,813	0.38	841	962	(d) 12.58	2,681	2,547	5.26
Passenger revenue.	\$313,120,871	\$313,577,627	(d) 0.15	\$13,013,114	\$13,855,475	(d) 6.08	\$86,243,761	\$90,270,836	(d) 4.46
Per revenue passenger.	(1) 7.23c.	(1) 7.06c.	2.41	22.56c.	23.05c.	(d) 2.13	(12) 9.52c.	(12) 9.42c.	1.06
Per total passenger.	(3) 5.63c.	(1) 5.51c.	2.18	21.54c.	22.04c.	(d) 2.27	(12) 7.93c.	(12) 7.85c.	1.02
Per mile of single track.	\$34,765	\$34,738	0.08	\$4,523	\$4,780	(d) 5.38	\$11,845	\$12,329	(d) 3.93
Per passenger car-mile.	(1) 43.30c.	(1) 43.00c.	0.70	36.96c.	37.03c.	(d) 0.19	40.88c.	41.90c.	(d) 2.43
Per car operated.	(2) \$15,279	(2) \$15,176	0.68	\$20,489	\$21,602	(d) 5.15	\$17,116	\$17,336	(d) 1.27
Per passenger car-hour.	(8) 4.12	(8) 4.04	1.98	6.23	6.33	(d) 1.58	3.85	3.93	(d) 2.04
Revenue passengers.	4,331,227,007	4,442,139,260	(d) 2.50	57,675,329	60,098,530	(d) 4.03	820,643,630	868,361,351	(d) 5.50
Per mile of single track.	480,880	492,092	(d) 2.28	20,048	20,732	(d) 3.30	123,503	130,290	(d) 5.21
Per passenger car-mile.	(1) 5.99	(1) 6.09	(d) 1.64	1.64	1.61	1.86	4.24	4.40	(d) 3.64
Per car operated.	(2) 207,751	(2) 211,472	(d) 1.76	90,262	92,262	2.17	175,153	177,546	(d) 1.35
Per passenger car-hour.	(8) 61	(8) 61	...	34	33	3.03	45	47	(d) 4.26
Total passengers.	5,558,794,467	5,691,493,550	(d) 2.33	60,416,859	62,860,239	(d) 3.89	984,914,715	1,042,077,191	(d) 5.49
Per mile of single track.	617,173	630,493	(d) 2.11	21,001	21,685	(d) 3.15	148,225	156,354	(d) 5.20
Per passenger car-mile.	(1) 7.69	(1) 7.81	(d) 1.54	1.72	1.68	2.38	5.09	5.28	(d) 3.60
Ratio: Transfer passengers to revenue passengers (per cent).	(4) 30.6	(4) 30.6	...	(9) 6.05	(9) 6.19	(d) 2.26	(15) 19.08	(15) 19.17	(d) 0.47
Revenue car-miles.	724,792,180	730,932,505	(d) 0.84	47,355,280	48,068,369	(d) 1.48	231,814,612	236,127,527	(d) 1.83
Per mile of single track.	80,471	80,971	(d) 0.62	16,495	16,582	(d) 0.52	31,837	32,249	(d) 1.28
Per car operated.	(2) 34,904	(2) 34,941	(d) 0.11	(7) 69,139	(7) 69,799	(d) 0.95	(18) 47,414	(18) 46,666	1.60
Per car-hour.	(8) 9.36	(8) 9.25	1.19	(5) 13.29	(5) 13.40	(d) 0.82	(14) 9.79	(14) 9.70	0.93
Car-hours (revenue).	(2) 67,341,035	(2) 68,598,984	(d) 1.83	(10) 2,017,900	(10) 2,026,382	(d) 0.42	(13) 18,513,517	(13) 19,058,888	(d) 2.86
Per car operated.	(6) 3,783	(6) 3,837	(d) 1.41	(11) 4,697	(11) 4,706	(d) 0.19	(17) 4,417	(17) 4,387	0.68

Reported by 100 companies. (4) Reported by 92 companies. (9) Reported by 14 companies. (12) Reported by 43 companies. (15) Reported by 36 companies.
 Reported by 91 companies. (5) Reported by 86 companies. (10) Reported by 33 companies. (13) Reported by 37 companies. (16) Reported by 40 companies.
 Reported by 95 companies. (7) Reported by 33 companies. (11) Reported by 27 companies. (14) Reported by 41 companies. (17) Reported by 34 companies.
 Reported by 81 companies. (8) Reported by 28 companies.

ough traffic was off 2.50 per cent. This was a result of the higher average fare per passenger received during the year. As with the combined properties, the savings were due to a reduction in service and to savings in cost per car-mile.

In this city classification the net revenue from auxiliary operations fell 13.90 per cent. The total amount of this item was small and the reduction of 3.01 per cent in taxes helped reduce the decrease in net, so that the operating income was only 0.72 per cent lower than in 1927. While not so large in amount as for the combination lines, the city lines increased the non-operating income 10.30 per cent, making the gross income 0.16 per cent higher in 1928 than in 1927. Reductions from gross income, however, were up 1.74 per cent, so that the net income was 2.92 per cent lower than in the previous year. In amount the net for 1928 was \$23,187,834 as against \$23,886,138 in 1927. Out of these amounts the dividends paid by 30 companies in 1928 were \$12,778,000, while in 1927 dividends of \$12,933,692 were paid by 30 companies.

INTERURBAN ROADS MAKE POOREST SHOWING

Of the three groups the interurban roads made the poorest showing. Although traffic held up better than on the combined city and interurban properties they did not make compensating gains in other items. The passenger car-miles were reduced 5.91 per cent while the loss in revenue passengers was 4.03 per cent. Freight car-miles, on the other hand, were increased, so that the total revenue car-miles were only 1.48 per cent lower in 1928 than in the year before. The average fare per revenue passenger, unlike the fares in the other groups,

went down from 23.05 cents to 22.56 cents, although the changes in fare during the year were minor.

Operating expenses of these interurbans went down 2.69 per cent while revenues dropped 3.55 per cent, so that the net operating revenue was off 8.79 per cent. Despite the smaller net revenue the taxes were higher, and operating income was 13.38 per cent less last year than in 1927. Non-operating income was down 12.64 per cent and fixed charges increased 1.53 per cent. There was a deficit of \$3,962,443 in 1928 compared with one of \$3,498,641 in 1927.

TABLE IX—COMBINED STATEMENTS OF ALL THREE TYPES OF COMPANIES ON A CAR-MILE BASIS

	City Lines—101 Companies			Interurban Lines—37 Companies			Combination Lines—44 Companies		
	Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent		Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent		Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent	
Railway operating revenue.	44.01	44.23	(d) 0.50	45.11	46.08	(d) 2.11	44.00	44.99	(d) 2.20
Railway operating expenses.	32.31	32.49	(d) 0.55	39.15	39.64	(d) 1.24	34.48	35.65	(d) 3.28
Net operating revenue.	11.70	11.74	(d) 0.34	5.96	6.44	(d) 7.45	9.52	9.34	1.93
Net revenue; Auxiliary operations.	0.09	0.10	(d) 10.00	0.33	0.31	6.45	0.35	0.27	29.63
Taxes.	2.90	2.96	(d) 2.03	2.47	2.41	2.49	2.39	2.40	(d) 0.42
Operating income.	8.89	8.88	0.11	3.82	4.34	(d) 11.98	7.48	7.21	3.74
Non-operating income.	0.86	0.77	11.69	1.29	1.46	(d) 11.64	0.94	0.68	38.24
Gross income.	9.75	9.65	1.04	5.11	5.80	(d) 11.90	8.42	7.89	6.72
Deductions from gross income.	6.55	6.38	2.66	13.48	13.08	3.06	6.98	7.01	(d) 0.43
Net income.	3.20	3.27	(d) 2.14	*8.37	*7.28	...	1.44	0.88	16.36

* Deficit.

TABLE X—OPERATING EXPENSES ON A CAR-MILE BASIS

	City Lines—101 Companies			Interurban Lines—37 Companies			Combination Lines—44 Companies		
	Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent		Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent		Cents per Car-Mile 1928	Increase or (d) Decrease, 1927 Per Cent	
Way and structures.	4.16	4.02	3.48	6.69	6.66	0.45	5.73	6.07	(d) 5.60
Equipment.	4.12	4.19	(d) 1.67	4.65	4.89	(d) 4.91	4.32	4.72	(d) 8.47
Power.	4.04	4.13	(d) 2.18	6.56	6.82	(d) 3.81	5.01	5.02	(d) 0.20
Conducting transportation.	14.87	15.09	(d) 1.46	12.60	12.76	(d) 1.25	13.20	13.51	(d) 2.29
Traffic.	0.11	0.09	22.22	0.69	0.76	(d) 9.21	0.39	0.36	8.33
General and miscellaneous.	4.65	4.60	1.09	7.96	7.80	2.05	5.86	6.00	(d) 2.33
Transportation for investment-credit.	-0.01	-0.02	(d) 50.00	-0.02	-0.05	(d) 60.00	-0.03	-0.03	.....
Total operating expenses.	*32.31	*32.49	(d) 0.55	39.15	39.64	(d) 1.24	34.48	35.65	(d) 3.28

* Includes 0.37 cents undistributed expense.
 † Includes 0.39 cents undistributed expense.
 ‡ Includes 0.02 cents undistributed expense.

Systematic Maintenance



Overhauling motors in the shops of the New Orleans Public Service, Inc. The motor is mounted on a four-wheel carriage which supports it at a height convenient for the workmen

Cuts Costs

Scientific department organization, careful training of employees and engineering supervision of work have resulted in improved performance of equipment

First, let us consider organization. These mechanical departments are organized on the underlying thought that the work of each department bears a very definite relation to the work of every other department, and the whole functions as a unit with a definite object of securing the highest possible standard of maintenance at the lowest possible cost. The duties of each

SINCE 1922, maintenance of equipment costs and car failures have declined steadily on the railways represented in the Electric Railway Association of Equipment Men, Southern Properties, as told in last month's issue of the JOURNAL. In Atlanta, Birmingham, Memphis and New Orleans, the average annual reduction in maintenance costs from 1922 to 1927 was \$350,000, making a total of \$2,100,000 for the six-year period. The average annual reduction in car failures was 77½ per cent, the maximum reduction in 1927 being 87½ per cent. The activities of the equipment men's association have been responsible in large measure for this outstanding achievement. The free interchange of cost data and other maintenance figures, the discussion of common problems at the association meetings, and the inspection of properties in the cities where meetings are held have given this group of equipment men an entirely new outlook. A spirit of competition, friendly yet earnest, has been created and has acted as a powerful force for improvement. The specific reasons why maintenance costs on these properties were 49 per cent lower and car failures were 87½ per cent lower in 1927 than in 1921 are worthy of careful study.

department are clearly defined and the relations between departments are thoroughly understood by all. The organization of the rolling stock and shops departments of the New Orleans Public Service, Inc., is shown by the accompanying chart.

It is believed that the scientific control of many of the operations in the shops, such as the dipping and balancing of armatures and the electrical and mechanical testing of apparatus, can be best secured through engineering supervision. Another deep-rooted belief is that the education of employees is an important factor in creating a high standard of workmanship. Educational facilities are provided so that not only the workmen but the foremen and carhouse foremen also may have an opportunity to learn how to do their jobs better and to prepare themselves for a better position in the organization. One property, for example, has mapped out a complete educational course and has prepared its own instructional manuals.

To aid further in creating an organization which will function smoothly, these companies believe in periodic meetings of department heads for discussion of the problems and co-ordination of the work. Meetings of

Department heads with carhouse foremen, at which operating costs and other maintenance data are discussed, are employed to keep up an active, friendly rivalry for the reduction of maintenance costs and car failures.

Having developed an efficient organization and having provided for competent, intelligent supervision of the work to be done, the next step in this improvement program appears to have been the development of a system of overhauling and inspection based on the old maxim that "an ounce of prevention is worth a pound of cure." In other words, preventive maintenance is

made at the carhouses; minor repairs only are permitted at these points in the belief that repairs of an extensive nature can best be made by the trained shop forces.

The record of car failures, or pull-ins as they are called, is a convincing illustration of the effectiveness of the overhauling and inspection system adopted. Its effect in reducing the principal causes of car failures is shown in the accompanying table. Monthly and annual figures on these and more than 50 other classified causes of car failures are interchanged by members of the association and serve to keep up an active competition.

The system of overhauling can best be described by following a car through the shop of one of these properties. The New Orleans property has been selected for this purpose. There overhauling is divided into two parts:

1. Car equipment overhauling.
2. Car body overhauling and painting.

Car equipment is overhauled on a 40,000-car-mile basis at the Carrollton shops. Bodies are overhauled at intervals of eighteen to twenty months at the Magazine shops. At the end of a 40,000-mile period, an order issued from the superintendent's office sends the car to the overhauling department. The department foreman is responsible for the quality of the work and a shop engineer is responsible for all of the testing of the overhauled equipment and the final performance of the car. The shop layout and the scheduling of work are such as to permit steady production. This, of course, involves the use of a sufficient number of spare equipment units so that the overhauling and re-equipping of the car may proceed without awaiting the overhauling and testing of any particular piece of equipment.

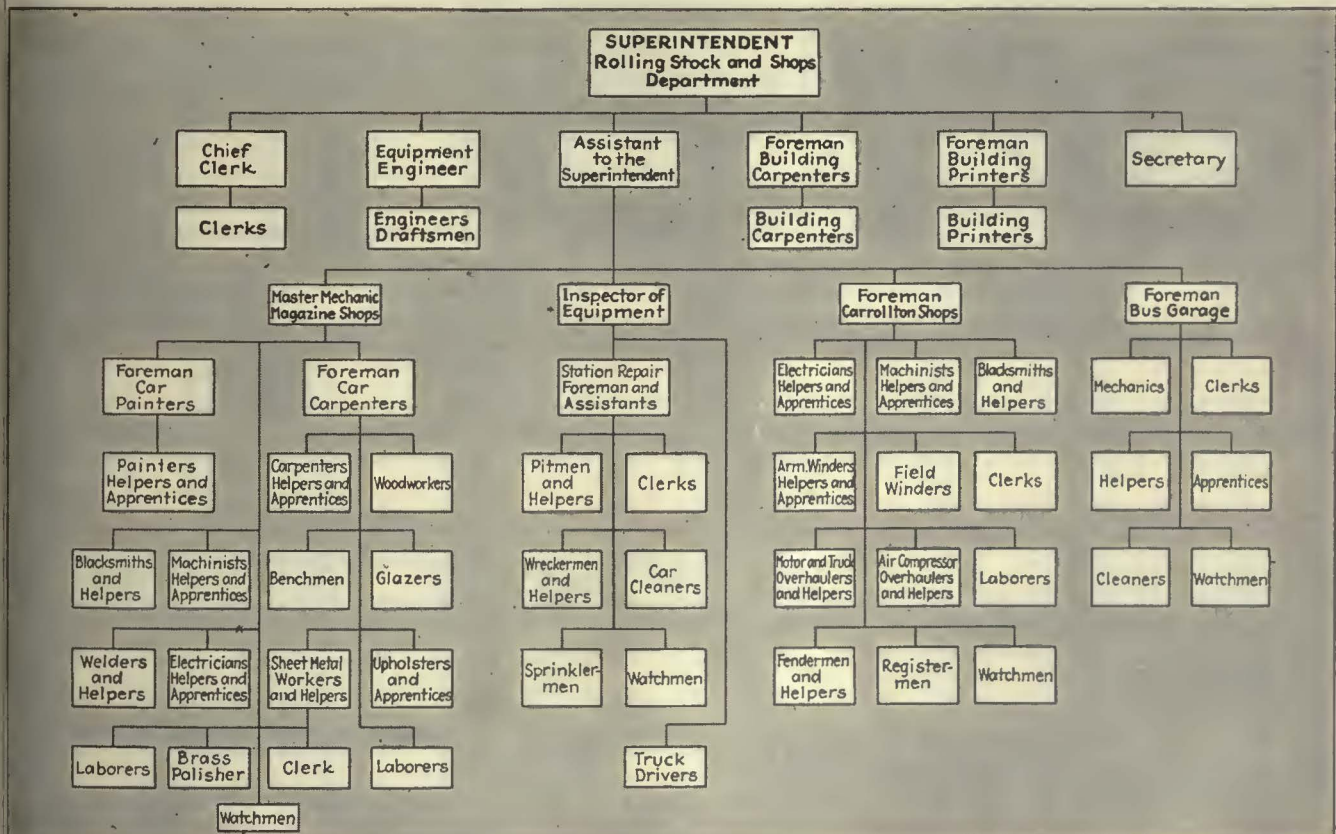
A car hoist raises the car body so that the trucks can be removed. The motors are removed by electrically-operated monorail hoists and transferred to the stripping

Southern Properties

By **G. C. HECKER**
Special Engineer
American Electric Railway Association

the guiding policy upon which the whole system is founded.

They have started out with the theory that a car in first-class condition should, with proper periodical inspection, operate a certain number of miles before requiring any extensive repairs or overhauling. Experience has indicated that on their properties this mileage is, roughly, 50,000. It is then assumed that at the end of that period the car should be completely and thoroughly overhauled, with the expectation that it will successfully operate through another similar period. Supplementing the overhauling, these properties have inaugurated a system of rigid inspection on a 1,000 car-mile basis. Inspec-



Organization of rolling stock and shops department of New Orleans Public Service, Inc.

position by a transfer crane. Oil and waste are removed from the bearing and the axle caps and bolts are removed and placed in a cleaning tank. Axle caps, after being cleaned, are checked and those requiring overhauling are sent to the machine shop. A small four-wheel carriage conveys the motor to a position beneath the jib crane where the armature and pinion are removed. The frame head or armature bearing caps are then removed and placed in the cleaning tank. The brush-holders are removed and sent to the electrical department. The armature is conveyed to the armature department.

A jib crane then transfers the motor shell to a storing position where the field coils are given a hammer test, their resistance checked and a 1,750-volt a.c. dielectric test applied for one minute. Coils which do not meet all

pinion-end up, the armature inserted and the pinion-end frame head put in place. The brush-holder alignment is checked, new brushes installed and the brush tension checked. The motor is then removed to the test floor where the armature bearings are packed with long fiber wool waste.

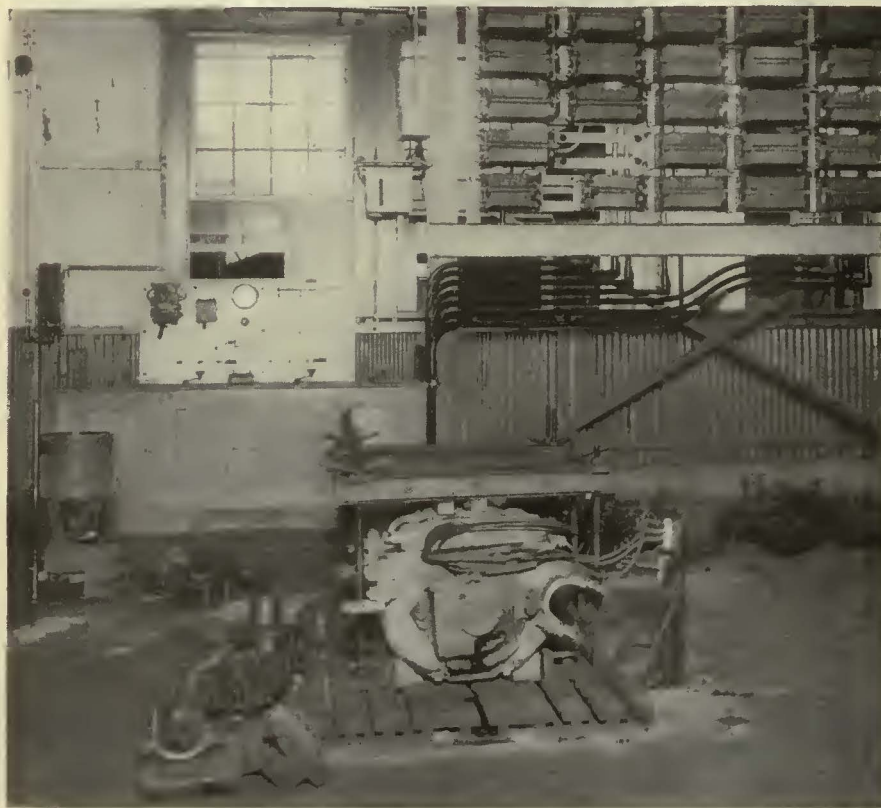
The motor is then given a fifteen-minute "running-in" test, the direction of rotation being reversed several times. At this time the armature end play and bearing temperatures are checked. The field coil resistance and the brush tension are rechecked.

Motors equipped with rewound armatures (and about 10 per cent of all other motors in addition) are given a load test, consisting of a 30-minute run, fifteen minutes in each direction, at 150 per cent of the one-hour rating.

Next, the pinion, previously heated in boiling water, is driven in place and the armature shaft washer and nut drawn up tightly against the pinion. Limit-of-wear gages are used to determine the discarding point of both pinions and gears and every effort is made to keep gears and pinions matched. The axle caps are loosely bolted to the motor shell, the motor is sprayed with truck paint and returned to the truck overhauling position.

In the meantime, practically all of the other electrical, mechanical and pneumatic equipment has been removed from the car, sent to the proper department, thoroughly overhauled and tested and returned for assembling. Also, the trucks have been most thoroughly overhauled and the work of reassembling the equipment begins. Before the trucks are placed under the car, the motor control, air compressor and buzzer wiring are given a 1,500-volt a.c. test for one minute. After the body has been placed on the trucks and the motors connected, a series of tests is applied to insure that all connections have been properly made.

To illustrate the thoroughness with which armatures are overhauled, let us follow an armature through the department. Armature overhaul is classified either as "dipped and baked" or "rewound," according to the work done on them. An armature of the first class is given a bar-to-bar test and also a 1,500-volt a.c. test for one minute. All bands and dressings are removed, the commutator string band is painted, fillers are placed on loose coils and the core bands replaced. The armature is then cleaned and preheated for four hours, after which its insulation resistance is measured. Next it is dipped and placed in the baking oven for at least 30 hours. The actual removal from the oven is determined by the insulation resistance which must be at least 0.6 megohms. The armature is redressed and the end bands replaced, the commutator is calipered and a light cut taken, after which it is slotted if necessary. A second bar-to-bar test and a high-potential test are then applied, the commutator is covered with cardboard, the bearings fitted to the shaft and the armature returned to the motor department.



Testing motors before they are returned to service

three of the above tests are sent to the armature department and are replaced with new or repaired and tested coils and a complete polarity check made.

After this, the motor shell is returned to the assembling position and thoroughly cleaned. This operation consists of placing the shell on a grating in the floor, surrounding it with a canvas-covered frame, and agitating the dirt with compressed air. A suction fan connected to the grating removes the dirt. Field bolts are checked for tightness, weak or broken springs on commutator, or oil-well covers replaced, motor leads and bushings examined and replaced if necessary. Outside leads are treated with a flexible insulating paint and the inside leads, field coils and interior of the shell are sprayed with air-drying varnish.

The overhauled brush-holders are reassembled in the frame, frame heads placed on the shaft of an overhauled armature and the bearings checked. Bearings showing excessive wear are replaced. The commutator-end frame head is then driven and bolted into place, the shell turned

Armatures which require rewinding go through substantially the same procedure after being rewound. Armatures of this class, after being stripped of old coils, are checked for loose or bent laminations and for bent or sprung shafts.

Short-circuited field coils of modern motors are replaced with new ones; the number to be repaired is so small that impregnating equipment cannot be justified. Field coils of the older motors are stripped, given a tapping and baking treatment, and thoroughly tested to insure their fitness for service.

Overhauling and testing of each piece of equipment are thorough. The quality of the work is clearly reflected in the steady decreases in the number of pull-ins due to equipment failures. Supplementing the thorough overhauling methods, of course, is a carefully worked-out system of inspection at each of the five carhouses, on a 1000-car-mile basis. These inspections cover everything from the trolley wheel to the brake shoe. Careless inspection simply is not tolerated. If a car fails between



Employee education has played an important part in improving maintenance practices

To illustrate, burned contact tips of line breakers may be renewed but if any other repairs are found necessary the unit is replaced by one from stock and is sent to the overhauling department where the necessary repairs are made and the unit tested, after which it is returned to stock. Each carhouse carries in stock a small supply of replacement units, including such items as a line breaker, circuit breaker, lightning arrester, resistor, motorman's brake valve, air compressor, compressor governor, truck brake rigging, wheel and axle and axle assembly.

In addition to the inspection and incidental repair or replacement of units, the oiling, cleaning and washing of cars are done in the carhouses. Other work done at these points is the grinding of wheels and the changing of wheels and axles, as this can be done in a fraction of the time necessary to send a car to the shop. It has the further advantage that the car need not be held out of service for such work, only between peak hours. The carhouses also maintain and operate sanding, sprinkling and emergency wrecker service.

A complete supply of hand tools and brake rigging maintenance parts is kept on a centrally located board at each carhouse. This method of storing tools and maintenance parts not only improves appearances but reduces lost motion to a minimum and serves as a check on tools, since a foreman coming on the job will not accept the board unless it is completely filled or missing tools are accounted for. In connection with the inspection and repairs at carhouses, a complete record is kept which gives the superintendent of equipment a most effective check on all work done and on equipment failures.

Although the overhaul and inspection systems on the four properties are not identical in all respects, the conception of the job to be done is the same. The practices outlined are considered typical of the type of organization and maintenance methods in use in the four mechanical departments.

ANALYSIS OF IMPORTANT CAUSES OF CAR FAILURES

Company	Car Failures Caused by	No. of Failures Annually from Each Cause							
		1921	1922	1923	1924	1925	1926	1927	1928
Canta.....	Armatures.....	320	270	177	147	63	41	13	
	Motor leads.....	271	177	80	32	13	12	9	4
	Hot journals.....	331	187	82	30	24	7	3	0
	Hot armature bearings.....	45	40	25	21	8	3	5	1
	Controllers.....	292	191	156	155	79	21	30	10
New Orleans	Brakes.....	397	194	121	69	50	26	26	7
	Armatures.....	1,505	400	56*	35	20	13	11	7
	Fields, leads and cables.....	1,168	315	43*	12	12	12	4	0
	Gears and pinions.....	72	20	7*	11	5	1	1	0
	Controllers.....	280	54	13*	12	7	3	2	2
Birmingham	Air and handbrakes.....	1,056	203	57*	27	8	2	1	1
	Circuit breakers.....	44	20	5*	1	0	1	2	0
	Hot journals.....	245	114	31	16	31	14	20	10
	Air brakes.....	230	141	74	66	30	17	12	8
	Brake rigging.....	262	119	67	70	29	32	36	16
Memphis...	Armatures.....	277	325	202	172	167	171	141	80
	Fields.....	211	224	192	130	141	117	119	40
	Armatures.....	93	...	...	...	...	...	...	39
	Hot armature bearings.....	25	...	...	...	...	...	...	8
	Controllers.....	23	...	...	...	...	...	...	7
	Trolley.....	16	...	...	...	...	...	...	2
	Hot journals.....	19	...	...	...	...	...	...	0

*Figures for 1923 cover only first nine months.

inspection periods the records disclose the identity of the inspector and he is cautioned by the foreman. A second offence takes him to the superintendent of equipment for stronger admonition and, on a third offense, he is invited to find work elsewhere.

Only light repairs are made in a carhouse. Apparatus requiring major repairs is replaced with tested units.



A complete supply of hand tools and brake rigging parts is kept on a centrally located board at each carhouse



Portable track in 33-ft. sections is placed, removed and carried from one location to another by means of a crane car

Portable Emergency Track Used in Los Angeles

TRACK reconstruction work by the Los Angeles Railway has been facilitated by the use of portable emergency track. This is made up in 33-ft. lengths using 70-lb. rails and ties securely fastened with spikes and $\frac{3}{8}$ -in. lagscrews. The lagscrews are driven through holes drilled in the inside flange of the rail, while spikes are used on the outside flange. Tierods are run through pipes which are cut the width of the gage to prevent the rails from spreading. In the center of each section are skew bracings to prevent the rails from creeping.

These sections can be conveniently carried on flat cars to the site of the work. They can also be picked up by the crane and carried, two sections at a time, from one location to another, as necessity demands. More than 900 ft. of track can be laid in half an hour. It is esti-

ated by the engineering department of the railway that there is a saving of \$1 per foot of single track over the old method.



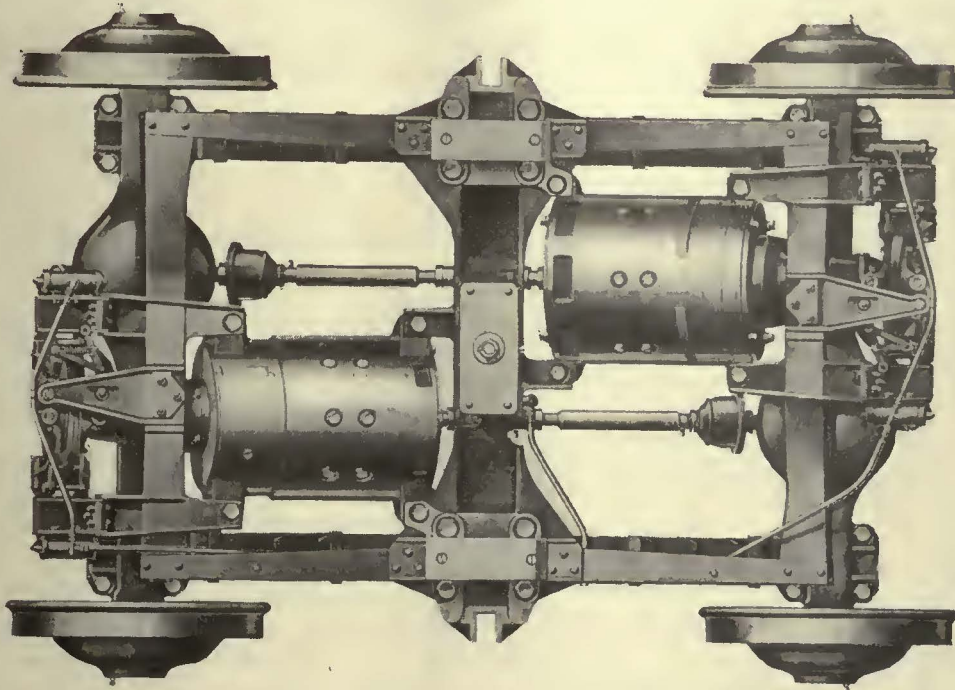
Rails are spiked on the outside to wood ties. The tierods run through pipe spreaders. Diagonal cross bracing is used to give rigidity to the section



For transportation to some distant points, the sections of portable track are carried on a flat car

New Timken Truck

Equipped With Armature Shaft Brake



New Timken worm-drive truck which has a disk brake mounted on an extension of the armature shaft at the commutator end of each motor

Disk brake on commutator end of each motor is actuated by two small-diameter air cylinders. Wheel design simplified. Unsprung weight of new worm-drive model has been reduced to 2,445 lb.; total weight is 6,030 lb.

SUBSTANTIAL reduction in unsprung weight has been accomplished in a new type of worm-drive truck, designed by the Timken Detroit Axle Company, by placing the brake mechanism on the armature shaft of each motor instead of the wheels or

axles as has been customary heretofore. The new truck, known as model 52, is similar in many respects to the model 51 truck exhibited last fall at the A.E.R.A. convention at Cleveland. The disk brakes, however, are an innovation for which many advantages are claimed. Besides the reduction in unsprung weight, the simplification of wheel design is considered to be an important improvement.

The armature shaft brake is mounted on the commutator end of the motor. An extended armature shaft and housing containing a bearing to support the shaft are carried over the axle, placing the brake out in the clear. This brake consists of a 16-in. self-ventilating disk with two pairs of shoes on each side operated by air. The four shoes have a total area of 123.27 sq.in., which is slightly greater than the total lining area of two wheel

brakes of the type previously used. Brake material is moulded directly to the shoes and, for this reason, the total thickness of brake lining is usable.

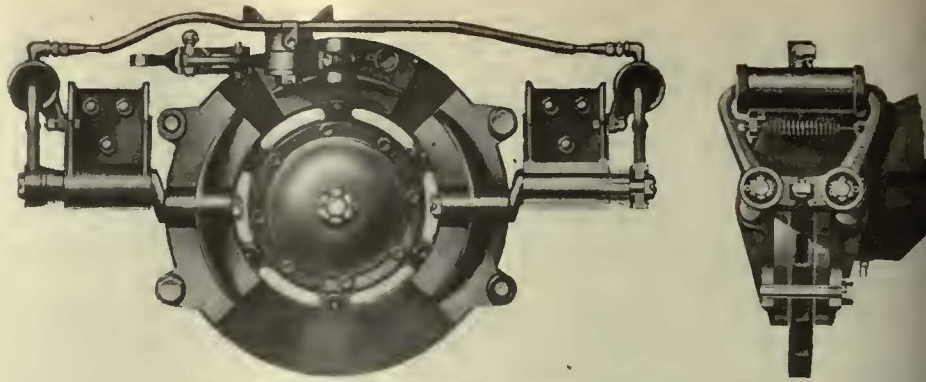
The armature shaft is in one piece and the extended portion is supported on a roller bearing

in the end of the special housing which is incorporated in the motor end cover. The disk and hub are designed to be mounted on the armature shaft so that the center line of the disk comes over the center line of the outboard bearing. The shoes are carried on cranks having 1 in. throw and mounted in brackets, each of which is attached to the frame end cross-member by three bolts. Adjustment to center the shoes in relation to the disk is made at the factory by shimming between this bracket and the truck frame end cross-member. Braking reaction is taken up by this cross-member.

Each pair of brake shoes is actuated by a small diameter air cylinder through a lever and crank arrangement, which gives sufficient braking effort when using 50 lb. of air pressure to slip 26-in. wheels with normal passenger load. As the bottom of the disk is a considerable distance

above the top of the rail, it is not subject to wheel wash as are wheel brakes. The centrifugal action of the disk will tend to prevent any oil, water, dirt, etc., remaining on the disk in sufficient quantities to affect braking. No adjustment for wear is necessary until at least one-half the brake material has been worn away. When adjustment is necessary it is made by loosening the nuts holding the serrated levers in place against the serrated collars and rotating the levers to compensate for wear and then locking them in place. It is thought that only one adjustment should be necessary in the life of the linings, which should be 20,000 car-miles or more.

Because of the position of the brake in the clear beyond the axles, replacement becomes very simple. The whole brake and mechanism are entirely accessible from a pit and there is no necessity for disturbing any part of the car body, trucks, axles, or motors to replace the shoes or any other part of the brake. To replace shoes, the shoe crank and bracket assembly on each side can be



The brake disk is acted upon by two pairs of brakeshoes, each pair being operated by a crank connected to a small-diameter air cylinder

disassembled by removing three bolts. Shoes can then be removed by taking the nut off the crank.

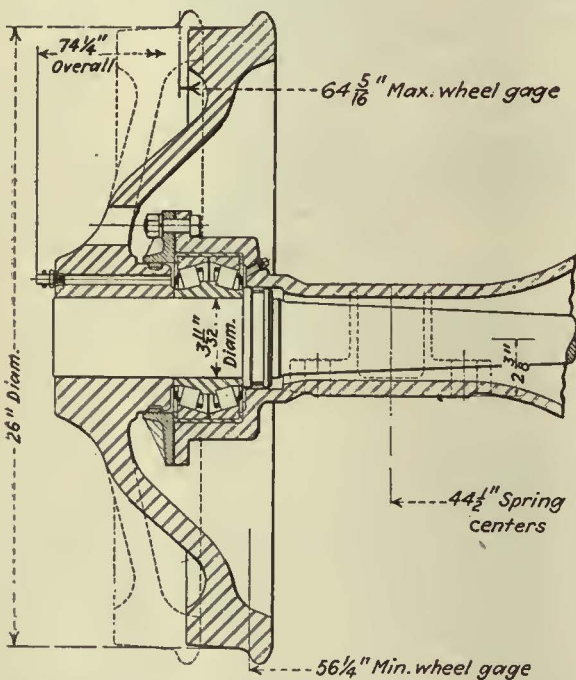
Due to the low coefficient of sliding friction between tire and rail, the braking stresses set up in the various members are no greater than the driving stresses. If the operator should make an air application before cutting out his controller, the stresses set up by locking the wheels with wheel brakes are considerably greater than if the wheels are locked with the armature shaft brake as under the latter condition the armature is slowed down and locked with the wheels. There are no additional loads put on the armature bearings as an additional bearing has been added in the extended housing to take care of the static and torsional loading imposed by the brake.

Mounted at the top of the armature shaft disk is an additional pair of shoes operated by hand. The total area of lining on these shoes is 41.08 sq. in. per pair. The shoes are mounted on levers which are carried by a supporting bracket attached to the frame and cross member. This bracket is adjustable so as to center shoes in relation to the disk. They are actuated by pulling on a link which operates the two levers carrying the shoes.

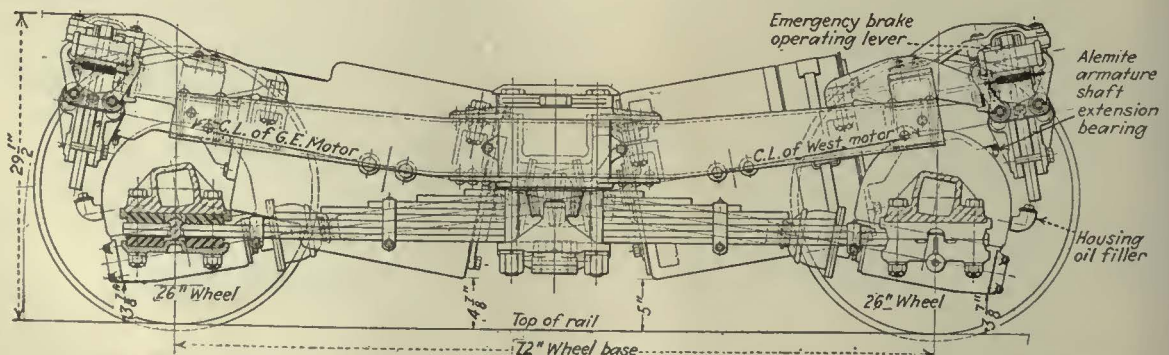
The new model truck without motors has a weight of only 4,160 lb. Each truck is designed for two 50-hp high-speed motors which will add approximately 1,870 lb. to the weight. The total weight is 6,030 lb., of which 2,445 lb. is unsprung.

The maximum weight which can be carried on the two trucks of a double-truck car is 60,000 lb. Wheel gage can be adjusted from a minimum of 4 ft. 8½ in. to a maximum of 5 ft. 4½ in. by varying the wheel offset.

It is expected that these new model 52 trucks will be in production early in May. Already orders have been received from the St. Louis Public Service Company, Chicago Surface Lines, Louisville Railway, Department of Street Railways, Detroit, Cleveland Railway, Pittsburgh Railways, and Boston Elevated Railway.



Elimination of wheel brakes has greatly simplified wheel design. By changing the offset, the truck can be adjusted to any desired track gage



Under normal load the over-all height of the new truck is 29½ in. from the top of the rail. The minimum clearance is 3¾ in. under the rear axle housing

TIE REQUIREMENTS

of Electric Railways

By

HOWARD H. GEORGE

Superintendent of Way
Cleveland Railway

HERE are in the United States and Canada at the present time approximately 8,400 miles of electric railway tracks, exclusive of electrified steam railroads. The total for Canada is approximately 2,500 miles, leaving about 40,500 miles in the United States, in which tracks there are probably not more than 101,200,000 ties of all kinds. There is no absolute record of the number of these ties that are substitutes for wood, or how many of the wood ties are treated. In 1922 one of the special committees of the American Electric Railway Engineering Association endeavored to secure information relative to the extent of the use of substitute ties and sent out an inquiry to a number of the principal street railway properties known to be users of this type of tie, with a total mileage of 17,156, of which about 42 per cent of the total in the country. Replies were received from only 24 companies, whose total mileage was 8,477, or only 21 per cent of the total mileage in the country. These companies reported having in all about twice a total of 219,415 substitute ties. The weighted average spacing of these ties was found to be 4.3 ft., which indicates that the ties reported in this investigation represented a little less than 180 miles of track.

The data referred to were so limited in their extent that I was unwilling to use them as the basis for my analysis of the situation as it exists at the present time. I accordingly sent out to a selected list of electric railways throughout the entire United States, which included every large property and many of the smaller ones, a special letter, requesting this information for their properties. The list included about 165 companies and covered practically every state in the Union. Replies were received from 156 companies with a total of 27,572 miles of single track. This is more than 67 per cent of the total electric railway mileage in the country and may, therefore, be considered as forming a fairly accurate cross-section of present practice in regard to the use of substitute ties by the electric railway companies. The above companies

U. S. electric railways have in use approximately 101,000,000 wood ties, and buy 4,700,000 ties per year, of which only 1,170,000 are treated. These facts were brought out by Mr. George in an address before the National Association of Railroad Tie Producers

reported a total of 1,717 miles of track constructed with substitute ties, or a little less than 6½ per cent of the total mileage reporting.* Out of the 156 companies reporting, 42, or more than 26 per cent, reported no substitute ties; and, from my personal general knowledge of the properties not covered by the inquiry, I feel that it is quite safe to state that, had the data been secured from them, the percentage figure just given for track built with substitute ties would be decreased.

Assuming that the percentage would not change materially if data for all trackage were included, this would mean that there are approximately 2,547 miles of electric railway track in the United States constructed with substitute ties. This would leave about 38,353 miles of track built with wood ties and would represent a total of approximately 101,000,000 wood ties. The latest information which I have had an opportunity to study indicates that the electric railways are purchasing about 4,700,000 wood ties per year, of which about 1,170,000 are treated. This latter figure would undoubtedly be increased somewhat if records were available to show the number of ties that were given some form of treatment by the electric railways themselves. The figures indicate that the average life of wood ties in electric railway tracks is slightly less than 21 years. The use of creosoted wood ties by the electric railways has not yet approached anywhere near that by the steam railroads.

The use of treated ties by the electric railways is on the increase and is bound to go forward more rapidly as their financial condition improves. While there is still much to be desired in this respect, it is probably safe to say that the prospects look better today than they have at any time since the war. As an economical proposition, the treatment of timber of any kind should not be figured in terms of first cost only. The thing that counts is the average cost per year of useful life. This is where the wood preserving business has failed to take fullest advantage of the possibilities of promotion in a field which offers great possibilities in the line of an increased market for its product.

*This includes the track in New York City and Washington, D. C., with underground conduit system.

It is well known that, in open track, the best untreated white oak tie obtainable today cannot be expected to give much more than ten years of satisfactory service, and other types of untreated timber proportionately less; and, furthermore, even when obtainable, its cost is as great as that of a pressure-treated red oak tie of the same dimensions, if not greater. In paved city track such white oak ties, if not disturbed, may be expected to last as long as the rail, where the life of the latter does not greatly exceed fifteen years, but it would certainly not be safe to replace another rail on these same ties. On the other hand, this is entirely feasible in the case of a properly treated tie, even in the case of relatively inferior grades of wood, as we know they have a life of from 25 to 30 years under such conditions.

CLIMATE AFFECTS LIFE OF TIES

Of course, sub-soil and climatic conditions materially affect the life of an untreated tie, and these must be taken into consideration in selecting the kind of timber to be used. We also have reason to believe that the best quality of untreated timber which is being supplied today cannot be expected to give the same length of service as has been secured from the same class of untreated timber cut from virgin forests in years gone by. Lumber might prove fairly satisfactory for certain soils and localities, but would not be at all satisfactory in many others. Then, too, the availability of certain local timber close to the point of use is another controlling factor. The observations made by the U. S. Forest Bureau and by many of the larger railroad companies have fairly well established the relative serviceability and longevity of the various kinds of timber used for ties; and, with these data available as they are, the user must then apply his own local-condition factors in deciding how far afield he can afford to go in order to obtain timber of a better grade.

With reference to the kind of preservative which should be used, I feel that this is a question which the individual must decide for himself. Personally, I favor Grade No. 1 creosote oil for pressure treatments, although I know of some very satisfactory results from the use of both water-gas-tar oil and coal-tar distillate. My position at this time is not to attempt to argue for any one type of preservative, but simply to go on record as favoring some form of preservative treatment, on the principle that half a loaf is certainly better than none. The only word of caution I wish to add is that some preservative treatments do not lend themselves to electric railway track construction, because of their effect in accelerating electrolytic action and corrosion of the rail and fastenings. One problem to which the wood preserver should devote a great deal of thought is that of reducing the manufacturing cost of wood-preserving oils. This will do more than anything else to increase the use of preservative treatment by the electric railways.

GENERAL AGREEMENT REGARDING TIE DIMENSIONS

A survey of tie practice of 196 companies, members of the American Electric Railway Association, representing 28,086 miles of single track, indicated that 86 per cent of the total mileage replying used ties 6 in. in depth, 77 per cent used ties 8 in. in width, and more than 64 per cent used ties 8 ft. in length. By far the largest part of those who did not use 8-ft. lengths specified 7-ft. lengths. Approximately 84 per cent of the mileage reporting was standard gage track, the remainder from 3 ft. 6 in. to a maximum of 5 ft. 4½ in.

I quote the above data to emphasize the rather general agreement among the electric railways with regards to the matter of wood tie dimensions. The divergence from standard gage is limited to a relatively few companies representing but a small percentage of the entire industry; and, in most cases where the gage differs from standard, an 8-ft. length of tie is used.

The essential difference between the requirements for a wood tie in paved track and one for open track is that for the latter the expense of replacement is relatively small compared with that in paved track, and the consequential effect of tie failure does not make itself felt in other elements of the track structure to the same extent as in paved track. Therefore, it is essential that only the longest-lived timber, and that which will provide the greatest spike-holding power, be used. Otherwise premature loosening of the rails, with the certain serious damage to the pavement, and ultimately the entire track structure, is bound to result. Then there is the matter of rather close conformity to the nominal dimensions. The trench for an electric railway track is excavated closely to given dimensions in order to disturb the minimum amount of the adjoining pavement. Sometimes there is laid a concrete base in the bottom of this trench on which the track is afterward built. In either case it is essential that the length and depth of the ties be quite close to the nominal dimensions specified.

INITIAL COMPRESSION A PROBLEM

There is one other factor in track construction which it might be well to discuss at this time, which is important in any type of track, but particularly so in track on paved city streets, where subsequent maintenance operations at relatively frequent intervals is so expensive as to be prohibitive. Even when sawn ties are used and tie plates are employed to better distribute the load over the tie, it is impossible, when spiking the rail to the tie, to eliminate all of the factors which are responsible for slight initial loosening of the rail when cars are first operated over the track. There is a certain amount of compression which this loading will cause that tends to bring the rail base and plate into more intimate contact with each other. It also compresses the wood fibers under the tie plate and seats the tie plate more solidly on the tie to the point where the natural resiliency of the wood is brought into play and further loosening of the rail fastening is materially retarded. Some woods are much better in this respect than others. White oak, for example, is probably the best, but it is not so susceptible to treatment as many other woods of inferior quality. It would be of material value to the electric railway engineers if the tie producers would develop accurate data along this line for various kinds of wood and for different surface finishes and for different methods of fastening the rail to the tie.

The switch tie problem will probably never be a serious one with the electric railways for their track in city streets, for the reason that the trench in which the track is installed is of such dimensions, and the special trackwork layouts frequently so complicated, as to make impracticable to use long ties, due to the difficulty of installing and replacing them. For this reason the majority of the electric railways will probably continue to install their special trackwork layouts on standard length cross ties interlaced as may be found most practicable. The general use of mechanical tamping machines has overcome the difficulty previously experienced of tamping ties in special trackwork layouts.

Keeping Cars Fit in Vancouver

British Columbia Electric Railway repaints cars on 70,000-mile basis, using enamel system

WHEN a street car of the British Columbia Electric Railway, Vancouver, B. C., has traveled 70,000 miles, which takes approximately eight months, it is held from service for entry into the overhauling shops.

When the car comes in to the shop it is lifted off its trucks, which are delivered to the mechanical department complete. Next the body of the car is lowered onto dumpy trucks and towed into the carpenter shop. Here all the windows are removed and workmen go over the floors, seats, and other portions of the car, completing necessary repairs. Then the car is transferred to the paint shop. On arrival every portion of the car is washed and scraped where necessary.

To facilitate the work the car is placed on its own trucks when it enters the paint shop. Body and trucks are painted at the same time, a spray being used on the trucks. The body painting is done by hand, five coats being used. The process takes approximately seven days from the time the car enters the carpenter shop until it leaves the paint shop.

The material used for painting the car bodies is a fire-red enamel. About 5 gal. are used on city cars. In addition, 1½ gal. of sash color, 1½ gal. of ivory paint and ½ gal. of dull semi-finished varnish are also needed. It takes 160 hours to complete this portion of the reconditioning. The cost, including material and labor, is about \$210. Interurban cars cost one-third more to paint and recondition than city cars.

In addition to painting the cars, 170 trucks and service cars are painted in the shop. The motor coaches operated by both the B. C. Electric Railway and its subsidiary, the B. C. Rapid Transit Company, go through the same process as is used on the cars, except that in the Rapid Transit Company's coaches the upholstery is cleaned. The coaches come into the paint shop approximately every 90 days. The average output of the shops is nine cars per month. Seven painters and five helpers are employed continuously on this work.

While the paint shops are situated at Kitsilano along with the mechanical department, the paint shop is en-

tirely separate to prevent floating dust from settling on the newly-painted surfaces. The shop is not heated by the fan system but has steam coils throughout. The object of this is to eliminate air currents which might carry dust through the shop. The heat can be varied from 0 to 100 deg. The stock room has a capacity of two months' supplies of paints, varnishes and oils. It has a concrete floor and 22-in. galvanized-steel plates around the walls at a height of 6 ft. The benches are also covered with galvanized steel, so that the paint and oil can be readily removed. This is done by washing them every night with paint remover.

To assist the painters, scaffolds mounted on wheels have been made. They are constructed of light-angle sections and can easily be moved by two men. They vary in height from 2 ft. 6 in. to 8 ft. 6 in., there being three platforms in all, with railings around the outside to protect the workmen. Each scaffold will accommodate three men at one time.

Mirror for Inspecting Converter

By S. M. SPINDLE

Engineer Power Department Cleveland Railway
Cleveland, Ohio

WHEN repairing, inspecting or removing foreign objects from the interior of a synchronous converter armature, it is frequently desirable to be able to see the inner surface of the armature coils; i.e., the surface exposed to the armature spider. In the compactly built machines of today this is virtually impossible by direct vision.

To fill this need the electrical maintenance division of the Cleveland Railway has developed a device consisting of a mirror, 3x5 in. in size, mounted through small worm gearing to a hollow tubular handle. By turning a knurled knob at the end of the handle the angle formed by the face of the mirror and the handle may be altered as desired. With the mirror inside the armature and the handle projecting out between the commutator spider arms a very comprehensive view of the interior may be easily obtained. A small lamp is rigidly attached to the handle in such a way as to illuminate the surface to be inspected, but not to shine upon the mirror. The wires are carried through the tubular handle to the lamp.



Interior of paint shop of the British Columbia Electric Railway. Both cars and buses are refinished. The gallery at the right is used for sign repairs

Look for the
PRIZE WINNERS
in the
June Issue

AT A MEETING of the judges in ELECTRIC RAILWAY JOURNAL'S Maintenance Contest, to be held at association headquarters in New York on May 7, 1929, the second group of prize winners will be announced. There is a separate prize of \$25 for the best item submitted from each department—equipment, track, electrical and bus.

Are you overlooking this opportunity to be identified with the progressive maintenance men of the industry? Entries are now coming in for the next group of departmental prizes. There is still plenty of time to join the ranks of those who are cooperating in this effort by the JOURNAL to raise the standards of local transportation maintenance.

Items submitted now will be judged for the third group of individual \$25 prizes. They will also be eligible for the annual cash prize of \$100, for the departmental certificates of merit and for the annual company maintenance trophy.

If you want to arouse interest in your department and company in going after these awards (in addition to the cash prizes) write to the

JOURNAL for printed folders giving full details of this greatest maintenance competition in the history of the industry!

There is no limit on the number of items that can be submitted by any individual, department or company. Nor is "fine writing" necessary. Just write a letter describing methods or devices used in maintenance work that save time and labor or improve workmanship. Your item does not need to cover something unusual or novel. A better method of doing an old job, or a simple jig, fixture or tool that saves labor and time, may win one of these prizes. Be sure to inclose a photograph or sketch illustrating your idea, and write "*Maintenance Contest*" at the top of your letter.

The JOURNAL pays \$5 for every item published, even though it does not win a prize. Make your maintenance ideas pay dividends by passing them along to the other fellow! Don't watch others romp off with these prizes. There may be several winning ideas that have been knocking around your department for months. Send them in now!

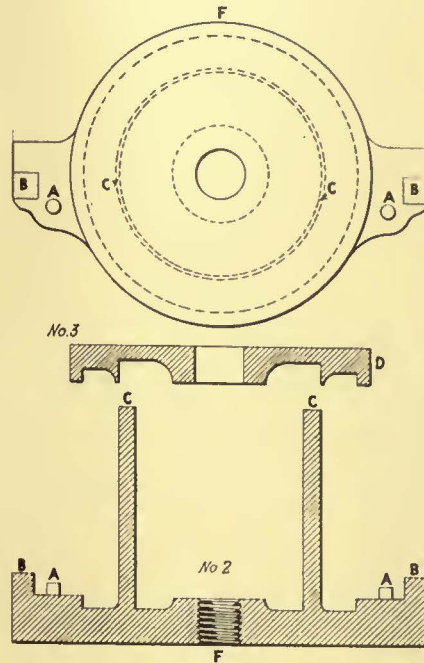
Rebabbitting Connecting Rods for Bus Engines*

By F. A. MARSH

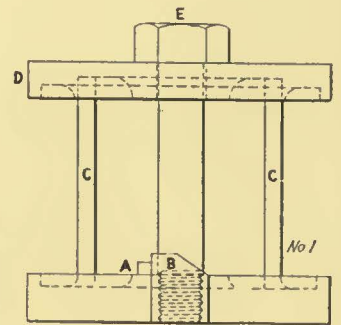
Superintendent of Equipment
St. Petersburg Municipal Railway
St. Petersburg, Fla.

WHEN it was found expensive and unsatisfactory to get bus engine connecting rods reconditioned outside the shop of the Municipal Railway of St. Petersburg, Fla., an arbor for babbitting was designed. This consists of three parts: a base with a circular portion extending upward, a cap and a $\frac{1}{2} \times 2\frac{3}{8}$ -in. hexagonal head capscrew. To allow air to escape and for replacing any babbitt which may be lost in leakage the connecting rods are drilled with two holes. A $\frac{1}{8}$ -in. hole is drilled parallel to the stem for the air and a $\frac{1}{4}$ -in. hole is drilled to the top bearing portion for babbitt.

Rods are cleaned thoroughly and then tinned. Shims, 0.005 in. thick,



Type of arbor used for rebabbitting connecting rods of bus engines



*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

(OVER)

Rail Clips for Emergency Repairs*

By F. W. DROWLEY

Roadmaster Way Department
Toronto Transportation Commission,
Toronto, Canada

FREQUENTLY on lines of the Toronto Transportation Commission the head has broken off from old girder rail in tangent track which is about due for replacement. Due to the short car headway or other con-

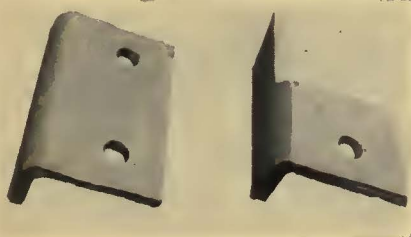
ditions of vehicular traffic, it may not be possible to do a proper repair job at the time. It is the practice, therefore, to use a temporary clip which is bolted to the rail and replaces the broken section of the railhead.

Clips of various lengths are carried by the emergency trucks and are fastened in position quickly by standard splice bar drilling, with large machine bolts to replace the regular track bolts. In cases where rail ends have broken in cast bound frogs or crosses, it is necessary to cut off about 3 in. of the ball outside the casting and drill a hole in the web to bolt the clip in place. Washers or shims are

placed between the web and the clip to hold the gage line of the clip to proper location.



Repair of a broken rail made with a rail clip



Repair clips for broken rail

*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

Rebabbiting Connecting Rods for Bus Engines—Continued

are used in assembling, and blind nuts instead of standard to avoid getting babbitt in to the threads of the studs.

With the rod in the arbor and the babbitt at proper temperature the assembled parts are pushed down in the hot babbitt to a depth of 6 in. and stirred around thoroughly. A wooden box about 12 in. square and 8 in. deep is filled with damp sand, in which a depression is made of a size slightly larger than that of the rod with the arbor attached and to a depth of about 5 in. When the rod is withdrawn from the babbitt it is placed in the sand, which is then packed around it an inch or so higher than the arbor. A riser of babbitt is then poured in

the depression with a ladle to insure a perfect rod regardless of shrinkage or leaks.

When the babbitted rod has cooled to a temperature less than 100 deg. F. it is taken out of the sand and the arbor is removed. The only machining operation necessary is boring out $\frac{1}{16}$ in. or so and relieving the sides for the oil ways.

The arbor shown in the accompanying illustration is designed with lugs and pins at A and B to rebabbit Yellow Coach Model X rods. The same type of construction, however, can be used for other types. The flanges and fillets being babbitted do not need machining, and when the

blind nuts are removed and standard nuts replaced the rod is ready for what little machining is necessary. If extreme care is used in making the arbor, the cost of about \$4.50, will be repaid in the class of work and low cost of machining which results. If many rods must be rebabbitted several outfits would increase efficiency.

By this dipping process the rod and babbitt are of equal temperature and the bearing is free from air bubbles, dross and dirt, and when the rod is held up on one finger by the wrist pin end and struck with a piece of metal, it will give out a clear metallic ring. This shows perfect adhesion between the babbitt and rod.

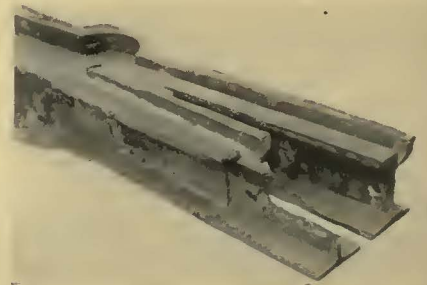
Repairing Broken Ends of Manganese Track Castings*

By R. J. FENNELL

Assistant Roadmaster Toronto Transportation Commission, Toronto, Canada

DUE to fracture along the bolt holes it has been necessary to remove from service on lines of the Toronto Transportation Commission several switch and mate castings from the ends of which the ball and part of the web had been broken. Ordinarily, these castings would go to the scrap heap, although they might have given from five to ten years' further service had it not been for the break. A

method of rehabilitation has been developed whereby the broken surfaces of the ball and web are evened up by grinding and then a short length of similar rail shaped to fit this surface and the whole seam welded with the metallic arc. Finally, a pair of $\frac{3}{4}$ -in. plates is applied and they, in turn, are seam welded at the top and bottom. The accompanying illustration shows the method of repairs.



Broken joint in the straight heel of a switch



Broken switch casting after repairs have been made

*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

Overhead Poles Supported on Long Ties*

By ANGUS G. SCOTT

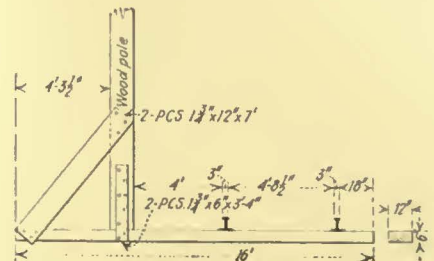
Assistant Superintendent of Overhead Lines
Cleveland Railway, Cleveland, Ohio

FOR dump tracks where the rails are being shifted as the fill progresses, the Cleveland Railway has found it advantageous to support the overhead by wood poles mounted on extra long ties. Formerly the poles were set in the ground, and whenever the track was shifted it was necessary to reset the poles and replace the overhead.

With the new method of attaching the poles to the ties it is unnecessary for the overhead department to make any changes when the track is shifted. The track crew automatically shifts the overhead along with the rail, thus avoiding the expense of digging new holes and transferring poles and equipment.

The accompanying illustration in-

dicates how this idea can be used to advantage, and the sketch shows the method of attaching wood poles to the extra long ties. Two double braces are spiked to each side of the pole and tie, and the pole in turn is spiked to the tie. The bottom plates are nailed to the tie and pole butt. Any suitable planking may be used. To hold the wire tight a counterweight, insulated several times from the trolley, is attached to the end pole, which is in turn mounted to the last tie. Any slack which may occur in the line is then taken up automatically. The economy of this operation is readily apparent, and, of course, depends upon the number of times the track is shifted, and the number of poles involved.



Method used for fastening wood pole to tie



Overhead construction supported by poles mounted on long ties on temporary track at Cleveland

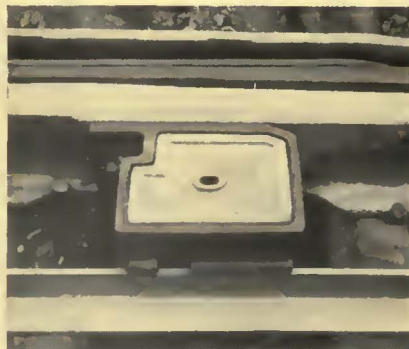
*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

Track Switch Box Support*

By W. J. McCALLUM

Foreman Way Department
Toronto Transportation Commission,
Toronto, Canada

DUE to the increasingly heavy loads imposed by vehicular traffic many bolted-on switch boxes on the tracks of the Toronto Transportation Commission have been broken off from the casting. In this condition they drop below the level of the pavement, especially at the outer edge. To overcome this trouble a lug has been incorporated in the switch box casting so that it rests on the top edge of a 3x3x1/2-in. angle, the latter being welded to the lug. The angle in turn is supported by adjacent ties.



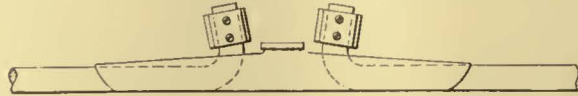
Type of support used for switch boxes of the Toronto Transportation Commission

*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

Emergency Splicing Ear*

By JULIUS E. REIFSCHEIDER

Engineer Ithaca Traction Corporation, Ithaca, N. Y.



Emergency trolley ear in use by the Ithaca Traction Corporation

FOR splicing broken trolley wire which is too old and worn to be deserving of permanent repair, a convenient emergency ear is used by the Ithaca Traction Corporation. This consists of an ordinary trolley ear with a hole drilled on each side of the boss. The ear is placed at the break with the broken ends of the wire projecting upward through

the two holes, as shown in the accompanying illustration. Clamps are attached to the projecting ends to hold the wire in position. While not suitable for use as a permanent repair job, this emergency ear has proved convenient for temporary use on account of its cheapness and of the ease of installation. Such ears are always carried on the line car.

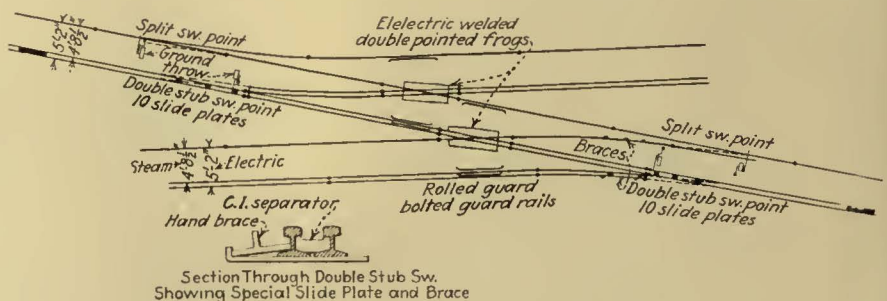
*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

Double-Gage Crossover Relieves Congestion*

By C. B. HALL

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

CONSIDERABLE congestion occurred in the yards of the Virginia Electric & Power Company, because the track gage for the electric cars is 5 ft. 2 in., while that for steam railroad cars which deliver material is 4 ft. 8½ in. To remedy this condition certain tracks were equipped with double rails and a double-gage crossover was installed. This has brought about a yearly saving of \$300 in hauling fees alone, and has speeded up the unloading of freight cars materially.



Double-gage crossover used in the yards of the Virginia Electric & Power Company

The design and construction of the double-gage crossover was carried out by J. C. Newman, engineer maintenance of way, for the company. Installation of a reversed split and

switch on each turnout of the crossover completes the through service over a change in track gage. The special double-pointed frogs were made up of old 70-lb. T-rail welded together at the seams. The cost of the crossover was approximately \$400. Labor was the major item, since other parts were made of second-hand material.

*Submitted in ELECTRIC RAILWAY JOURNAL Prize Contest.

New Offerings of USEFUL Equipment

New Mack Bus Has Low Engine Speed

IN A NEW Mack bus recently put on the market, the motor has a $4\frac{1}{2} \times 5\frac{1}{2}$ -in. bore and stroke, and is suspended at four points in Mack Rubber Shock Insulators. Although 110 hp. is developed, the engine speed is kept as low as 1,700 r.p.m. The six cylinders are cast in block having removable heads in pairs. The crankshaft is drop forged, case hardened and counterbalanced with integrally forged counterweights. Fuel feed is optional and electric pumps, vacuum tanks, or both, are available. Carburetor is of Zenith double venturi type, model 105 DC, $1\frac{1}{4}$ in. The capacity of the gasoline tank is 80 gal., being mounted on the right side in a cradle suspended on three rubber shock insulators.

Final drive is of the dual reduction type, having a full-floating rear axle, with a one-piece banjo drop forging of heat-treated chrome-nickel steel. Model BK is available in two standard wheelbases, 233 and 265 in., either of which is suitable for city type or parlor car bodies. The 233-in.



The Parlor body on the 233-in. wheelbase chassis will accommodate 29 passengers, while the 265-in. wheelbase type can carry a parlor body for 33 passengers

with seat centers of $34\frac{1}{2}$ in., 29 passengers may be accommodated, even with the use of reclining chairs or other similar models.

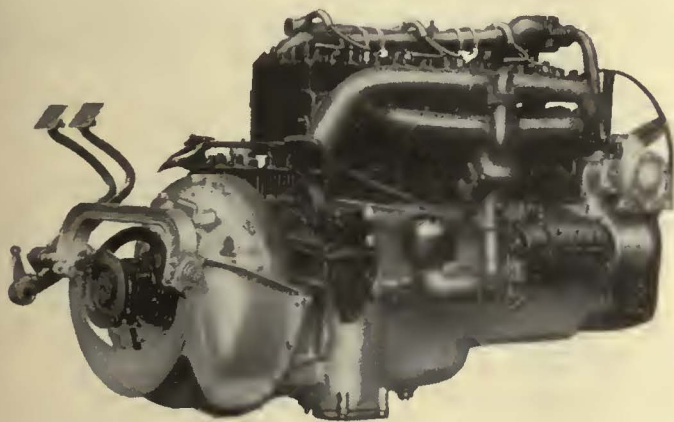
Rubber shock insulation, is used to an extent even greater than heretofore. Not only are the spring tips secured to the frame by blocks of live resilient rubber compressed into steel boxes, replacing spring shackles

vacuum booster attachment by means of which additional power may be exerted on all four wheels with but little effort on the drivers part. The total braking area of both sets is 759 sq.in. and of the hand brake, which is mounted separately, 144 sq.in.

Water-Cooled Carbon Electrode Holder

FOR heavy-duty welding by the carbon-arc process, a new water-cooled carbon electrode holder is announced by the Lincoln Electric Company, Cleveland, Ohio. This is designed primarily to insure greater comfort and less fatigue for the welder. With this type of holder it is possible to weld with the arc tip of the carbon electrode projecting less than 3 in. from the carbon-holder. Consequently, there is less carbon area heated, thereby reducing the vaporization of the carbon. Smaller carbons can be used with higher current density, which effects a saving in electrode costs.

The weight of the new type holder is $3\frac{1}{2}$ lb. The hose which carries the water is also used to carry the cable to the holder. Each of the two water tubes contains a small light cable from the connector to the holder. The water flowing through the holder also acts as a cooling agent for the cable. The carbon-holder consists of coiled copper tubing through which water circulates. The carbon electrode is



The new Mack six-cylinder motor, which develops 110 hp. at 1,700 r.p.m., is cast in block with removable heads in pairs

chassis equipped with a 96-in. city type body, having seat centers of 30 in., will accommodate 29 passengers, or with seat centers of 28 in., 33 passengers may be accommodated, while the 265 in. wheelbase chassis will accommodate 37 passengers. The 265-in. chassis, equipped with parlor car body having 30-in. seat centers, will accommodate 33 passengers, or

pins and bushings, but similar means are employed for the suspension of the radiator, the engine, the transmission, the gasoline tank, the steering column and the front bumper.

Four-wheel brakes of the expanding mechanical type enable model BX to travel with safety at high speed. Augmenting these brakes is the



Water-cooled carbon electrode holder

inserted through the tubing. A hand shield of compressed magnesium protects the operator's hands from the arc rays. The water-cooling system is incorporated in the hand grip of the holder to keep it cool.

Recent Developments in Atomic-Hydrogen Welding

BY PETER P. ALEXANDER
Thomson Research Laboratory
General Electric Company

RECENTLY a new method for atomic-hydrogen welding has been developed in the laboratories of the General Electric Company. The apparatus used is simple, consisting of a support to hold the tungsten electrodes and two tubes directing a hydrogen flame around them. All energy which is supplied to the weld is from the electrical circuit, while the gas serves only to shield the electrodes, to protect the metal from oxidation, and to increase the efficiency of the arc.

There are several processes using the indirect arc for welding, but they are inefficient. It is only when air is replaced by hydrogen that the efficiency of the process of indirect arc welding is increased to such a degree that it becomes a successful process. All the energy is coming from the electrical circuit, so it is essentially an electrical welding method and yet it possesses all the characteristics of a gas-welding process. This process is adaptable to the welding of thin materials. Another field of its application is welding of special alloys and those with a low-melting point. Since in the atomic-hydrogen process the electrodes are non-consuming, the material can be added to the welded plate from a special welding rod of any desired composition. If it would be attempted with direct arc, it would be found that if the electrode has high chromium or carbon, it is almost impossible to maintain an arc. However, if the arc is maintained inde-

pendently, this rod could be used quite easily.

The importance of aluminum and other light alloys is increasing. It is almost impossible to weld these alloys with the direct electric arc, although they can be welded with gas. On account of a very low-smelting point of these alloys when arc is established between the electrode and the plate, much of the metal is vaporized, but with indirect arc the temperature may be easily kept within the desired limits.

Hydrogen protects the alloys from oxidation. The greatest obstacle for welding aluminum, however, is the formation of aluminum oxide, which prevents the metal from running together. With atomic hydrogen welding, it is possible to weld aluminum under certain conditions without the danger of forming aluminum oxide, and it is even possible to reduce the aluminum oxide already formed to its metallic state. Still, it is not practical at the present time to use the atomic-hydrogen welding process for welding thin aluminum sheets without fluxes, on account of the desire to maintain a high speed of welding the thin materials. In practical applications of the torch for welding thin aluminum sheets, it has been found necessary to use additional fluxes.

Spring-Cushioned Rattan Seats

COMFORT and durability are the features claimed for the new rattan and leather seats No. 201-E, designed by The J. G. Brill Company, Philadelphia, Pa. These seats are unusual in construction in that they are upholstered in a combination of rattan and leather. The cushion, which is of the spring-edge type, 18



The leather facing provides a flexible edge for the deep spring cushion

in. wide, 4½ in. deep at the front and rear and 5½ in. at the crown, is upholstered in canvas-lined rattan top and edged all around with brogue taxi grain leather. This leather facing, while adding to the appearance of the seat, serves the more useful purpose of providing a flexible edge for the spring cushion, thus allowing a deep spring-edged type of construction and providing a more comfortable and durable seat than possible with an all-rattan upholstery. Another advantage claimed for this seat is the elimination of complaints by women passengers resulting from torn clothing which would be caused by projecting pieces of broken rattan on the edges of the ordinary rattan cushion.

The back of the seat is upholstered in rattan. The aisle and wall plate and pedestals are of pressed steel. These seats were first designed for the eighteen cars recently furnished to the city of Phoenix, Ariz., by the American Car Company. As the Phoenix cars are of the double-ended construction, the seats are of the reversible type.

High-Conductivity Lips for Trolley Ears

WITH the idea of lowering overhead line maintenance cost by reducing the arcing and burning of trolley ears, the Westinghouse Ele-



New trolley ear with high-conductivity copper lips

tric & Manufacturing Company has developed their new "Champion" trolley ear. Experience shows that trolley ears burn out rather than wear out by the abrasion of the trolley wheel or shoe. If the material used in the lips of the trolley ear has a conductivity equivalent to the trolley wire used, some of this burning will be eliminated. This is accomplished in the "Champion" ear by using lips made from bronze or copper sheet having high conductivity. This sheet is blanked and shaped with loops formed on the top into which an aluminum-copper alloy of very high strength is cast by the permanent mold method. This assures metal under the trolley wire of high conductivity and also a strong base. These ears are manufactured in 9-in. and 15-in. lengths for Nos. 00, 000 and 0000 round wire.

NEWS of the Industry

Fare Increase Sought

Company in Portland, Ore., wants 10-cent cash fare. Five-year comparative income statement

FACING declining revenues, increasing operating expenses and taxes, and increasing capital investment, the Portland Electric Power Company, Portland, Ore., filed on April 22 with the Public Service Commission a new tariff calling for an increase in the basic adult fare on city lines from the existing 8-cent cash and six tickets for 45 cents to a straight 10-cent cash fare. The tariff also calls

Preliminary announcement of the fare increase asked by the company was made to a group of prominent Portland business men by Mr. Griffith at a luncheon meeting, April 19, in which the reasons for the increase were fully discussed.

Harley Johnson Safety Awards

A new safety record was established by employees of the Chicago Rapid Transit Company during 1928, when less than 3½ per cent of the 5,848 men and women in service sustained lost time or disability injuries.

New Franchise in Albany, Ore.

The city of Albany, Ore., has awarded a franchise to the Oregon Electric Railway for a railroad link over the streets and sidewalks of Albany within the area bounded by its present track and the Southern Pacific line on the north and south and by Main Street and the eastern city limits on the west and east. The motive power will be optional in the new franchise as the former franchise specified electrically-driven cars. The term of the grant is 50 years, superseding the old one held by the Oregon Electric Company, which expires in 1937.

A. J. Witchell, chief engineer for the line, states that both freight and passenger service will be permitted. The arrangement is significant in that it will make possible a connection with the northern railway lines and the Southern Pacific in East Albany. Transportation of logs from the timber area in eastern Linn County is the aim. According to Mr. Witchell, new lines between Lebanon and Foster and between Sweet Home and Calapooia have been located.

COMPARATIVE INCOME STATEMENT OF CITY LINES OF PORTLAND ELECTRIC POWER COMPANY

Year	Gross Revenue	Operating Expenses	Bridge Rental	Taxes	Total Expenses and Taxes	Operating Income	Average Invested Capital	Rate of Return Per Cent
1924	\$4,874,681	\$3,658,111	\$97,604	\$339,127	\$4,094,843	\$779,837	\$19,459,967	4.01
1925	4,835,977	3,682,582	98,181	289,960	4,070,724	765,253	19,676,919	3.89
1926	4,755,770	3,753,060	95,951	325,740	4,174,751	581,018	19,830,388	2.93
1927	4,630,431	3,729,748	94,645	358,045	4,182,439	447,992	19,936,384	2.25
1928	4,523,475	3,789,850	91,496	379,218	4,260,565	262,909	20,050,846	1.31

Depreciation included in operating expenses is depreciation found by Public Service Commission for rail lines plus depreciation on buses.

for an increase in school children's tickets from 25 to \$1 to twenty for \$1. The existing 8-cent fare was put into effect July 1, 1922, when it was increased from 5 cents. The step from 5 to 6 cents was taken on Sept. 15, 1918, these two increases being the only ones ever asked for the Portland company. Under the newly-filed tariff universal transfer privileges are to be continued.

The new tariff was accompanied by a petition by Franklin T. Griffith, president, setting forth in full the reasons why relief from a situation rapidly growing intolerable is desired. Showing that the rate of return on the capital invested in railway property has steadily declined from year to year from 4.01 per cent in 1924 to 1.31 per cent in 1928, the petition states that the company faces "confiscation of the property and demoralization of the service" if relief is not granted, and invites a public hearing where interested persons may have the opportunity to examine all angles of the problem.

The communication contained a comparative income statement for the years 1924 to 1928, and elaborated at some length on the factors influencing the decrease in annual operating income of \$517,000 in that period. The decline in gross revenues was charged principally to the increased use of the private automobile; the increase in operating expenses, in spite of labor saved through an increasing use of one-man cars, to the expense of operating unprofitable additions to service forced on the company by the absolute necessities of a growing community. The increased capital investment involved in these service extensions, which have been effected largely through bond issues, has amounted approximately to \$10,000,000 in the four-year period, an item contributing to the decreasing rate of return. A reconstruction program facing the company in the near future is cited as an added reason for immediate relief.

Employees of the transportation department of the elevated line set a new high mark with only 80 disability injuries in a grand total of 57,227,346 car-miles operated during the year—an average of 715,342 car-miles per disability injury. In addition to being the best safety mark in the history of the company, it is one of the most remarkable of the kind ever recorded.

The North Side division led all other divisions of the transportation department, operating "L" trains an average of 1,109,796 car-miles—more than 44½ times around the world—for each disability injury.

With a view to promoting even higher safety standards on the "L" lines, four shields donated by Harley A. Johnson, general manager, will be presented to the departments establishing the best employee safety records each six months of the year. These trophies will be awarded on Jan. 1 and July 1 of each year. They will be known as the Harley A. Johnson Awards for Accident Prevention.

5½ Per Cent Interest for New York Subway Notes

Controller Berry, of New York City, has announced that the new subway construction notes, on which he is about to call for bids, will bear interest at the rate of 5½ per cent. These are four-year notes, complying with the Board of Estimate's policy, under which the city will raise out of taxes a large part of the money it needs for the construction of the new municipal subway.

The amount of the present issue is \$52,000,000; it is part of a total authorization of \$318,000,000. The first installment was marketed a year ago, after the controller, in a court action, had unsuccessfully opposed the decision of his colleagues. At that time the rate was 4 per cent.

Trainmen Stirred by St. Louis Company's Statement

A recent exchange of communications between the officials of the local amalgamated union and Stanley Clarke, president St. Louis Public Service Company, indicates the strained relationship that has developed because of the failure of the Missouri Public Service Commission to announce its decision on the wage controversy submitted to the commission for arbitration several months ago.

The new controversy resulted from an article "Will Car Fares Be Increased?" that appeared in the April 15 issue of *Transit News*, the official publication of the railway, distributed to riders. This was interpreted by union officials as propaganda on the part of the company preparatory to a drive for a 10-cent fare, regardless of the outcome of the wage controversy.

The *Transit News* article pointed out that fares are largely governed by the wages paid employees, that the 5,500 employees of the Public Service Company are paid a total of nearly \$10,000,000 a year in wages, a sum approximately two-thirds of the operating cost. The article contended that the men are receiving higher wages than the average paid in other cities. It expressed regret that the riders could not pass on the wage question similar to the recent vote on the question of whether the wages of the city's firemen should be increased \$25 a month, a measure which was defeated.

"Our motormen and conductors have much the same relation to you that the city firemen have," the article continued. "They are public servants, performing a necessary task," etc., concluding higher carfare was equivalent to higher taxes.

The burden of the answer of the representatives of the men was that the plea was "obviously an attempt to prepare the public for a 10-cent fare request and you also

improperly seek to shift in advance to the street car men the public criticism you expect from that request."

The company in its rejoinder kept its answer almost entirely to the issue of the adequacy of the pay now being received by the men contrasted with that paid elsewhere.

To this the representatives of the men made reply in a communication in which they took exception to Mr. Clarke's statement "because, like the *Transit News*, it is replete with misleading half-truths, tending to prejudice the public against the street car men."

To this last communication President Clarke declined to reply, saying that so far as the company was concerned the controversy was a closed incident, the company resting its case on the points contained in the statement previously issued.

It is very uncertain when the state commission will pass on the wage dispute.

Levis Banquets H. E. Weyman

Some managers are roasted and others are toasted. H. E. Weyman, general manager Levis Tramways, Levis, Que., is in the toasted class. On April 2, some 150 of his fellow-citizens honored him with a banquet to mark his energetic work as president of the Chamber of Commerce and his fifteenth anniversary in the rescue and upbuilding of the Levis transportation system. With the banquet came a permanent reminder of the occasion in the form of a fine set of tableware.

Mayor LeBlond, toastmaster of the evening, dwelt upon Mr. Weyman's untiring efforts to advance the commercial and industrial progress of the "South Side." As a graceful conclusion, he quoted Longfellow's "Psalm of Life" with its emphasis on "Learn to labor and to wait."

"The hero of the fête," (to translate *Le Quotidien* literally) in a happy reply to the Mayor, said this occasion proved that an overwhelmingly French-Canadian community could take an Anglo-Canadian to its bosom. He hoped that the example of Levis in this respect would be a precedent to others. After thanking his friends for their gift, he discussed the advantages of the Levis district as one offering 12 miles of first-class harbor with the further advantage of being able to build double-deck piers without the necessity of excavation. Since publicity was imperative in these days, the Chamber had distributed broadly during the year the first publication of note on the merits of the district.

Mr. Weyman was followed by Noel Belleau, a noted lawyer who said: "You see before you a man of tranquil mien who labors unceasingly for the good of his community and who is astonished to find that his work is appreciated by all the world." Continuing, Mr. Belleau related how Mr. Weyman had restored the Levis tramways system and made it a matter of community pride; and that when he completed this work, he must have said: "Now I belong to the people," as evidenced by his splendid rejuvenation of the Chamber of Commerce.

The *Chronicle-Telegraph*, of Quebec, the big city opposite Levis, took note of the banquet in an editorial entitled "Levis Forges Ahead." Of Mr. Weyman, it wrote: "He has not only brought the public utility in question to a high station of efficiency but—most unusual feat—has made it a popular institution in the community."

Bootlegging of Rides Prohibited

A LAW passed by the Maryland General Assembly to permit owners of automobiles to transport fellow employees to and from their work for pay has been signed by Governor Ritchie to become effective on June 1. Car owners who plan to engage in this kind of service will be required to obtain an employees' certificate of convenience from the Public Service Commission, at the same time filing the names and other information dealing with those they plan to transport.

Only those who are not convenient to other means of transportation will be permitted to use this form of travel. Certificates so issued will carry a special license plate from the motor vehicle commissioner to cost \$3 a year additional. Each owner of a passenger car so run must carry a copy of the certificate in his vehicle. Owners, will not be permitted to transport passengers for pay except as provided in the certificate.

Theatre Party for Metropolitan Section Members

"What Do You Say?" a musical comedy, is the attraction which has been arranged for the entertainment of the members of the Metropolitan Section in New York in accordance with the annual custom of the manufacturers. The theatre party will be held on the evening of May 3 at the Lyric Theatre, New York, 42nd Street west of Broadway. The members of the cast of the comedy are all employees of the Third Avenue Railway. Their services are being donated through the courtesy of Slaughter W. Huff, president of that company. Two tickets to the show will be sent to each member of the section. Since the seats are not reserved, the early arrivals will benefit most. The play will start at 8.15 sharp. Arrangements to present it were perfected under the direction of T. W. Casey, chairman of this year's committee.

\$7,000,000 Capital Outlay to Handle 80,000 Stadium Crowd

Cleveland's new civic stadium will cost \$2,000,000. Its capacity is estimated at 80,000. Properly to care for the crowds expected to attend the events there will entail an expenditure of \$7,000,000 on the part of the Cleveland Railway. President Alexander said that a number of studies of possible rapid transit facilities to handle stadium crowds had been made by the engineering firm of Parsons, Klapp, Brinckerhoff & Douglas in connection with their transportation survey for the Cleveland Railway. He is quoted:

"The most feasible plan is underground operation on a loop starting at the Terminal tracks, north in West 9th Street to Lakeside Avenue, east in Lakeside to East 9th Street and south on East 9th Street to Huron Road, connecting with the Euclid Avenue subway, which would carry the loop back into the terminal area.

"This route would be accessible to surface cars and rapid transit trains from any

part of the city. It would cost \$7,000,000 but the cost would be materially less if it were constructed in conjunction with other proposed subways."

Mr. Alexander said the possibility of using the Big Four tracks, which run the Terminal area at low level in the present Union Depot, had been considered but that he did not think such an arrangement would be satisfactory. He said:

"That would make a stub arrangement. When one train was loaded another would have to back in. Trains can be loaded and dispatched much faster with a loop, there is continuous movement."

Railway Participates in Baltimore Products Week

The United Railways & Electric Company, Baltimore, did its part toward the great success of "Baltimore Products Week," observed from April 22 to 27, during which almost all the downtown stores showed products manufactured in Baltimore in their display windows. There were about 300 elaborate exhibits.

In connection with the event the United issued a handy guide which the exhibitors, gave the location of display and recorded the numbers of the car lines passing each place of exhibit.

The company printed 150,000 of guides. Of this number 100,000 were placed in the street cars, 25,000 distributed among the public school children, 15,000 were distributed to pupils of the parochial schools and 10,000 were mailed by the United and distributed through the company's business of information. The company said:

"Among the most important of Baltimore's products is safe, economical, convenient street car transportation. Round figures 300,000,000 such rides produced in 1928. The railway industry of Baltimore, carrying hundreds of thousands daily between homes, stores, churches, business of construction projects, theatres—home again—is one of the city's 'essential industries.' Its products—street car rides—are among the city's 'essential products.' Its duty is public service. The United Railways is proud of Baltimore and proud of its opportunity to serve Baltimore. Its lines are links between the homes of Baltimoreans. The exhibits of 'Baltimore Products Week'—every week throughout the year."

The company also helped to boost the exhibit by displaying dash signs on the cars. These read: "Among Baltimore's Chief Products—Street Car Rides—Nearly 300,000,000 Produced in 1928."

It was explained that the 300,000 included revenue and transfer passengers.

Medals for Safe Driving—Twenty-four operators of the Pittsburgh Motor Coach Company, subsidiary of the Pittsburgh Railways, were awarded medals at a party given in their honor on March 20. T. W. Noonan, in chief of the Pittsburgh Motor Coach Company, praised the 24 men and then Graham, Jr., manager of the Pittsburgh office, Ocean Accident & Guaranty Company, presented the medals to them. There were music, refreshments and entertainment.

American Standards for Track Bolts and Nuts

Proposed American standards for track bolts and nuts, as recently approved by the sub-committee of the sectional committee of the standardization of bolt, nut and nut proportions, are ready for criticism. Track and way departments of all electric railways will be interested in this new proposed standard. The proposal is in tentative form for discussion and criticism. Copies may be obtained by addressing C. B. Page, assistant secretary of the American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.

The dimensions given have been determined from data obtained by tests which were carried on under the direction of the sub-committee, and in co-operation with the rail committee of the Engineering Division of the American Railway Association.

The sectional committee consists of 46 members representing manufacturers, consumers and general interests. It was organized by the Society of Automotive Engineers and the American Society of Mechanical Engineers, as joint sponsors, under the procedure of the American Standards Association.

Traffic Studies Planned in St. Louis

Traffic studies to be the basis of recommendations to the Transportation Survey Commission at St. Louis, Mo., are now being made by R. F. Kelker, Jr., Chicago, engineer for the commission.

Initial studies and reports will take up the present railway lines and how that service may be speeded up and existing surface routes be used to a fuller extent.

Mr. Kelker will work out a plan for rerouting street cars in the downtown section without increasing trackage. The existing downtown lines are now taxed to their maximum capacity in the morning and evening rush hours, while many important lines that, it is felt, should enter this district directly, now merely skirt it. In a maximum half-hour in the afternoon, 331 cars enter the district bounded by Ninth Street, Washington Avenue, Fourth and Pine Streets. It is said that Mr. Kelker hopes through rerouting to bring a maximum of 349 cars into this section in the maximum half-hour.

Preliminary studies have revealed that the average speed of the St. Louis street cars compares very favorably with that of cars in other cities. It has been found that the lines with modern cars and facilities for quick loading and unloading of passengers and quick acceleration and retardation have much higher speed averages than the lines with old equipment.

As is well known Mr. Kelker contends that before expensive rapid transit facilities are installed, a city should make full and effective use of all existing facilities. He favors subways only as a last resort.

Canadian Association to Hold Silver Jubilee—Montreal has been selected as the meeting place for the Canadian Electric Railway Association. The convention, which will mark the 25th anniversary of the founding of the association, will be held at the Stadium on June 5, 6 and 7. Convention headquarters will be at the Windsor Hotel.

COMING MEETINGS OF

Electric Railway and Allied Associations

April 29-May 3—Chamber of Commerce of the United States, annual meeting, Washington, D. C.

April 30-May 3—Arkansas Utilities Association, Arlington Hotel, Hot Springs, Ark.

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

May 3—Metropolitan Section, American Electric Railway Association, 33 West 39th Street, New York, N. Y.

May 9—Central Electric Railway Master Mechanics' Association, Lima, Ohio.

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

May 15—Central Electric Railway Traffic Association, Fort Wayne, Ind.

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

May 20-23—National Conference on City Planning, annual meeting, Buffalo and Niagara Falls, N. Y.

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

June 5-7—Canadian Electric Railway Association, annual convention, 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.

July 26-27—Central Electric Railway Accountants' Association, Angola, Ind.

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.

Rerouting Helpful in Atlanta

Opening of the last unit of the new Central Avenue-Pryor Street viaduct in Atlanta, Ga., has resulted in changes in railway routing by the Georgia Power Company, greatly simplifying traffic through the downtown section of the city.

One of the most important changes has been the rerouting of the Inman Park-Grant Park car line. Formerly this line entered the downtown district on Edgewood Avenue, crossed the north-and-south traffic on Peachtree Street, turned south on Broad, and recrossed the traffic lines on Hunter Street before turning on Washington Street to go to Grant Park.

Wherever possible cars are turned back at the so-called "railway gorge" to make a loop without crossing the downtown section. Where this is not possible, cars have been rerouted to use the new viaducts and relieve the crossings at Peachtree and Broad Streets. Only where absolutely necessary do street car lines now cross from east to west and vice versa.

Consideration of Louisville Increase Deferred

Action in the matter of the fare plea of the Louisville Railway, Louisville, Ky., is not expected for several weeks. The city had 60 days in which to take action, after which, under existing laws, the increase would automatically become effective. The Council did take action, but only to the extent of extending the time for passing upon the matter by 90 days, with the result that the 60-day period is just about ending, and there is the 90-day extension, before action is necessary.

Partial Relief in Iowa

An act partially relieving electric railways of the burden of paving between tracks has been passed by the Iowa Legislature during the present session. It provides as follows:

Street railways shall provide a suitable foundation for the track of a width equal to their ties, but in no case less than the width comprised between lines lying 1 ft. outside of each rail of the track, and shall be assessed for the construction or reconstruction of paving between the rails and for 1 ft. outside of each rail, in the amount that the cost of such pavement per yard of area exceeds the cost per yard of the remainder of the paving upon such street. In the making of assessments for paving, in the event that the track or tracks also are to be paved or repaved, the engineer shall estimate the cost of building such improvement, and he shall also make an estimate of the cost of building such improvement upon said street as it would be in the event that the street car tracks did not there exist; and the street railway shall be charged with the difference in said estimates of cost and shall pay the same as other special assessments are paid.

Separate bids shall be taken in case of single track upon that portion of the street between the rails and 1 ft. outside of each rail, and in case of double track upon the entire portion of the street included between lines parallel to and 1 ft. outside of the outer rail of each track. The street railway shall be permitted to bid upon this portion of the pavement and the lowest bidder thereupon shall be awarded the contract. One-third of the remaining cost of the improvement for the area between the rails of the tracks of the street railway and 1 ft. outside shall be assessed against the street railway, one-third thereof shall be assessed against the abutting property and the owner, and one-third shall be paid for by the city either out of the improvement fund or general fund.

All repairs or maintenance between and 1 ft. outside the rails made necessary by the operation of the street railway and any other repairs or maintenance made necessary by the operation of the street railway shall be made by the railway and if not so made, the city shall have the power to make such repairs and assess the cost to such company.

The word "paving" as used in the preceding section shall include any kind of hard surfacing, gravel or macadamizing together with the necessary paving base.

The provisions of the act shall apply to cities acting under special charter.

Recent Bus Developments

Railways Dominate Bus Field

Companies in Toronto, Hamilton and Montreal greatly strengthen their positions as common carriers

THE recent acquisition by the Toronto Transportation Commission of four independent interurban motor coach lines, which gives the publicly-owned railway system control of practically every line operating into and out of the Queen City, recalls to the *Canadian Financial Post* similar consolidations which have been effected in Montreal, Hamilton, and on the Pacific Coast.

Last year, for instance, the Ontario Bus Owners' Association undertook to work out a scheme, involving about eight lines in the province, whereby passengers could be routed by motorcoach from almost any point in Ontario to anywhere in the United States, this being made possible by a working agreement with the operators across the border. Gray Coach Lines, Ltd., subsidiary of the Toronto Transportation Commission, was the leader in this scheme. With the purchase of all the bus lines operating as far as Oshawa on the east, Hamilton and Niagara Falls on the west, and all the lines to the north, they have simplified considerably the through-routing of passengers desiring to travel by motor coach because all the lines in this area are controlled by one company.

The same thing applies in Hamilton, where the Dominion Power & Transmission Company, Ltd., has likewise taken over independent lines and have forged the various lines into a strong department of the company. In Montreal, Provincial Transport, Ltd., has also bought out most of the independent operators, and now control motor coach operation in Montreal and vicinity.

Over on the Pacific Coast the Vancouver Island Transportation Company, Ltd., recently established, has taken over twelve coach lines operating in and around Victoria as well as considerable property. It has an authorized capitalization of \$500,000 first mortgage 7 per cent debentures, of which \$350,000 is issued, and 5,000 shares of common stock of par value of \$100 each, all of which are issued.

The purchase of the twelve established motor coach lines included equipment, terminal leases and an exclusive franchise granted by the corporation of the district of Saanich giving the company sole rights to operate vehicles for the carriage of passengers for a twenty-year period. All the old routes have been improved and expanded, and the company is negotiating for further purchases to increase its control of operation on Vancouver Island.

BUY NEW MOTOR COACHES

To return to the Toronto development: Immediately after taking over the four lines, the Toronto Transportation Commission announced the purchase of 35 new coaches, which brings the total equipment operated by the commission up to 221 vehicles. This is made up as follows: Buses and coaches operated prior to the purchase, 171; buses and coaches acquired with the routes, 15; coaches ordered, 35.

Ten of the new coaches are of 17-passenger capacity, with reclining chairs.

Fifteen are 21-passenger vehicles, while the remaining ten are 35-passenger coaches, which have a regular seating capacity of 29 with six folding seats extra. All are of the parlor type. The commission expects first deliveries in the second week of May, with final deliveries in the first week of June.

Asked for the reason for the smaller type of coach—the 17-passenger—the manager of the Gray Coach Lines explained that the company intended to give more frequent service with the small-capacity vehicles. The new schedules will be announced soon.

The Toronto Transportation Commission with 221 vehicles dominates the field in Toronto; the Dominion Power & Transmission Company, with the recent acquisition of six lines operating out of Hamilton and in Preston and Galt, is supreme in the Ambitious City; Provincial Transport has acquired 31 lines in and around Montreal and now has a total of 125 buses and coaches; and on Vancouver Island the Vancouver Island Transportation Company practically controls the situation there with a fleet of 46 buses and coaches and prospects of an early increase in this equipment.

No-Parking Speeds Up Baltimore Traffic

NO-PARKING regulations put into effect on Fayette Street, Baltimore, recently, have resulted in speeding up the movement of cars of the United Railways & Electric Company on that thoroughfare. Officials of the company declare that the cars have been enabled to increase their speed between 10 and 15 per cent. Opposition to the banning of parking on both Fayette Street and Lexington Street, which developed before the new rules were put into effect, has subsided.

Another Step in Taggart Tangle

That no additional taxicabs be allowed to operate in Seattle for an entire year, and that present operators be placed under rigid new city regulation, are requests made to the city officials by opponents of Sam W. Taggart and associates, who are seeking an exclusive taxicab franchise. At the suggestion of John E. Carroll, president of the City Council, an amendment to the existing taxicab ordinances is being prepared by T. J. L. Kennedy, corporation counsel. This measure will be in keeping with the views of George B. Avery, superintendent of public utilities, who has sought to preserve competition in the taxicab business under stricter city control over rates and the number of taxicabs in service, instead of granting the Taggart monopoly measure.

Rate-cutting to the point of competition with the Seattle Municipal Street Railway by taxicabs hauling five passengers for one fare has afforded the Taggart interests grounds for one of their strongest arguments for a monopoly.

Jitneys Ordered Off Chicago Streets

Six small jitney companies, which been operating a total of 75 buses on northwest side of the city of Chicago 5-cent fare, have been ordered by Municipal Judge Damron to cease operation pending issuance of permits.

Resolutions subsequently adopted by City Council, however, enjoined the permittees from interfering with the operation of these independent lines.

Alderman Joseph C. Ross argued that the order were to be enforced the city would be showing favoritism to the Chicago Motor Coach Company, which operating buses on Chicago streets at 10-cent fare with no authority from city. To this Alderman Jacob M. A. replied that the Chicago Motor Coach Company was protected in its rights by court injunction.

Additional Bus Service for Providence—Petitions have been filed with Public Utilities Commission by United Electric Railways, Providence, R. I., asking approval of a plan to operate buses between Providence Woonsocket and between Providence and Crescent Park. Temporary abandonment of electric car service in Woonsocket and the substitution of buses were asked. The proposed rebuilding Main Street, Woonsocket, makes necessary to discontinue trolley service temporarily. If permission is granted by the state authorities, "the buses supplement the trolley service." How long both types of service would be operated the company has declined to say.

Substitution in New Brunswick—Public Service Co-ordinated Transport Newark, N. J., has been authorized by the City Commission of New Brunswick, N. J., to remove its tracks and overhead structure on Schuyler French Streets and Codwise Avenue to abandon the Middlesex line running between New Brunswick and Plainfield. Buses will be substituted. The line will connect with buses operating between Plainfield and Metuchen. The date for the substitution has not been announced.

Buses to Lynchburg's Union Station—Authority to abandon its railway service from Main Street to the Union Station in Lynchburg, Va., has been granted to the Lynchburg Traction & Light Company, after a hearing before the Virginia State Corporation Commission. The company will substitute bus service. An agreement between the company and the City Council of Lynchburg was presented at the hearing. With the petition was filed the answer of the city in which the city joins in the petition. The company is to reroute its Cab Street bus line to care for travel to and from the Union Passenger Station. Cars are not to be removed from the Union Station line until the company provides new buses for the route.

Southern Pacific Seeks to Buy California Bus Line—Permission has been sought of the California Railroad Commission by the Southern Pacific Motor Transport Company, the motor station subsidiary of the Southern Pacific Company, to purchase all of the outstanding stock of the California Parlor Car Touring Inc., Los Angeles, for \$75,000.

Financial and Corporate

Wichita Reports Presented

Plan taking shape under which local syndicate proposes to take over Illinois Power & Light holdings

REPORTS made by the engineering firm of Black & Veatch, Kansas City, and Clinton H. Montgomery & Company have been submitted to the city of Wichita, Kan. The first, an engineering firm, and the other one, accountants, were employed by the city last fall to make a valuation of the rail lines and to audit the books of the Wichita Railroad & Light Company. With the reports in hand, negotiations have begun looking toward a valuation as a rate base, the fixing of new fares which will apply both to street cars and buses, with a free transfer between, and the working out of a new franchise.

The Wichita properties, namely, the Wichita Railroad & Light Company and the Wichita Motor Bus Company, are under option from the Illinois Power & Light Corporation as of March 1, 1927, to a syndicate in which Messrs. Campbell, Wheeler and Clevinger are interested. This contract gives the Wichita group three years, if necessary, to refinance and purchase the property. Involved in the program is the securing of a new franchise, the working out of a new fare schedule on both street cars and buses, and the rerouting of the latter.

The Wichita Transportation Company was organized as a holding company of the other two companies, but since the street railway was under the jurisdiction of the city, while the bus operation was under the jurisdiction of the Kansas Public Service Commission, the Wichita Motor Bus Company was organized, entirely separate from the original company, the Wichita Railroad & Light Company. Through the Public Service Commission, the company succeeded in getting a new schedule of fares on the buses, as well as a rerouting, the bus fares being 8 cents cash, two for 15 cents, five for 35 cents and 24 for \$1.50.

Nearly two years ago, a proposal was submitted to the City Commission asking for an equitable franchise and for an increase in the street car fares to that of the buses. The present street car fare rate is 6 cents cash, nine for 50 cents, resulting in an average fare of 5.88 cents.

The Kansas Legislature last winter passed a so-called, home rule bill, applying to cities of 90,000 people and more, which would vest the jurisdiction over the buses in the City Commission, if and when a franchise were granted to companies operating both facilities. In the Wichita case, the franchise would probably be granted to the Wichita Transportation Company.

Important Deal Rumored in Michigan

Well-substantiated reports are to the effect that the Michigan Central Railroad is closing negotiations with the committee of bondholders for the purchase of the defunct Michigan Railroad's interurban lines between Grand Rapids and Kalamazoo,

Battle Creek and Allegan. Executive officials of the Michigan Central imply that the lines would not be bought for operating purposes.

Shipping interests in Grand Rapids foresee in the purchase a cutoff between Grand Rapids and Chicago for westbound freight routed over the Michigan Central. Persons acquainted with the plan say the line would also give the Michigan Central access to a new territory with several prosperous towns that are good shipping points and would obviate the diversion of western freight by way of Jackson, Mich. The property would also give the Michigan Central considerable new trackage and exclusive service to several big mills and industries in Grand Rapids.

The Michigan Railroad's property was bid in by the bondholders several weeks ago at a sale conducted by the United States District Court for eastern Michigan. Announcement of the pending deal came from the interurban headquarters at Jackson, and will be subject to certain restrictions imposed by the court. The deal would include all track, right-of-way and property connected with the two lines. Interurban freight service will be continued for 60 days.

\$15,000,000 Bonds Urged

Expert for Detroit municipal railway says system can not keep pace with improvements by financing them with earnings

DETROIT'S municipal railway is charging a fare insufficient to meet the demands that are being made upon the system for extensions and improvements in service, and the Council should be asked to authorize a bond issue of \$15,000,000 for the use of the department, John H. Morgan, auditor for the municipally-owned lines, has so informed the members of the Street Railway Commission. The system cannot keep pace with the growth of the city on the present revenue because earnings are insufficient.

For the present construction year the Council has tentatively authorized the expenditure of \$5,600,000 for improvements, extensions and new equipment. Mr. Morgan said that this money cannot be obtained from the present revenue of the system. No suggestion was made at the session at which the Morgan report was presented to increase the fare, although figures compiled by the American Electric Railway Association reveal that the average fare in the country is now in excess of 8 cents as compared with 6 cents in Detroit.

In lieu of an increase, Mr. Morgan suggests that the Council be asked to appropriate \$15,000,000 to be used by the D. S. R. as it is needed. The street railway department could then use this money to provide better service and also to construct lines to newly-developed sections of Detroit.

Mr. Morgan said that the present method of financing cannot continue, and suggested that the commission go before the Council and "lay all cards upon the table." The city is paying to private interests 6 per cent for money loaned and by bond issue could go out and borrow the money for 4½ per cent he said.

In arguing for a refinancing of the sys-

tem, Mr. Morgan stated that annually the Michigan Bell Telephone company is spending \$10,000,000 in Detroit to keep pace with the growth of the city; the Detroit Edison Company \$20,000,000 and the Detroit City Gas Company, \$8,000,000.

Mayor Lodge said that the commission, before going to the Council for an authorization for the bond issue, should first ascertain if the system is in a position at the present time to take care of outstanding obligations. When questioned later the Mayor said that if bonds were issued there would be no question but that the revenue from the system would be sufficient to meet interest and sinking fund charges upon the new issue. This would be made possible by the fact that the money now taken from revenue for track repairs, equipment, etc., would be made available for bond retirement and interest.

\$29,357,465 Value

City Engineer so reports on property of Market Street Railway, San Francisco in preliminary statement

VALUATION of the properties of the Market Street Railway, San Francisco, Cal., in their present condition is placed at \$29,357,465 by City Engineer O'Shaughnessy. This is an increase of \$2,991,099 over the figures of 1921, due, according to Mr. O'Shaughnessy, to increase in cost of materials and labor. The final report in eight volumes of 500 pages each is expected to be ready in several weeks. The report just made public is a brief summary of the completed set-up.

VALUATION DETAILED

Valuation of the lines of the Market Street Railway, upon which the franchises expire this year, according to the city's interpretation, and in 1930, according to the company's contention, show the following:

Reproduction cost new	\$9,003,436
Condition, per cent	58+
Reproduction cost new, less depreciation	5,239,569

Mr. O'Shaughnessy's present valuation, as of June 30, 1928, based on Interstate Commerce Commission system of accounting and covering the entire Market Street system shows the following figures:

Reproduction cost new	\$46,805,977
Condition, per cent	63
Reproduction cost new, less depreciation	29,357,465

The city engineer says that these figures will require readjustment to make certain allowances, such as the city's interest in the tracks on Ocean Avenue, additions and betterments and changes in inventory since June 30, 1928.

The valuation of June 30, 1921, also made by Mr. O'Shaughnessy, was as follows:

Reproduction cost new	\$35,273,442
Condition, per cent	75
Reproduction cost new, less depreciation	26,366,366

\$11,000,000 INCREASE

The difference in cost of materials and labor between 1921 and 1928 resulted in the \$11,000,000 increase in reproduction cost new, partially offset by the 12 per cent decrease in condition, giving a final present valuation only \$3,000,000 more than in 1921.

The city engineer will also report that the request for a detailed statement on what the city will do in rerouting and improvements, when it takes over the Market Street lines, cannot be made for some weeks, as the field surveys are still in progress.

\$479,226 Surplus in St. Louis in 1928

The statement of the St. Louis Public Service Company and subsidiaries for the year ended Dec. 31, 1928, shows consolidated net income of \$972,195 after depreciation, taxes, interest, etc., equivalent after dividend requirements on \$7 preferred stock and after deduction of \$250,000 for sinking fund requirements, to 66 cents a share earned on 343,620 no-par shares of common stock. This compares with net loss of \$108,192 in 1927.

The consolidated income account for the year 1928 compares as follows:

	1928	1927
*Gross earnings.....	\$19,862,058	\$19,533,261
Expenses.....	13,814,110	13,699,189
Depreciation.....	1,266,128	1,599,021
Taxes.....	1,889,825	1,851,139
Interest and miscellaneous charges.....	1,919,800	2,492,104
Net income.....	\$972,195	†\$108,192
Preferred dividends.....	492,969	.....
\$Surplus.....	\$479,226	†\$108,192

*Includes non-operating income. †Loss. ‡Deficit
 \$Amount available for sinking fund requirements and common stock.

The balance sheet of the St. Louis Public Service Company and subsidiaries as of Dec. 31, 1928, shows total assets of \$78,344,502 and total surplus of \$17,970,884. Current assets amounted to \$1,656,926 and current liabilities \$1,996,985.

Refunding Desired in Seattle

A series of conferences with Mayor Frank Edwards, of Seattle, Wash., other city officials and A. W. Leonard, president Puget Sound Power & Light Company, has been started in an effort to refund approximately \$11,000,000 of Seattle's debt for the purchase of the Municipal Street Railway. The plan would cover about 30 years, with annual payment of between \$300,000 and \$500,000 so that a large part of the railway current earnings may be used for extensions and new equipment.

Under the present arrangement, the city is paying \$833,000 a year in principal on the purchase price of \$15,000,000, together with interest, which brings the total annual payments close to \$1,200,000, and leaves virtually nothing to finance extensions and new equipment. The railway last year was compelled to borrow about \$800,000 from the city light and water departments. George B. Avery, superintendent of public utilities, and Councilman A. Lou Cohen induced the last Legislature to pass a special street railway refunding bill for Seattle in the hope that the city might be given approximately 30 years, instead of ten, in which to retire the debt. A. W. Leonard, the city is advised, has full authority to represent both the Old Colony Trust Company, which acts for the bondholders, and the Stone & Webster interests.

Edmonton Sale in Prospect—Negotiations are under way for the purchase of the Edmonton Municipal Street Railway System in Edmonton, Alberta. C. J. Yorath, president Canadian Utilities, Ltd., of Calgary, Alberta, has offered the Edmonton City Council \$3,500,000

for the street railway and the municipal light and power systems. His company would add to the power resources of the city by an additional development to augment the equipment of the railway. Payment would be spread over a period of twenty years and the city of Edmonton would be required to create a fund for payment of debentures on municipal utilities outstanding on Dec. 31, 1929. This amounts to approximately \$234,701.

Foreclosure Suit Against Bristol Line—A bill in equity was filed in the United States District Court at Philadelphia on April 19 by the Union Trust Company, of Maryland, trustee for the foreclosure of a mortgage on property of the Trenton, Bristol & Philadelphia Street Railway, Bristol, Pa. This mortgage covers the outstanding 30-year bonds, amounting to \$544,500 on which no interest has been paid since 1927. The default in interest amounts to \$108,900.

New Director in Oakland—Frank Lloyd, purchasing agent Key System Transit Company, Oakland, Cal., has been elected to the board of directors to fill the vacancy caused by the resignation of C. P. Murdock. Mr. Lloyd has been connected with the Key System for twenty years.

Oklahoma Railway Acquisitions—The Interstate Commerce Commission has authorized the Oklahoma Railway to acquire control by lease of the Oklahoma City Junction Railway, a 6-mile line and permitted to acquire control of the 5-mile Oklahoma Belt Railway to purchase of capital stock and by lease.

Decrease in Net for March Quarter in Providence—Totaling \$644,549, the gross operating revenue of the United Electric Railways, Providence, R. I., for March, showed a decrease of 2.8 per cent, compared with the preceding month. Net earnings for the month amounted to \$41,435, after deduction of interest and all other charges. This was a decrease of 13.83 per cent, in comparison with net earnings for March 1928. For the quarter ended March 31, 1929, the company showed gross earnings of \$1,867,712, a decrease of 4.77 per cent compared with a similar period last year. Net earnings, after all charges, amounted to \$96,543, a decrease of 42.5 per cent over the March quarter in 1928.

Deposit Time Extended for Michigan Railroad Issue—Notice has been issued to holders of Michigan Railroad first mortgage five-year 6 per cent gold bonds due on May 1, 1924, that the bondholders' protective committee for this issue, comprising Allen G. Hoyt, Stanley A. Russell and William W. Bridgman, will receive deposits under the agreement dated Oct. 23, 1924, until May 1, 1924, next. Holders failing to deposit the bonds on or before that date will not be entitled to become parties to the agreement or to share in the benefits thereof, and will acquire no rights thereunder. The Bay City-Flint division of the Michigan Railroad is reported sold to two Saginaw scrap-metal dealers. The sale included 47 miles of track, 4 overhead wires and 39 interurban cars.

Spokane Railways Sells Park—Natarium Park, amusement park of Spokane, has been sold by the Spokane United Railways to Louis B. Vogel, concessionaire. The reported price is \$100,000.

Conspectus of Indexes for April, 1929

Compiled for Publication in ELECTRIC RAILWAY JOURNAL BY

ALBERT S. RICHEY
 Electric Railway Engineer, Worcester, Mass.

	Latest	Month Ago	Year Ago	Last 5 Years	
				High	Low
Street Railway Fares* 1913 = 4.84	April 1929 7.75	March 1929 7.75	April 1928 7.61	April 1929 7.75	Jan. 1924 6.91
Electric Railway Materiale* 1913 = 100	April 1929 145.0	March 1929 144.8	April 1928 140.0	March 1924 163.9	Feb. 1928 139.5
Electric Railway Wages* 1913 = 100	April 1929 230.1	March 1929 230.1	April 1928 228.8	April 1929 230.1	Jan. 1924 217.4
Am. Elec. Ry. Assn. Construction Cost (Elec. Ry.) 1913 = 100	April 1929 200.9	March 1929 203.4	April 1928 202.2	March 1924 206.8	Sept. 1927 199.4
Eng. News-Record Construction Cost (General) 1913 = 100	April 1929 203.4	March 1929 207.8	April 1928 206.4	March 1924 224.7	Nov. 1927 202.0
U.S. Bur. Lab. Stat. Wholesale Commodities 1926 = 100	March 1929 97.5	Feb. 1929 96.7	March 1928 96.0	Nov. 1925 104.5	April 1927 93.7
Bradstreet Wholesale Commodities 1913 = 9.21	April 1929 12.90	March 1929 13.00	April 1928 13.42	April 1925 11.41	Dec. 1924 12.23
U. S. Bur. Lab. Stat. Retail Food 1913 = 100	March 1929 153.0	Feb. 1929 154.4	March 1928 151.4	Nov. 1925 167.1	May 1924 141.0
Cost of Living Nat. Ind. Conf. Bd. 1914 = 100	March 1929 159.8	Feb. 1929 161.0	March 1928 161.1	Nov. 1925 171.8	March 1929 159.8
Industrial Activity Elec. World—Kw.-hr. used 1923-25 = 100	March 1929 135.7	Feb. 1929 140.4	March 1928 118.2	Feb. 1929 140.4	July 1924 73.4
Bank Clearings Outside N. Y. City 1926 = 100	March 1929 103.9	Feb. 1929 110.1	March 1928 101.6	Feb. 1929 110.1	May 1924 84.4
Business Failures Number Liabilities (Millions)	March 1929 1703	Feb. 1929 1720	March 1928 2001	Jan. 1924 2231	Sept. 1928 1348

*The three index numbers marked with an asterisk are computed by Mr. Richey, as follows: Fares index is average street railway fare in all United States cities with a population of 50,000 or over except New York City, and weighted according to population. Street Railway Materials index is relative average price of materials (including fuel) used in street railway operation and maintenance, weighted according to average use of such materials. Wages index is relative average maximum hourly wage of motormen, conductors and operators on 136 of the largest street and interurban railways operated in the United States, weighted according to the number of such men employed on these roads.

Personal Items

E. R. Heiny Promoted

IN RECOGNITION of his successful handling of a number of difficult problems in the rehabilitation of the Lincoln Traction Company, Lincoln, Neb., after had been taken over by Nebraska units of the United Light & Power Company, E. R. Heiny, general superintendent, has been promoted to the position of vice-president and general manager. Mr. Heiny is thoroughly trained on both the technical and executive sides of the work of supplying street car service.

He was graduated in 1908 from the University of Pennsylvania as an electrical engineer, and immediately entered the service of the Philadelphia Rapid Transit Company, being a member of its engineering corps for four years. From there he went west into the service of the McKinley interests, operators of a number of interurban lines out of St.



E. R. Heiny

Louis, becoming, during his nine years of service there, division superintendent of the Illinois Traction Company, a member of the McKinley group. In 1918 he was made superintendent of transportation for the Lincoln Traction Company, then locally owned. Later he became general superintendent, and has been in charge of the operating end ever since it was divorced from other utility service and centered activities on transportation.

Mr. Heiny has been able not only to restore the company to popular favor, but also has been diligent in effecting a working agreement with the regulatory authorities that has gained willing cooperation in eliminating unnecessary car lines, and in developing supplementary bus service. Eight bus lines giving better service, earning larger gross revenues, and costing less to operate have so far been established. His efforts at co-ordinating service while keeping it satisfactory is reflected in a constantly increasing surplus.

Changes on South Shore Lines

R. H. James, was recently elected vice-president of the South Shore Lines. He will have direction of all traffic matters, including rates and divisions. Mr. James joined the Commonwealth Edison Company in May, 1925, and was appointed to

the president's office, a position he still holds.

In December, 1925, under instructions from Samuel Insull, he organized and was appointed executive in charge of the traffic bureau, and at the same time was also appointed vice-chairman of the executive traffic committee.

In June, 1928, he joined the Chicago, South Shore & South Bend Railroad as assistant to the chairman, and in March, 1929, was elected a vice-president of that railroad.

In March, 1929, he was elected a vice-president of the Chicago, Aurora & Elgin Railroad, and in April, 1929, a vice-president of the Chicago, North Shore & Milwaukee Railroad.

Three changes were put in effect on April 1 by Charles H. Jones, general manager.

William H. Ragsdale, formerly general shop foreman, became master mechanic.

Merle Aldrich, formerly electrical engineer, became engineering assistant to master mechanic.

Charles F. Ludden, formerly assistant to Mr. Aldrich, became acting electrical engineer.

Changes in West Penn

Paul M. Mase, formerly assistant general auditor with the West Penn Electric Company, has been made controller of the Monongahela West Penn Public Service Company and subsidiary companies, with headquarters at Fairmont, W. Va. His first West Penn connection was with the Pittsburgh, McKeesport & Greensburg Street Railway in 1904 in the capacity of clerk and from 1906 to 1910, inclusive, he was cashier at Oakford Park. For nearly twenty years he has held various responsible positions in the accounting department of the Pittsburgh office, culminating in his promotion to controller of "Monongahela West Penn." Mr. Mase was born in Greensburg, Pa., and received his early education there, later attending Ohio State University for three years.

Due to Mr. Mase's promotion, a number of advancements and changes has been made in the accounting department. A. W. Evans, auditor of disbursements, assumes jurisdiction of the distribution and payroll work in addition to his present duties, and reports to M. W. Glover, general auditor. Mr. Evans has been with the company since Nov. 1, 1921, being employed from then until March 1, 1923, as chief clerk in the disbursement department. On the latter date he became auditor of disbursements.

Prior to becoming affiliated with the West Penn organization, Mr. Evans spent ten years with the Midvale Steel & Ordnance Company as chief cost accountant, two years in the army as first lieutenant with the ordnance department, and two years as resident auditor for the General Electric Company at the plant of the Allegheny Steel Company in Brackenridge.

George W. Buchanan is appointed to the position of assistant auditor of disbursements. He was formerly distribution auditor in Cuba and Mexico for The Foundation Company of New York City.

Other changes affect the duties of F. S. Diebold, who in addition to work orders

has been put in charge of payrolls and construction, and those of R. C. Oswald, who is now chief clerk in charge of distribution and vouchers.

Honor for G. W. Van Derzee

G. W. Van Derzee, vice-president and assistant general manager of The Milwaukee Electric Railway & Light Company, was unanimously elected president of the Wisconsin Utilities Association, Milwaukee, Wis.

His first work with The Milwaukee Electric Railway & Light Company was in power sales and he shortly became assistant to S. B. Way, then vice-president. A while after Mr. Way became president of the company, Mr. Van Derzee was made vice-president and assistant general manager, in which position he continues.

After graduating from the University of Wisconsin in 1908, Mr. Van Derzee spent some time in graduate work and on the instruction staff at the Houghton School of Mines, after which he entered the shops and later sales forces of the General Electric Company in Milwaukee.



G. W. Van Derzee

He has been active in the commercial and public relations work of his company. In his present position, he has general supervision over the advertising, commercial, rate, accounting, purchasing and stores, and publicity departments and for years has been president of the company Employees' Mutual Savings and Building and Loan Association.

Mr. Van Derzee has had much to do with arranging the programs for some of the later conventions of the Wisconsin Electrical Association and more recently has been actively interested in the National Electric Light Association and the Association of Edison Illuminating Companies.

Milton R. Stahl, an attorney of St. Louis, Mo., has been appointed by Governor Henry S. Caulfield of Missouri to the chairmanship of the Missouri Public Service Commission. His term as commissioner will expire on April 15, 1935. He succeeds Dudley Calfee, of Jefferson City, as a member of the board and replaces Almon Ing, of Poplar Bluff, as chairman. Mr. Ing is still a member of the board. Mr. Stahl is a graduate of the University of Missouri, class 1916, and studied law at the Washington University Law School in St. Louis. He served abroad during the war and then returned to the law school and graduated in 1920. He is 35 years old.

G. H. Stagg with Niagara Gorge

George H. Stagg has been appointed general passenger agent for the Niagara Gorge Railway, Niagara Falls, N. Y., operating the scenic belt line in the lower Niagara gorge. This appointment was announced by Lee H. Jones, traffic manager of the company, and approved by A. D. Robb, vice-president.

For several years Mr. Stagg has been traveling passenger agent for the Seaboard Air Line at Buffalo. He started his railroad career as a boy at the Elmira office of the Lackawanna Railroad where he spent twelve years, finally being advanced to city ticket agent. In 1901 he resigned to become associated with a Buffalo firm, but in 1905 returned to railroading, accepting the position of city passenger agent for the Erie Railroad in New York City. In 1912 he became associated with the Seaboard Air Line and has held the position of traveling passenger agent for that company until his resignation to become general passenger agent for the Niagara Gorge Railway.

Mr. Stagg was born in Philadelphia.

M. L. Hibbard Succeeds W. R. Putnam at Boise

M. L. Hibbard, for the past year assistant general manager of the Idaho Power Company, Boise, Idaho, has been made vice-president and general manager, succeeding W. R. Putnam, who resigned to join the Electric Bond & Share Company's organization in New York, in which system the Boise property is included.

Mr. Hibbard has had a wide experience in the utility field. Executive positions he has held include that of superintendent of the electric department of the Union Light & Power Company, Fargo, N. D., and later general manager of that company; engineer for the San Antonio Gas & Electric Company and the San Antonio Traction Company, San Antonio, Tex., in charge of engineering and construction of the gas, electric and street railway systems; general manager of the Fargo & Moorhead Street Railway; assistant vice-president in charge of operation, Northern States Power Company, Minneapolis, and later chief operating engineer of that company.

Mr. Hibbard is a graduate of McGill University, Montreal.

Changes in Washington Company

New appointments have recently been announced by George Newell, local manager in Everett of the Puget Sound International Railway & Power Company.

C. C. Coates, general superintendent of Pacific Northwest Traction Company, North Coast Transportation Company and Portland-Seattle Stage Company. T. F. Marsh, assistant general superintendent. E. M. Swift, superintendent of equipment. W. N. Ringrose, assistant treasurer. George Lancaster, purchasing agent.

All of these report to Mr. Newell.

H. R. Leigh, formerly assistant to Col. M. D. Mills, is appointed superintendent of the North Coast Transportation Company and the Portland-Seattle Stage Company. P. T. Lee continues as superintendent of the Pacific Northwest Traction stage lines and is also appointed assistant to H. R. Leigh. L. R. Holt is appointed general foreman of all stage transportation.



Charles H. Clark

Cleveland Men in New Posts

Messrs. Clark and George well known for their outstanding work in engineering fields

LITTLE need be said to the readers of *ELECTRIC RAILWAY JOURNAL* in the way of introducing Charles H. Clark and Howard George, who recently stepped into new rôles in Cleveland. Both have a background of electric railway experience in operating and mechanical capacities.

MR. CLARK AT CLEVELAND SINCE 1901

Mr. Clark, who became civil engineer of the Cleveland Railway, on April 1, working directly under President Alexander, first became identified with work in Cleveland in 1901 when he took charge of the track work of the Cleveland Electric Railway. He remained engineer of way until 1907. For about a year he was connected with the International Railway as engineer of way, and later was associated with the Andrews & Stanley interests, first on the New York & North Shore Traction System and later as engineer of maintenance of way Rochester Railway. In 1909 he returned to the Cleveland Railway as chief engineer.

WAS FORMERLY A MANUFACTURER

Mr. Clark began his railway career in the manufacturing end of the business with William Wharton, Jr., & Company as draftsman. Although he was graduated from Cornell University in 1892 he had started work a long time previous to that incident. At twelve years old he was a water boy on the West Shore Railroad. Later in the employ of T. W. Harris, contractor, he assisted in building the railways in Scranton, Cleveland, Troy and Norristown. Out of this work he drifted into general engineering and was engaged



Howard George

in the work of helping to build the Tre Falls dam. From this work he became identified with the Utica & Mohawk Railway and had charge of the construction of that line for the Andrew Stanley syndicate. For these same interests he went to Cleveland in 1901.

MR. GEORGE BEGAN HIS CAREER IN NEW JERSEY

Mr. George, who gives up the title of superintendent of research for superintendent of way, was well known as assistant chief engineer of the Public Service Production Company in Newark, N. J., prior to his becoming superintendent of research for the Cleveland Railway year. He began his career in the railway industry in 1906 with the Public Service Railway. There he remained until July 1925, serving successively as field engineer, division engineer, assistant to chief engineer and engineer of maintenance of way. It was in the latter-mentioned year that he was transferred to the Public Service Production Company, the construction subsidiary of the Public Service Corporation. Mr. George has been very active in American Electric Railway Association work, particularly in the Engineering Association. From 1923 to 1928 he served as chairman of the committee on way and structure. He has represented the American Electric Railway Association sectional committee on the specifications of the American engineering standards committee, and also on specifications for special trackway materials.

Mr. George is a graduate in civil engineering of the University of Pennsylvania class of 1907.

William C. Edwards has assumed directorship of the Texas Public Service Information Bureau and the editorship of the bureau news bulletin. The few years Mr. Edwards has spent in Washington, D. C., and Atlanta, Ga., the April 15 issue of the *Public Service News*. Mr. Edwards states the purpose of the bureau is not only to furnish the public with accurate information regarding public utilities but also to contribute to the upbuilding of Texas.

J. N. Shannahan, president of Omaha & Council Bluffs Street Railway and chairman of the advisory council of American Electric Railway Association has been chosen to head the committee for the celebration of the 75th anniversary of the admission of Nebraska to the United States as a territory. Appointment to this civic committee is a reflection of the high esteem and public confidence which Mr. Shannahan has won in Omaha and Nebraska in his twenty years as head of the utility.

H. L. Engelhardt was recently promoted to the newly-created position of safety engineer in charge of the safety division, a new division authorized by the California Railroad Commission. Mr. Engelhardt, who assumes this rôle May 1, has had many years' experience in safety work and during his two years' employment with the commission he devoted his entire efforts to that class of work. He will be assisted in his new duties by three safety inspectors, W. Lemon, H. C. Lemon and A. Meininger. This new division will investigate serious accidents and "will enable the commission to serve the public even more adequately than before in the important respect."

Messrs. Nicholl and La Monte in New Rôles

As a farewell to Thomas H. Nicholl who resigned as superintendent of motive power of the Union Traction Company of Indiana on April 1, his associates expressed their appreciation of his services in the form of a banquet held at the Hotel Stilwell in Anderson, Ind. Mr. Nicholl has accepted a position with the Cleveland Railway in the research department.

From September, 1914, to 1916, he was engaged as light and power solicitor with the Traction Light & Power Company, Anderson, Ind. In May, 1917, during the World War, Mr. Nicholl entered the First Army Officers Training Camp at Fort Benjamin Harrison. Upon completion of this training course he received a commission as Captain of the Tenth United States Infantry, where he served through the duration of the war. His first position upon leaving the army was with Ball Brothers, Muncie. He next was employed as manager of the Komo Chemical Company, Kokomo, where he remained until his resignation in August, 1922, to accept a position as acting superintendent of motive power with the Union Traction Company of Indiana, in which capacity he has been engaged until his recent appointment in Cleveland. During the past year or two Mr. Nicholl has been active in the Central Electric Master Mechanics Association, being its first president and now chairman of the standardization committee and a member of the handbook committee of that organization.

Mr. Nicholl was born at Baltimore, Md., on Dec. 11, 1893. He received his education at the University of Michigan.

Mr. Nicholl was succeeded by Heber La Monte, purchasing agent for the past three years. He will retain this position in addition to his new duties with headquarters at Anderson. Mr. LaMonte's first railroad work was with the Erie Railroad in May, 1911, when he was employed as yard clerk, chief yard clerk and assistant yardmaster at Huntington, Ind. In January, 1913, he was promoted to general yardmaster, which position he occupied for several years. He then left railroad service and was engaged in various official capacities with the Anderson Rubber Works until the fall of 1923. From 1923 to 1926 he was in the advertising and brokerage business out of Chicago. His first electric railway service began in 1926, as purchasing agent with the Union Traction Company of Indiana, which work has culminated in his present appointment to superintendent of motive power. Mr. La Monte was born on April 30, 1891, at Huntington, Ind. After graduating from the Huntington High School in 1908, he attended the University of Indiana for three years.

William E. Wood, of Richmond, president Virginia Electric & Power Company, who has been on a brief pleasure trip to Europe, has landed in New York from the Lloyd Sabauda liner "Conte Grande." Mr. Wood remained in New York for a few days on business for the Virginia Electric & Power Company before continuing on to Richmond. Mr. Wood sailed on the "Berengaria" on March 8 from New York and spent most of the time in Germany and Spain. He took the steamer at Gibraltar on April 8.

J. P. Potter, vice-president Key System Transit Company, San Francisco, Cal., was recently elected vice-president of the Pacific Railway Club for the coming year.



Curtis L. Hill

Messrs. Hill and Lamb Will Give Tacoma Best Service

An ambitious program has been laid out by Curtis L. Hill, new manager of the Tacoma Railway & Power Company, Tacoma, Wash. In outlining the new policies of the company and its associated companies, the Tacoma Bus Company and Pacific Traction Company, Mr. Hill announced that the bondholders plan an aggressive business policy involving the expenditure of \$366,000 for track and equipment improvements. He invited constructive criticism of the service saying that the problem was an engineering one and not a political problem and that he wanted all to consider the Tacoma Railway & Power Company a Tacoma institution.

Mr. Hill, a native of Tacoma, was educated in engineering at the University of Washington, served overseas in the air service, and has engaged in private engineering practice since the war. He has been affiliated with the Puget Sound Power & Light Company and the Tacoma Railway & Power Company since 1920, having served in the power department during that period.

L. L. Lamb, who becomes general superintendent of the railway, has been with the Tacoma Railway & Power Company since 1911 in various capacities connected with the maintenance of railway equipment. He has a wide experience in this kind of work.

The remaining members of the reorganized personnel were mentioned previously in ELECTRIC RAILWAY JOURNAL NEWS. Change in the control of the system to the hands of Richard T. Sullivan, Tacoma representative of the bondholders, was effective April 1. The Stone & Webster control had extended over the past 27 years.



L. L. Lamb

This change, by which direction of the company is lodged with local Tacoma interests, was foreshadowed some weeks ago by Scott Z. Henderson, receiver for the Puget Sound Electric Railway, former operator of the Tacoma-Seattle interurban and owner of the stock and second mortgage bonds of the Tacoma Railway & Power Company. Under the plan Mr. Sullivan remains in executive control instead of general manager of the system. The change involves the Pacific Traction and Tacoma Bus Companies as well as the Tacoma Railway & Power Company.

Homer Loring

Homer Loring, whose election to the board of directors of the Boston Elevated Railway, Boston, Mass., was mentioned previously, has always elicited the eternal "how" for his singular achievements in restoration and rehabilitation. He first came into the limelight some years ago when, as State Administrator for the Commonwealth, he instituted several polices of economy in the state service. Later he took over the control and rehabilitation work of the Eastern Massachusetts Street Railway, then known as the Bay State Street Railway, and when he left that position he was elected to the board of directors of the Boston & Maine Railroad. He became its chairman and was instrumental in bringing about the financial reorganization of the company, the reconstruction of its terminal facilities and the building of the new North Station. His latest work has been in connection with the restoration of the textile industry.

On the directorate of the Boston Elevated Railway there may not be very much to do unless the relation of the road to the Commonwealth changes, for the company is under public control, managed by a Board of Trustees.

All other directors were re-elected at the April 1 meeting.

A. LeRoy Hodges in Massachusetts

Public trustees of the Eastern Massachusetts Street Railway are confident that A. LeRoy Hodges will bring to the Brockton district an enthusiasm and a background of valuable experience. His appointment as manager of the Brockton District, effective on April 9, was mentioned in the ELECTRIC RAILWAY JOURNAL NEWS.

For several years Mr. Hodges was assistant general manager and a director of the Brooklyn City Railroad, a system with 230 miles of lines and operating 1,300 cars. During his connection with the Brooklyn company the road was completely rehabilitated, and the entire rolling stock modernized.

Mr. Hodges began his street railway career with the Westchester, Kennett & Wilmington Railway, Kennett Square, Pa., as secretary to the general manager. In 1908 he was secretary to the assistant general manager of the switch board department of the General Electric Company at Schenectady, and in 1911 became secretary to Vice-President and General Manager A. W. McLimont, of the Michigan United Railways, Jackson, Mich. When this property was leased to the Commonwealth Power, Railway & Light Company, he was appointed chief clerk to C. E. Morgan, general superintendent Michigan Railway, and continued in that capacity at Jackson and Grand Rapids until he went with the

Brooklyn City Railroad in October, 1919, under Mr. Morgan.

Since the promotion of A. J. Boardman, former Brockton manager, to be vice-president and acting general manager, the public trustees have had under consideration numerous street railway operating men, in various parts of the country, for the Brockton management.

C. W. Squier in New Post

Clarence W. Squier, formerly of the staff of *ELECTRIC RAILWAY JOURNAL*, has assumed his new duties as associate editor of *Mechanical Engineering*, published by the A.S.M.E.

Not a theorist alone, but a practitioner, Mr. Squier is also a correctionist whenever and wherever he is brought face to face with needed transit improvements and developments. Testimony of this fact is seen in his four years' activity with the General Electric Company as designer of control apparatus, and in the capacity of designing engineer with the Sprague Electric Company when that company was pioneering in multiple-unit control apparatus. This intensive experience was to be extended across the Atlantic in 1904. At the Pittsburgh Works of the Westinghouse Company he followed the testing and equipping of the first 35 electric locomotives for the New York, New Haven & Hartford electrification.

In 1908, with a background of high spots in practical equipment work, Mr. Squier went to Brooklyn, where he was an important factor in the preliminary work looking toward the unification of the Brooklyn Rapid Transit System. After the dual rapid transit contracts were signed, Mr. Squier was appointed assistant statistical engineer for the Public Service Commission for the First District, State of New York. It was these duties he relinquished in 1918 to become associate editor of *ELECTRIC RAILWAY JOURNAL*, which saw, and later found in him, a valuable link in the chain of theoretical and practical transit development.

David V. S. Maxwell, retiring president of the Schenectady Rapid Transit, Inc., Schenectady, N. Y., has been made superintendent of bus operations, following the purchase of that company by the Schenectady Railway. Other officers, who will continue with the new owners, are Olin T. Randall, secretary, and Ernest H. James, treasurer. Until a survey of the bus operations in Schenectady and vicinity is made, the same policies will govern the continued operation as prevailed at the time of the purchase.

Julius Klein, director of the United States Bureau of Foreign and Domestic Commerce since 1921, has been appointed Assistant Secretary of Commerce by President Hoover. Mr. Klein is a Californian by birth and a recognized authority on commercial and trade matters. He is a regular contributor to periodicals on the subject of foreign trade and on economic and commercial problems.

J. D. Barnhart, for the last eleven years superintendent of shops of the electrified lines of the Illinois Terminal Railroad at Decatur, Ill., is now in charge of the shops of the former Illinois Terminal Company, at Federal, Ill., a suburb of Alton, his territory and jurisdiction having been extended to include that plant. Mr. Barnhart joined

the Illinois Traction System as master mechanic at Granite City and two years later became superintendent of shops in Decatur. His latest advancement puts him in charge of car shops of both the steam and electric lines of the system.

A. Balfour Brehman has been elected president of the Union Traction Company, Philadelphia, operated under lease by the Philadelphia Rapid Transit Company. He succeeds the late Jeremiah Sullivan. At the special meeting of the board a new office of chairman of the board of directors was created, to which Arthur V. Morton, vice-president of the Pennsylvania Company for Insurance on Lives, was elected. An executive committee of the board was also formed, composed of Edward M. Story, chairman; Joseph Gilfillan, Arthur V. Morton, John H. Mason, Sr., and John J. Sullivan. Officers of the company are ex-officio members of the committee.

John Leisenring has been appointed assistant to the chief engineer of the Illinois Terminal Railroad System, Springfield, Ill. One important duty will be supervision over problems involved in the operation of the railroad properties of the company including direct power supply facilities.

OBITUARY

William Gillies Ross

The life of the late William Gillies Ross, president and managing director of the Asbestos Corporation, Ltd., director and executive of many important industries and companies in Canada, and one of the best-known street railway experts in America, was crowded with successful effort in many phases of Dominion activity. A skilled economist and an astute financier, he played an important part in the reorganization and development of many Canadian enterprises.

Born in Montreal on Aug. 6, 1863, he was educated at the Montreal High School and in 1880 entered commercial life as a chartered accountant. Eight years later he associated himself with the late James Ross in the electrification of the railways in Winnipeg, Toronto, Montreal and St. John, and the organization of electric railways in Jamaica and Mexico City. He was named comptroller of the Montreal Street Railway in 1896, and assumed the managing directorate of that company and of the Montreal Park & Island Railway in 1904, retaining these two posts until 1910 when he entered the asbestos business. During these years he had also become second vice-president of the Montreal Light, Heat & Power Company; director of the Dominion Iron & Steel Company; president of the Quebec Railway, Light & Power Company; and president of the Canadian Street Railway Association. He served as president of the Street Railway Accountants Association of America in 1904, and in 1910 as vice-president of the American Street Railway Association. In this latter post he was the first Canadian so to serve. Mr. Ross founded and was first president of the Montreal Street Railway Mutual Benefit Society, an organization devoted to the relief and care of the electric railway's employees.

His war work, particularly his organization of the Navy League in Canada and his founding in the Dominion of the British sailors' relief fund, was recognized by His

Majesty the King, who awarded him the Special Service decoration in appreciation of efforts on his part which resulted more than \$3,000,000 being obtained to the widows and children of British and Canadian seamen who had been killed during the war.

As an accountant and economist Mr. Ross had few equals in the Dominion. Who experts from the United States and Great Britain needed aid in their efforts to solve the intricate task of rearranging the accounting of the Dominion Iron & Steel Company and of the Dominion Coal Company, he, in a short time, helped materially by suggesting the installation of methods which are still in use by these corporations. In every company which he directed, he reorganized the systems of accounting. He was frequently consulted by leaders of the industry on accounting and financial problems.

At the time of his death, Mr. Ross was president and general manager of the Asbestos Corporation Limited; vice-president and director of the Amherst Park Land Company; director of the Canadian General Electric Company, Ltd., and director of the Fire Insurance Company of Canada.

P. W. Ellis, chairman Toronto Transportation Commission, Toronto, Ontario, died in that city on April 22. He was a pioneer in the movement which resulted in the province acquiring a hydro-electric system of its own, and was interested in a score of public and private enterprises. He was the first president of the Canadian Manufacturers' Association, and had served as vice-chairman and treasurer of the Ontario Power Commission and as a member of the first hydro-electric power commission. The *Toronto Globe* stated that he was his strong zeal for public ownership showing itself in early life that enlisted the time, talents and energy of Mr. Ellis in the service of the people. If it were in the public interest no sacrifice was too great for him to make. He had made a thorough study of labor questions which proved of value to him in the discharge of his duties. He was 71 years old.

William J. Curtin, former general counsel for the Eighth and the Ninth Avenues Railways in New York and for the Brooklyn-Manhattan Transit Corporation, is dead. Mr. Curtin was born in Buffalo 59 years ago. He attended the Buffalo Law School and became an assistant district attorney in that city later coming to New York.

Andrew F. Daley, for 22 years general foreman of construction for the Rockford Electric Company, operating the railway system in Rockford, Ill., died April 19. He was born in Baldwinsville, N. Y., 64 years ago.

Franklin D. Jones, lawyer and author, died recently. He was a recognized authority on trade associations and was prominently identified with several of them. His book on trade association activities and the law was recognized as the standard authority in the trade association field, while his historical development of the law of business competition is considered the most thorough and scholarly treatment of that subject in print.

C. H. Bartels, for 25 years employed by the East St. Louis & Suburban Railway, East St. Louis, Ill., first in the claims department and later as a special agent, died recently.

Spring Construction Programs Getting Under Way

WHILE purchases of electrical material and wire for transmission and other purposes undoubtedly have been held up during the past few weeks due to the fluctuating prices of copper, the purchase of track material has gone forward and a number of noteworthy projects have gotten under way with the coming of better weather.

It is announced that the Milwaukee Electric Railway & Light Company will spend more than \$1,000,000 in renewing and extending its street railway trackage during the year, including an extension of double tracks which will add nearly 2 miles to the company's system. The program is coordinated with municipal street paving plans so that the entire width of certain streets will be improved simultaneously. In addition, costly special work is to be replaced at a number of important intersections.

Virginia Electric & Power Company, Richmond, Va., launched its spring and summer program with the reconstruction of 6,000 ft. of single track on its Q Street line, preparatory to paving the thoroughfare with 6,000 yards of vitrified brick. The project, which will cost \$60,000, is part of a \$250,000 improvement outlay set for completion during 1929. The company has recently purchased 1,200 International steel twin ties for T-rail. The Bethlehem Steel Company is supplying one carload of rail tieplates, 660 tons, 7 in., sec. 407-A rail and 160 tons, 80 lb. A.S.C.E. T-rail.

CITY TO REPAVE TRACKS IN SEATTLE AND RECONSTRUCT ELEVATED

The city purchasing agent, Seattle, Wash., has received a low bid of \$28,304 from the Bethlehem Steel Company for three solid manganese, special track layouts and 1,100 tons of rail for the municipal street railway lines. An ordinance appropriating \$28,000 from city funds has been prepared to cover the cost of paving the municipal street railway's share of the street improvement on Second Avenue North and to do the necessary track reconstruction. The City Council has also passed a bill appropriating \$140,000 for the reconstruction of the elevated railway structure on West Spokane Street and East Marginal Way.

The Cleveland Railway has started a \$200,000 track extension program in the Cleveland Heights district. When completed the fare in Cleveland Heights will be increased in accordance with a franchise adopted last December. Approval has been given for the purchase of brake shoes to the value of \$55,000 from the Railway Material Company; 40,000 creosoted, red oak ties from Republic Creosoting Company, \$70,000; and weatherproof copper cable from the American Electrical Works, \$6,500.

Engineers of the Capital Traction Company, Washington, D. C., are planning to install new rail and paving on Connecticut Avenue, a distance of 3,116 ft., and on Pennsylvania Avenue from 9th to 15th Streets. The Connecticut Avenue work is estimated at \$28,000 and that on Pennsylvania Avenue at \$38,000.

Allegheny Valley Street Railway, Pittsburgh, Pa., has received 370 tons of 70-lb. T-rail, to be used for rebuilding the line between Aspinwall and Cheswick.

Construction of about 4 miles of street

railway track in Vancouver, B. C., is promised by W. G. Murrin, vice-president British Columbia Electric Railway, in a statement discussing the question of raising the fares from 6 to 7 cents. Various other major track extensions are also under consideration.

For sundry maintenance and improvement work the Chicago Surface Lines has recently purchased 250 tons of 7-in. rail, 100,000 lb. hook-head spikes, 13,500 welding plates, 15,000 tierods, 178,000 lb. trackbolts, 54,000 lb. welding rods, 2,120 switch ties and 130 crossing ties. Line material purchased includes 1,800 wood strain insulators, 3,500 insulated bolts, 100 quick-break switches, 9,375 split pole sleeves, and 75,000 ft. soft-drawn span wire.

Track reconstruction under way and contemplated on the lines of the Duluth Street Railway, Duluth, Minn., has necessitated the purchase of 10,000 tamarack ties, 2,400 white oak ties, 2,000 tieplates, 120 kegs of spikes and 20 kegs screw spikes. Orders have also been placed for 500 gross tons 5-in. Illinois section 8040, 25 gross tons 7-in. Lorain Steel Company section 93/507 and 18 gross tons 7-in. Lorain Steel Company section 114/480 steel rails, as well as 5 miles No. 00 trolley wire.

An extensive program of track construction and reconstruction is indicated by the purchase by the Toronto Transportation Commission, Toronto, Ont., of 1,200 gross tons 122-lb. section L.S. 122-491 grooved-girder rail, 50 gross tons 140-lb. section L.S. 140-468 girder-guard rail, 50 gross tons 114-lb. section L.S. 114-480 girder-guard rail, 11,000 standard trackbolts, 25,000 combination flat tieplates, 10,000 track spikes, 3,000 7-in. rail bonds, type

AW-8, 750 pairs 26-in. six-hole standard splice bars and 600 pairs 122-lb. welding splice bars. This is in addition to seven complete special trackwork layouts and 400,000 granite paving blocks.

The Connecticut Company, New Haven, Conn., has ordered 1,600 tierods, 800 kegs track spikes, 1,035 gross tons of rails, 550 pair joint plates, 379 kegs trackbolts and 2,000 steel ties.

A program of track improvement and reconstruction undertaken by the Twin City Rapid Transit Company, Minneapolis, Minn., has necessitated the purchase of a quantity of material, including 700 gross tons 5-in., 80-lb. T-rail, section 8040, 800 gross tons 6-in., 100-lb. T-rail, section 10020 (both orders filled by Illinois Steel Company) 400 kegs railroad spikes, 8,000 white oak ties, 5,000 cedar ties, 33,600 vitrified paving brick, and 6,600 bbl. Portland cement. Two single-track branch-offs and five standard 75-ft. radius switches were supplied by the Lorain Steel Company. Line material purchased included 133,000 ft. $\frac{3}{8}$ -in. seven-strand, double perfected galvanized wire, and 70,000 ft. $\frac{1}{2}$ -in. wire from Jenney, Sempole, Hill & Company. For work on car repair and remodeling there were ordered 1,500 34-in. steel car wheels and 150 steel billets from Illinois Steel Company, 25,000 ft. Southern white oak and 12,000 ft. No. 3 common oak lumber from various dealers, 200,000 gal. asphalt road oil were ordered from Standard Oil Company, and 30,000 gal. viscoline lubricant from Phillips Petroleum Company. New road building machinery purchased includes one No. 7 Rex concrete mixer, a No. 818 all-steel Universal crusher, and a $\frac{3}{4}$ -cu.yd. shovel, supplied by the Motor Power Equipment Company and powered with a 25-hp. General Electric motor.

LEHIGH VALLEY TRANSIT COMPANY BUYS TRACK MACHINERY

Purchases of the Lehigh Valley Transit Company, Allentown, Pa., include 4,000 white oak ties, and a number of special track appliances, including two No. 8 BP L.G. electric grinders from the Chicago Pneumatic Tool Company, one Eccentric rail grinder No. 138 and one Sansom rail grinder No. 704 from the Verona Tool Works, and one Atlas rail grinder from the Railway Trackwork Company.

While no extensive improvements are planned, the Pittsburgh Railway, Pittsburgh, Pa., has made liberal purchases of track, overhead line and shop material for maintenance and repair. In the first category are listed 50 kegs of various size boat spikes, 100 kegs trackbolts, 50 kegs of machine bolts, 620 railroad crossing bolts and 2,580 ties. Line work projected has called for the purchase of 30 tubular-steel poles from the National Tube Company, 50 crossarm supports from the Electric Railway Improvement Company, 500 W216151 and 1,000 W268588 straight-line feeder insulators and 500 W256162 corner insulators from the Westinghouse Electric & Manufacturing Company. A quantity of sectional insulators, trolley guard and crossings was supplied by the Ohio Brass Company.

Washington Railway & Electric Company, Washington, D. C., has purchased six No. 158 pneumatic diggers and three CC-45 paving breakers from the Ingersoll Rand Company.

In addition to the experimental cars mentioned elsewhere, the Louisville Railway has also recently placed orders for 300 tons 7-in. A.E.R.E.A., 122-lb. grooved rail, 250 tons standard A.S.C.E., 70-lb. T-rail, 10,000 trackbolts and 6,000 machine bolts. Fifteen

Exhibitograph No. 9

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miles of No. 00 trolley wire and 5 miles phono-electric wire have also been purchased.

Construction is under way on the extension of the Park Street line in Beaumont, Tex., to the new baseball park.

The Ottawa Electric Railway, Ottawa, Canada, contemplates the purchase of 150 gross tons of 122-lb. grooved rail. This company has recently purchased a quantity of track spikes and trackbolts, mainly from Canadian manufacturers.

Rolling Stock Orders Numerous

Altoona & Logan Valley Electric Railway has placed an order with the Osgood-Bradley Car Company, Worcester, Mass., for five cars to cost approximately \$18,000 each. Delivery is to be made during July or August. The J. G. Brill Company's Kuhlman plant has received an order for two double-truck, double-end cars for the Newell Bridge & Railway Company, Newell, W. Va. The same company has also recently received orders for 33 single-end motor car bodies and 200 Brill 76-E type trucks from the Chicago Surface Lines, five passenger and smoking motor bodies complete, with Brill 27-MCB type trucks for the Philadelphia & Western Railway, Norristown, Pa., and ten bodies, 42 ft. 1½ in. over-all length, complete with Brill 177-E type trucks, from the Delaware Electric Power Company, Wilmington, Del.

The Nashville Interurban Railway, operating an 18-mile route between Nashville and Franklin, Tenn., announces through its president, Elliott Napier, the purchase for July delivery of two high-speed interurban cars, seating 52 passengers each, from the Cincinnati Car Company.

Purchase of fifteen new cars to cost about \$300,000 is planned by the British Columbia Electric Railway.

Completion of its program of remodeling the first group of cars used by the Key System Transit Company, Oakland, Cal., in its transbay service, has been announced by A. J. Lundberg, president. The improvements include the installation of deep-cushioned, individual leather seats; a new seating arrangement, industrial carpet and modern illumination units. Noise-deadening and shock-absorbing shims have been placed between the trucks and the car bodies and about the air compressors.

Gary Railways, Gary, Ind., has placed in service one of two light-weight interurban cars, supplied by the Cummings Car & Coach Company.

Orders have been placed by the Cleveland Railway for five pairs of Timken model 52 car trucks.

That the electric railways continue as the largest group purchasers of buses is indicated by the orders made public during the past month. The Rockford City Traction Company, Rockford, Ill., which already has a fleet of 26 buses, has added two 40-passenger, A.C.F., metropolitan type coaches. Mack-International Motor Truck Corporation reports sale of three model AB, four-cylinder, 25-passenger, city-type buses to the Illinois Power Company, Chicago; and one model AL, 33-passenger, city-type bus to the Houston Electric Company, Houston, Tex.

Twin Coach Corporation has recently delivered four coaches to the Los Angeles Railway, three to the Milwaukee Electric Railway & Light Company, six to the Detroit Motorbus Company, all of the urban type, and five suburban-express type coaches to the United Railways & Electric Company, Providence, R. I.

United Railways & Electric Company, Providence, R. I., has ordered ten Twin Coaches from the Twin Coach Corporation,

Kent, Ohio. The company has also purchased a considerable quantity of material for the usual maintenance work, including 2,000 D-67 brakeshoes and 2,000 D-61 brakeshoes from the American Brake Shoe & Foundry Company.

Orders placed by the Denver Tramway Corporation, Denver, Colo., include an A.C.F. urban type bus, one model 53 White chassis, and one model 54 White chassis, mounted respectively with 25-passenger and 33-passenger Bender, pay-enter, city type bodies.

The Gray Coach lines, a subsidiary of the Toronto Transportation Commission which recently acquired five bus routes from private operators with the approval of the Toronto City Council, is now purchasing 35 new buses for June delivery at a cost of approximately \$365,000.

The Twin City Rapid Transit Company also is planning to increase its fleet of buses by the purchase of two 33-passenger, model GY chassis, 239-in. wheelbase buses, complete with bodies, from the C. H. Will Motor Corporation, two 33-passenger, de luxe parlor car bus bodies from Eckland Brothers Company, three four-cylinder, Mack model AB 230-in. wheelbase chassis, and two 29-passenger, all-steel bus bodies from the Lang Body Company, Cleveland.

Other bus sales reported include three A.C.F., 40-passenger, metropolitan type coaches to the Portland Electric Power Company, Portland, Ore., one 21-passenger, Studebaker street car type bus to the Oklahoma Railways, Oklahoma City, Okla.; one A.C.F. de luxe urban coach to the Poughkeepsie & Wappingers Falls Railway, Poughkeepsie, N. Y., fifteen A.C.F., 40-passenger metropolitan coaches to the Detroit Department of Street Railways, and three A.C.F., 30-passenger, urban coaches and two 23-passenger urban coaches to the Scranton Railway, Scranton, Pa. The Altoona & Logan Valley Electric Railway through its subsidiary, the Logan Valley Bus Company, has placed an order for five A.C.F., 23-passenger urban coaches.

Types of Cut Tacks and Nails Reduced

The Bureau of Standards of the Department of Commerce has published bulletin R47-28 dealing with recommendations for the manufacture of cut tacks and small cut nails, prepared in accordance with the departments' policy of bringing about the elimination of waste through simplified commercial practices. As the result of conferences, held under the auspices of the bureau, the leading manufacturers and users of these materials have tentatively agreed to accept the standards set up in the bulletin. Prior to the adoption of the present list, the possible selection of style, size, finish and packing of tacks and nails comprised 21,200 combinations. The present simplified list has reduced the number to 1,156 stock items. Among other organizations which have agreed to accept the proposed recommendation is the American Electric Railway Association.

High Price of Copper Retards Purchases by Public Utilities

Hand-to-mouth buying, which has been hailed as one of the great stabilizing influences in American business, seems to be chiefly responsible for the runaway market in copper, consumers of which, along with buyers of nearly every other commodity, had practically discontinued the practice of carrying reserve stocks. Ordinarily, economists agree, this practice contributes importantly to stabilization.

When, in the past, the retailers, the small users, and jobbers and wholesalers were forced to carry stocks because transportation was less efficient than now and subject to frequent and unexpected interruptions, a dangerous situation was created. With large stocks in the hands of so many persons, statistics were difficult to secure and overproduction of commodities frequently resulted before the situation could be corrected. Now, with the responsibility of meeting demand resting principally upon the producer, the danger is greatly minimized, as the producer is in a much better position to know the relationship between demand and supply. In the case of copper, however, this practice played into the hands of those who are anxious to attain more influence in that industry. The consumers would have been in a much better position to protect themselves in this instance had more adequate statistics been available.

The recent great increase in the price of copper is regarded as an unhealthy boom, since in it were the elements of a combination of increased demand by the consumer and a disposition by the producer to exact the greatest toll out of temporary shortage. As a result, world trade in that commodity has been disorganized and difficulties have been passed down into all the ramifications of the important business. That the consumer are not without redress is instanced by the recent recessions in the price of this metal.

Louisville Railway Receives Experimental Cars

The second of four different types of cars, which have been ordered by the Louisville Railway, Louisville, Ky., for trial purposes on its lines, was recently placed in service. The first of the new cars, supplied by the St. Louis Car Company, was delivered some weeks ago and was favorably received by the public. The seats 51 passengers in individual leather upholstered seats, arranged in pairs, and is provided with other modern conveniences. The second car to arrive was supplied by the Kuhlman plant of the J. G. Brill Company. This car has a well entrance and exit, in contrast to the St. Louis car which had treadle-folding steps. The third car to be supplied by the Cincinnati Car Company is expected to arrive early in May. The fourth car will be built in the company's own shops, using Timken trucks and Westinghouse high-speed motors. Seats will be of the semi-individual, leather upholstered type. The two cars already received are similar in seating arrangement, ceilings are low and the front dash has adopted features of bus construction.

O. M. Edwards Company, Syracuse, N. Y., is to equip the 100 new cars being supplied to the city of Detroit, Department of Street Railways, by the Perle A. Thomas Car Works, with brass sashes together with necessary sash fixtures.

J. G. Brill Company Ships Cars to South America

As an evidence of the expanding character of American foreign trade which has extended to all branches of industry, there were recently shipped from Eddystone ten of an order of twenty trolley cars completed by the J. G. Brill Company at its Philadelphia plant for the Companhia Carris Porto Alegre, of Porto Alegre, Brazil. The cars were completely assembled down to the last detail for shipment. This is said to be the first occasion that a foreign shipment has not been made in sections or unassembled. An accompanying photograph shows one of the cars being loaded aboard the Norwegian freighter, "Belpamela," from the pier at Eddystone.

The new cars are the first of the so-called "master-unit" type developed by Brill. A complete account of the reasons for developing the line and general specifications of the various models, were given in an article by George Frey published in this paper for Jan. 26, 1929. The car body is of the light-weight type, arranged for double-end, one-man or two-man operation. Sides are single-weep curved, with skirt below the sill. Platforms are drawn in and the ends have sloping window sash, somewhat after the manner of the latest types of bus construction. A well at each end has two two-leaf folding doors at each corner of the platform for entrance and exit. Seats are of the reversible type, upholstered in rattan. "Admor" seats of mahogany are provided at diagonal right-hand corners, bringing the total



Loading new Porto Alegre cars on the Norwegian freighter "Belpamela" at Eddystone, Pa.

seating capacity up to 44. A pedestal seat, with spiral spring and cushion, is provided for the operator.

Underframe is of steel throughout, and copper bearing steel is used wherever needed to resist corrosion. The door mechanism is arranged to interlock with brakes. The motorman, or one-man operator, controls the doors at both ends

of the right side of the car through a selector valve, and both ends of the left side through a double-control valve. The conductor is to operate the doors on each side of the platform at the rear through a control valve attached to a stand located at the center of the end sills, cross-wise of the car.

No scale weights of the cars are

SUMMARIZED SPECIFICATIONS OF CARS SHIPPED TO BRAZILIAN ELECTRIC RAILWAY

Name of Railway	Companhia Carris Porto Alegre, Porto Alegre, Brazil
Number of units	20
Type of unit	One-man or Two-man, Motor Passenger, City, Double end, Double truck
Number of seats	44
Date of order	Dec. 31, 1928
Date of delivery	April 1, 1929
Upholster centers	17 ft. 5 in.
Length over all	38 ft. 1 in.
Length over body posts	27 ft. 5 in.
Truck wheelbase	5 ft. 4 in.
Width over all	8 ft. 5 1/2 in.
Height, rail to trolley base	10 ft. 6 1/2 in.
Window post spacing	3 ft. 5 in.
Body	Semi-steel
Doors	Arch
Door brakes	Folding, end
	General Electric

Axles	A.S.T.M. specifications
Car signal system	Buzzer, Faraday single stroke bell
Compressors	CP-27-B
Conduit	Duraduct and Duratube
Control	Safety Car, type K
Couplers	Brill radial drawbars
Curtain fixtures	Curtain Supply Company
Curtain material	Pantasote No. 86
Destination signs	Hunter, type 226-RB
Door mechanism	National Pneumatic Company
Fare boxes	Cleveland model 5
Floor covering	Yellow pine and Tuco Flexolith
Glass	Libby-Owens
Hand brakes	Peacock staffless
Hand rail and stanchions	Monel metal
Headlights	Crouse-Hinds
Headlining	Agasote, 1/4 in.
Interior trim	Mahogany window sills, enameled steel posts and fittings

Journal bearings	Plain
Journal boxes	MCB, 3 1/4 x 6 in.
Lamp fixtures	Electric Service Supplies Co.
Motors	Four G.E.-265, inside hung
Roof material	Cypress, canvas covered
Safety car devices	Standard
Sash fixtures	Curtain Supply Company
Seats	Brill No. 201-E Phoenix type
Seat spacing	31 in.
Seating material	Rattan, leather faced
Slack adjusters	Brill mechanical
Steps	Stationary
Step treads	Kass
Trolley catchers	Keystone
Trucks	Brill No. 177-EX-1
Ventilators	Brill exhaust
Wheels	Steel tired, 27 in. diameter
Wheelguards	H-B
Windshield wiper	Brill single blade



Wide windows give a pleasing effect to the car interior



Streamline painting in bright colors creates an attractive exterior

available. The estimated weight for all-steel cars of this type is given as 34,635 lb.

Porto Alegre, the point to which the cars are destined, is a city of about 100,000 population, containing large foreign elements, mainly German and Italian. It is the capital city and principal port of the Brazilian State of Rio Grande do Sul.

Single-Phase Railway System Reviewed

Development of the single-phase system for railway propulsion is the subject of an attractive special publication of the Westinghouse Electric & Manufacturing Company, known as Reprint 357. The history of the system is taken up from its inception. That history is, according to the authors, J. V. Dobson and F. C. Hanker, closely interwoven with the engineering activities of the late B. G. Lamme. Early experiments culminating in the equipment of the New York, New Haven & Hartford Railroad are considered in some detail. Following this are short sections on the Norfolk & Western, the Virginian, and the Pennsylvania Railroad installations. Brief mention is made of the motor-generator locomotives, such as are used on the Detroit & Ironton and the Great Northern systems.

At the end of the publication is a complete list of railways throughout the world using single-phase systems, with detailed statistics on the locomotives of all types employed on them.

Copperweld to Be Sold by General Cable

General Cable Corporation has consummated an agency agreement with Copperweld Steel Company, whereby General

Cable Corporation is appointed the sole and exclusive agent in the United States to draw wire from Copperweld rods and to sell wire so drawn and wire products made therefrom.

Copperweld Steel Company has recently enlarged its special equipment for the production of Copperweld billets and rods and General Cable Corporation has, in its several plants, large capacity for the drawing of these rods into wire and for the fabrication of wire products. These complementary facilities, together with the engineering, sales and distribution organizations of both companies, will be effective to secure increased production and distribution of Copperweld wire and wire products, together with improved service to all users of Copperweld material.

Hereafter all copper-covered steel wire and wire products handled by General Cable Corporation will be produced exclusively from Copperweld material.

Full and complete sales and engineering service on Copperweld wire and wire products is now available through each of the divisions of General Cable Corporation.

Steel Companies Merge

Merger of the Commonwealth Steel Company, Granite City, Ill., with the General Steel Casting Company, Philadelphia, Pa., brings the American Steel Foundries, Baldwin and American Locomotive Corporations into a new combine, since General Steel Castings Company has recently been organized by those three concerns. J. P. Morgan & Company, New York, is handling the financing and has been designated as the depository for the stocks in the merger.

The Commonwealth Steel Company recently announced a \$1,000,000 program of additions to its Granite City plant. This plant occupies about 80 acres with 170 acres of additional industrial property held by the company in the immediate vicinity,

giving ample room for expansion. The plant is equipped with six large open hearth furnaces, having a capacity of 10,000 tons annually, used chiefly in the manufacture of steam railroad locomotive boiler gas-electric rail car beds, Pullman trucks and parts.

This company manufactures street car interurban and trailer trucks for the electric railway industry and has truck stalls on the Philadelphia Rapid Transit Company, Pacific Electric, Detroit Street Railway, Interborough Rapid Transit Company and other large properties.

TRADE NOTES

Ross F. Hayes, who during the past five years has been engaged as manufacturers' agent, railroad supplies, at New York, has become connected with Adams & Westlake Company as representative in charge of Eastern sales of Rex car specialties. Mr. Hayes was formerly for many years with the Curt Supply Company as Eastern manager, New York, and later was general sales manager at Chicago. The Curt Supply Company was consolidated about two years ago with the Adams & Westlake Company. Mr. Hayes goes to Adams & Westlake Company at its Eastern office, 50 Church Street, New York.

General Electric Company, Schenectady, N. Y., has received orders for the first quarter of 1929 amounting to \$10,365,208, compared with \$79,925,840 in the corresponding period of last year, an increase of 27 per cent.

The White Company, Cleveland, Ohio, announces the promotion of Thomas Blagden, Jr., Australian division manager, to vice-president of the export region. L. M. Hart, managing director of The White Company, Ltd., has been appointed vice-president in charge of the Canadian territory. Vice President Jay Rathbun, who has had entire responsibility of the export in Eastern regions, will devote his time to the Eastern region exclusively. Messrs. Blagden and Rathbun will have their offices at 225 Broadway, New York.

Montain Treating Company, Westboro, Mass., has extended its operations into the pole-treating field, using its patented process of wood preservation. Licenses for the use of this process have been negotiated by the Pensacola Crosoting Company, Inc., Pensacola, Fla., and the Gulfport Crosoting Company, Gulfport, Miss. Plans are on foot to utilize a 50-acre site adjacent to the present plant at Westboro, Mass., for pole-treatment and storage center to serve New England utilities.

J. C. Lincoln, formerly president of the Lincoln Electric Company, Cleveland, Ohio, has been elected chairman of the board. J. F. Lincoln has been elected president. The company maintains a complete line of motors and welding devices.

Sullivan Machinery Company, Chicago, Ill., manufacturer of compressors and air-driven machinery, has moved its general offices from 122 South Michigan Avenue to the Wrigley Building, 400 North Michigan Avenue, Chicago, Ill.

ELECTRIC RAILWAY MATERIAL PRICES—APRIL 25, 1929

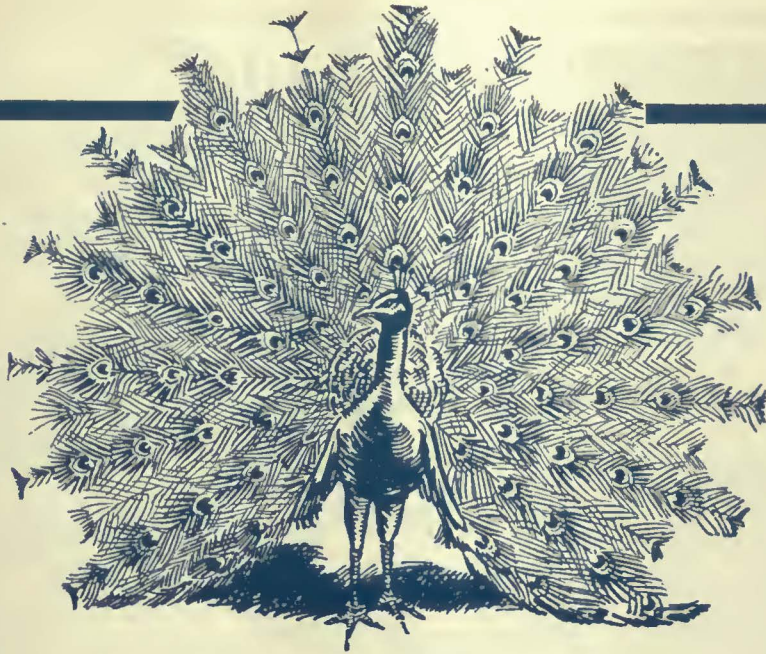
Metals—New York	
Copper, electrolytic, cents per lb.	17.775
Lead, cents per lb.	7.00
Nickel, cents per lb., ingot	35.
Zinc, cents per lb.	6.625
Tin, Straits, cents per lb.	44.656
Aluminum, 98 to 99 per cent, cents per lb.	24.30
Babbitt metal, warehouse, cents per lb.:	
Commercial grade	54.00
General service	31.50
Bituminous Coal	
Smokeless Mine Run, f.o.b. vessel, Hampton Roads, gross tons	\$4.10
Somerset mine run, f.o.b. mines, net tons	1.80
Pittsburgh mine run, Pittsburgh, net tons	1.58
Franklin, Ill., screenings, Chicago	1.70
Central, Ill., screenings, Chicago	1.45
Kansas crushed mine run, Kansas City	2.25
Track Materials—Pittsburgh	
Standard steel rails, gross ton	\$43.00
Railroad spikes, drive, 1/2 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.	10.3
White lead in oil (100 lb. keg), cents per lb.	13.25
Turpentine (bbl. lots), per gal.	\$0.585
Putty, 100 lb. tins, cents per lb.	5.725

Wire—New York	
Copper wire, cents per lb.	19.875
Rubber-covered wire, No. 14, per 1,000 ft.	6.85
Weatherproof wire base, cents per lb.	20.875

Paving Materials	
Paving stone, granite, 5 in., f.o.b.	
New York—Grade I, per thousand	\$150
Wood block paving 3 1/2, 16 lb. treatment, N. Y., per sq. yd., f.o.b.	\$2.78
Paving brick 3 1/2 x 8 1/2 x 4, N. Y., per 1,000 in carload lots, f.o.b.	51.00
Paving brick 3 1/2 x 8 1/2 x 4, N. Y., per 1,000 in carload lots, f.o.b.	45.00
Crushed stone, 1-in., carload lots, N. Y., per cu. yd., delivered	3.25
Cement, Chicago consumers' net prices, without bags, f.o.b.	2.05
Gravel, 1-in., cu. yd., delivered	3.25
Sand, cu. yd., delivered	2.00

Old Metals—New York and Chicago	
Heavy copper, cents per lb.	13.875
Light copper, cents per lb.	11.875
Heavy yellow brass, cents per lb.	7.275
Zinc, old scrap, cents per lb.	3.585
Lead, cents per lb. (heavy)	5.375
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



Making Assurance! Doubly sure!

WITH PEACOCK STAFFLESS BRAKES

Assurance of brakes that will hold in the emergency—when they are the one thing between disaster and safety.

Safety not only to your cars—to those who ride on them—but to those on the street.

Peacock Staffless Brakes banish all the “bugaboos” that assail you when brakes must stop the car.



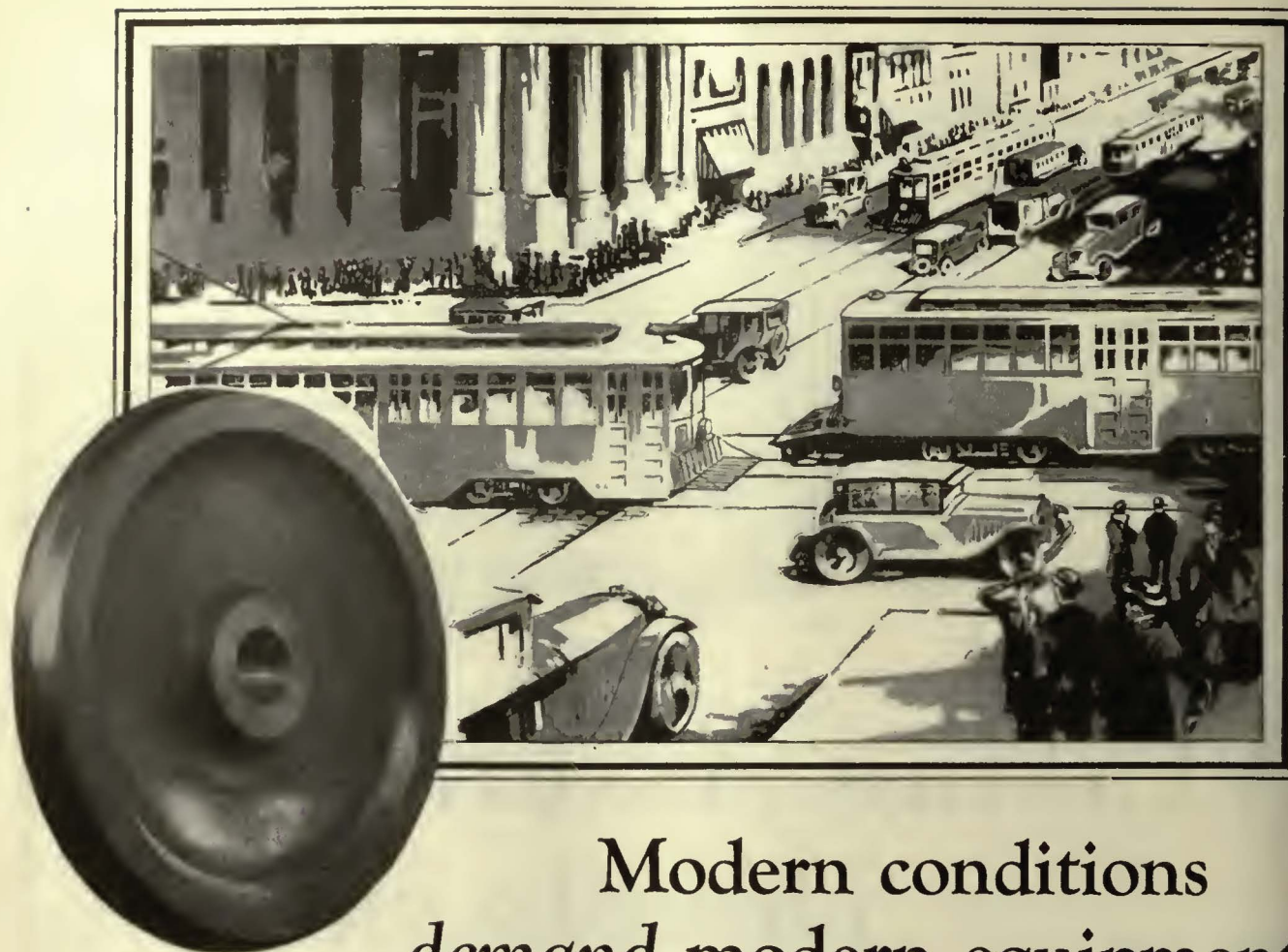
National Brake Company, Inc.

890 Ellicott Square, Buffalo, N. Y.

General Sales Office: 50 Church St., New York

Canadian Representative:

Lyman Tube & Supply Co., Ltd., Montreal, Can.



Modern conditions *demand* modern equipment

Traffic conditions today—big cars, heavy loads, accelerated starting and emergency stopping—throw an ever-increasing burden on equipment. Wheels bear the brunt of it all.

Carnegie Wrought Steel Wheels assure high resistance to the wear and tear of modern traffic. Wrought Steel is obtained through forging and rolling. A 10,000 ton hydraulic press (twenty million pounds!) refines the steel—insures a homogeneous structure, free from irregularities that might cause trouble. The rolling process rolls mileage into the steel—mileage to spare. It is this extra mileage that makes Carnegie Wheels such an economical investment.

Before you invest in new wheels, investigate the many advantages of Wrought Steel. A catalogue will be sent at your request. Our wheel engineers are always at your service.

CARNEGIE STEEL COMPANY

Subsidiary of UNITED STATES STEEL CORPORATION

CARNEGIE BUILDING—PITTSBURGH

More car-miles per dollar



The Texas Company's refinery in Port Arthur, Texas, where "Texaco Lubricants" are made.

HERE is where Texaco car oils and gear lubricants are made. Much of the country's electric railway equipment is running on Texaco Lubricants, because railway executives have found that Texaco Lubricants substantially cut the costs of operation. They give more car-miles per dollar.

This great Port Arthur refinery of The Texas Company is the source of better lubrication. Selected crudes from the country's oil fields flow into the refinery through thousands of miles of Texaco pipe lines. Scientifically correct crudes are available for every type of lubri-

cant, and only such crudes are used as are perfectly fitted for the production of each specific product. These exceptional crude resources, the exacting laboratory control of every process and the perfection of modern refinery equipment are responsible for the quality of Texaco products.

Texaco Lubricants and Texaco Lubrication Service (the service of engineering specialists in lubrication) are recognized and appreciated the world over. Complete stocks of the same uniformly high quality Texaco Lubricants are available everywhere.

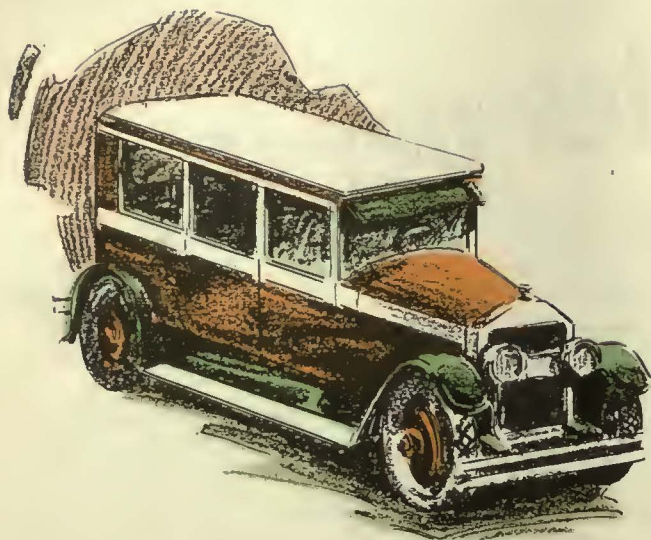
TEXACO LUBRICANTS

THE TEXAS COMPANY
17 Battery Place,
New York City

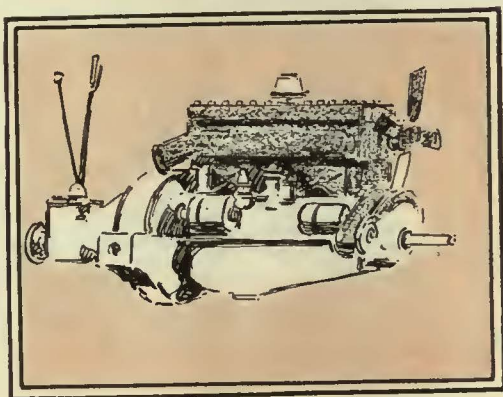


Offices in
Principal Cities

T H E R E I S A T E X A C O L U B R I C A N T F O R E V E R Y P U R P O S E



Longer Mile



Passenger car lubrication is one problem . . . Motor bus lubrication another

Koolmotor Bus Oils are the result of a fundamental fact, early recognized by Cities Service lubrication engineers. The lubrication problems of the motor bus are distinctly apart from those of any other automotive vehicle on the highways. This fact has always guided our research, which has resulted in the development of Koolmotor Bus Oils.

The rapid increase in use of Koolmotor Bus Oils on so many of the largest motor bus lines in the country reflects the results which they have brought about—greater lubrication efficiency, which has reduced operating costs and increased profits.

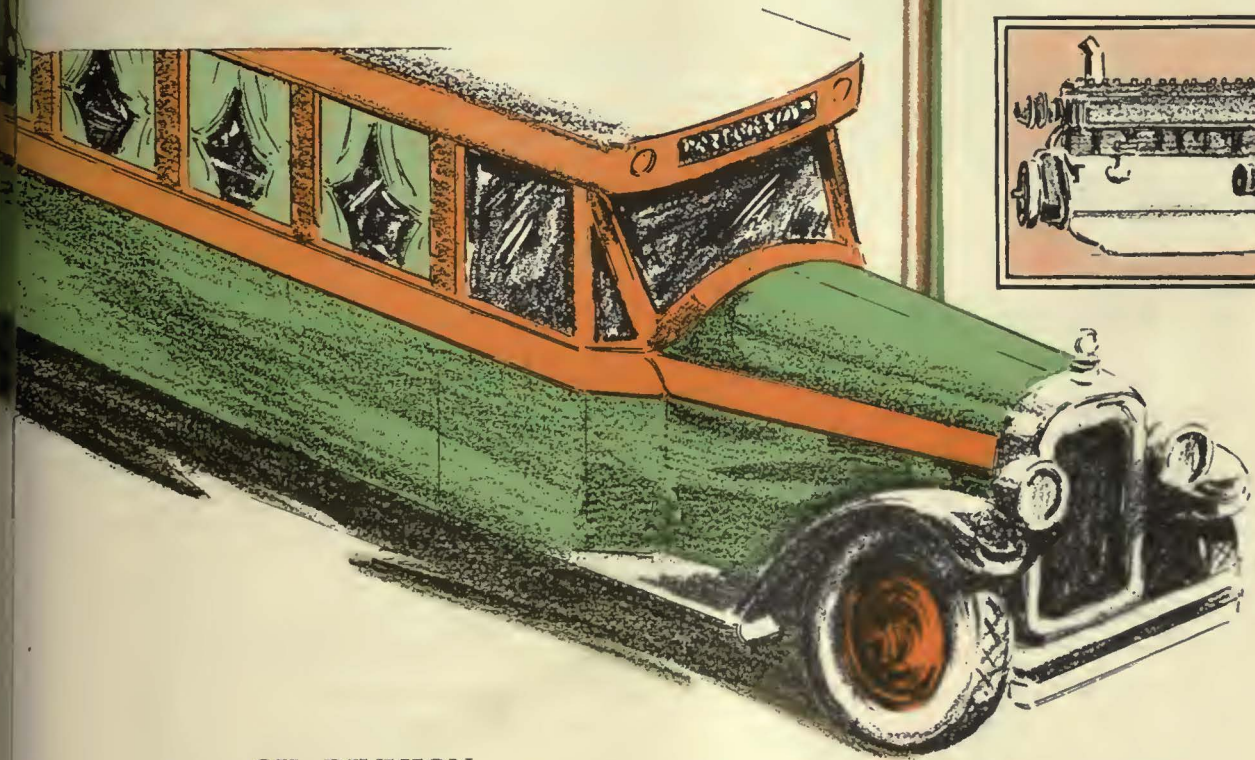
You, too, can insure “longer mileage life” by lubricating your vehicles with our recommended grades of Koolmotor Bus Oils.



Life



KOOLMOTOR BUS OILS are carefully refined from 100% Pennsylvania crude for the special requirements of heavy duty, high speed motor bus lubrication. The method used in refining them is based on the findings of the highly trained corps of Cities Service lubrication engineers who are always on the alert to change refining formulas or develop new ones to accommodate everchanging lubrication conditions.



OIL DIVISION

CITIES SERVICE COMPANY

60 WALL STREET, NEW YORK, N. Y.

Koolmotor Products



The high conductivity and uniform quality of Anaconda Metals are the result of the co-ordinated control by a single organization which is responsible for every step in their production from mine to finished product.

ANACONDA WIRE *and* CABLE

SELECTED FOR THIS MODEL
RAILWAY ELECTRIFICATION
ON THE BASIS OF QUALITY
AND ENGINEERING SERVICE

IN planning the complete electrification of the Boston, Revere Beach & Lynn Railroad, the management, recognizing its responsibility to the travelling public, spared no engineering effort or cost to provide passenger safety and continuity of service.

An example is the selection of Anaconda Red-Brass Guy Wire for the cross span cable. This alloy was specified because of its high strength and resistance to the corrosive action of salt atmosphere.

The 500,000 C. M. Anaconda Concentric Copper Main Messenger Cable was spliced with Anaconda Seamless Connectors which develop the full strength and conductance of the cable.

The contact wire is Hitenso "A", an Anaconda Cadmium Bronze, and was selected because of its combined high conductivity, high strength and resistance to wear, also because it does not become brittle when overheated as from a short circuit.

An important factor governing the selection of Anaconda Wire and Cable for this project was the technical service given by Anaconda Engineers in helping to solve problems relating to sag, tension, conductivity and other requirements.

Our Technical and Engineering Departments are always ready to cooperate in any way possible.

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



A Modern Seat in Every Way!

In every possible way this de luxe seat fulfills the requirements of modern bus travel. The 90 P is a smart looking, luxurious style that offers real comfort and relaxation on the long haul. Among its unusual features are the broad roll headrests; the deep, removable comfy spring cushions; and shaped, comfy spring back pads. This style is made with only one armrest to increase comfort and conserve space. This chair may be secured with fibre sides in any desired color. Write to the nearest Heywood-Wakefield sales office for complete details on the 90 P and other popular bus seats in our line.



If you have not received a copy of our new Bus Seat Catalogue, write for it.

**HEYWOOD - WAKEFIELD
COMPANY**

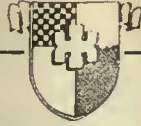
BOSTON, MASSACHUSETTS

516 West 34th St., New York City
J. R. Hayward, Liberty Trust Bldg., Roanoke, Va.
H. G. Cook, Hobart Bldg., San Francisco, Calif.

439 Railway Exchange Bldg., Chicago, Ill.
A. W. Arlin, Delta Bldg., Los Angeles, Calif.
The G. F. Cotter Supply Co., Houston, Texas

The Railway and Power Engineering Corporation
133 Eastern Ave., Toronto; Montreal; Winnipeg, Canada

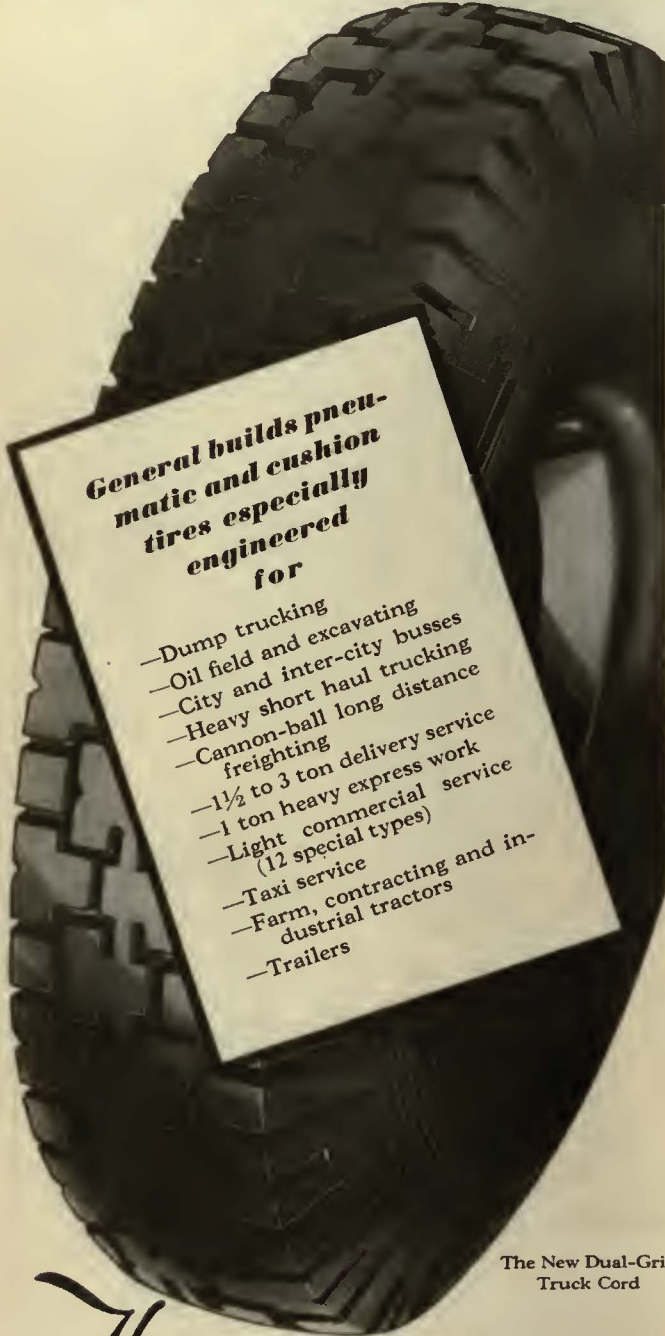
IT'S THE NON-STOP MILEAGE



THAT MAKES THE BIG HIT

Name Your Tire Problem

- General Will ... Solve It



General builds pneumatic and cushion tires especially engineered for

- Dump trucking
- Oil field and excavating
- City and inter-city busses
- Heavy short haul trucking
- Cannon-ball long distance freighting
- 1½ to 3 ton delivery service
- 1 ton heavy express work
- Light commercial service (12 special types)
- Taxi service
- Farm, contracting and industrial tractors
- Trailers

The New Dual-Grip Truck Cord

Whatever your particular tire problem may be—whether you operate a single unit or a fleet—the General distributor stands ready to help you solve it.

General maintains a specialized engineering service expressly for looking up and licking the toughest jobs everywhere in truck and bus operation.

There isn't a kind or condition of service that General hasn't tackled and tamed—no demand that is too severe for its transportation experts.

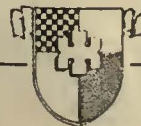
Get in touch with the General distributor. He has a knowledge of tire conditions gained from General's years of leadership in the commercial field. He knows how to fit the right tire to the truck or bus. This is an added assurance of big, continuous low cost mileage. The General Tire and Rubber Company, Akron, Ohio.

The complete General Commercial Line Includes:

Dual-Grip truck cord; Truck and Bus Balloon; the "Jumbo" Ford and Chevrolet line; Heavy Express Special; One-Ton Express Special; Regular Cushion; Demountable Cushion; Heavy Duty Non-Skid Cushion; high-speed and regular; Extra Heavy Non-Skid Cushion; Air Center Cushion, non-skid and rib-tread; High Smooth Cushion.

The GENERAL TIRE

GOES A LONG WAY



TO MAKE FRIENDS

what

The public has tasted luxury transportation and likes it. It is now short of full measure. The industry must meet changed conditions . . . that quickly . . .

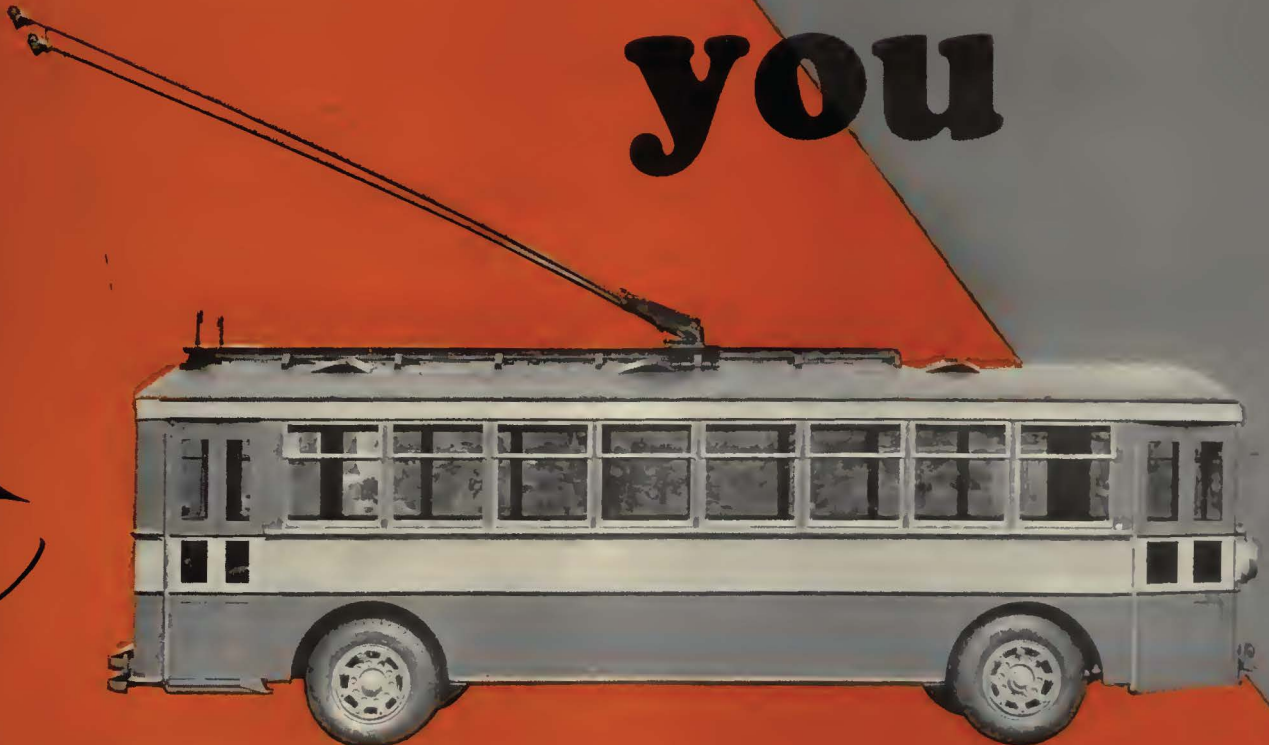
(from an editorial in Electric Railways, February 16, 1929.)



do



you



need

READ THIS MESSAGE



Cincinnati has the designs—Cincinnati has built the most modern cars for years, is building the most modern cars today—cars that are modern in efficiency as well as luxury. And Cincinnati's Survey and Plan Method of selling enables any property to have modern cars at once—and to pay for them out of increased earnings.

We recently submitted a survey and plan to a large property in Indiana. The plan was approved and Cincinnati Cars supplied. Running time on all routes was cut 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 power was established (the power rate is 1.1c per K.W.H.) Figures to date indicate an an-

SAGE AGAIN!

Annual 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?

NEW ORLEANS

—and a new



*How the New Orleans Public Service, Inc., applied Carey Elastite System of Track Insulation to the inside and outside of the rail. Note the new and interesting type of rail construction in connection with girder rail
No. 122-491.*



Showing granite blocks placed next to the rails, preparatory to placing the asphalt paving.

transit discovery

IN 1925, the New Orleans Public Service, Inc., discovered the new-day advantages of using Carey Elastite System of Track Insulation in connection with girder-rail construction. Immediately they made this transit improvement a definite part of their extensive betterment program.

Now New Orleans' hundreds of thousands of passengers enjoy smoother, swifter-moving traction service. Now New Orleans' paving stays in better condition—no vibration to spread from the track, no bumping and pumping around the rails. Traction perfection! A saving in maintenance and a route to faster schedules.

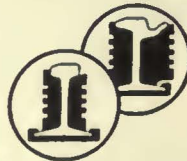


A view of the finished job, protected by Carey Elastite System of Track Insulation. Observe the smooth appearance of the pavement, between the rails and from rails to curb.

Carey Elastite System of Track Insulation: a durable, asphaltic compound substantially reinforced with pressure-preformed, asphalt-

saturated fibre. Used and recommended by street railway officials and public utility organizations throughout the entire United States. Write for full information.

Carey Elastite
TRADE MARK REGD. U.S. PATENT OFFICE

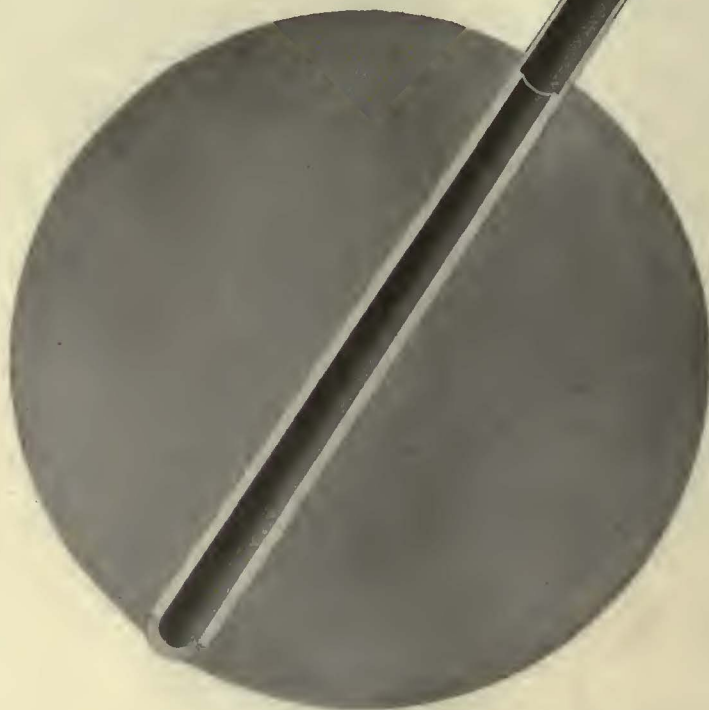


SYSTEM OF TRACK INSULATION

Cleveland, CINCINNATI, OHIO

“**NATIONAL**”
SHELBY
 SEAMLESS STEEL
TROLLEY POLES

Reinforced where reinforcement is needed, without adding superfluous weight or sacrificing resiliency.



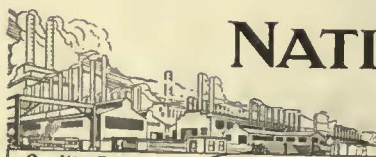
THE standard “NATIONAL-SHELBY” Poles are made from 13-gage material, as years of practical experience have shown that a lighter gage may fail by local injuries, and a heavier gage simply adds to the weight of the pole without increasing its strength to a corresponding extent. The theoretical requirement for a pole of minimum weight points out a method for increasing the strength of the pole without a proportionate increase in the weight. This method consists of the use of a reinforcement at the base end, and on the inside of the 13-gage member.

These poles are made by improved methods of manufacture, particularly in the method of inserting the reinforcement. The reinforcement is integral with the body of the pole, which adds materially to its efficiency.

NATIONAL TUBE COMPANY

Frick Building, Pittsburgh, Pa.

SUBSIDIARY OF
UNITED STATES STEEL CORPORATION



Quality Products

AMERICAN BRIDGE COMPANY
 AMERICAN SHEET AND TIN PLATE COMPANY
 AMERICAN STEEL AND WIRE COMPANY

PRINCIPAL SUBSIDIARY MANUFACTURING COMPANIES:

CARNEGIE STEEL COMPANY
 CYCLONE FENCE COMPANY
 FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

ILLINOIS STEEL COMPANY
 MINNESOTA STEEL COMPANY
 NATIONAL TUBE COMPANY

THE LORAIN STEEL COMPANY
 TENNESSEE COAL, IRON & R. R. COMPANY
 UNIVERSAL PORTLAND CEMENT COMPANY

Dependable Service

Pacific Coast Distributors—United States Steel Products Company, San Francisco, Los Angeles, Portland, Seattle, Honolulu. Export Distributors—United States Steel Products Company, New York City



WHITE 38-41-passenger SIX

IN two years the White Six Bus, Model 54, has set new standards in performance, economy and lasting qualities. It has been a revelation in all things which make a bus desirable to both operator and public.

Now the essential units which gave Model 54 its remarkable success—engine, transmission, rear axle, etc.—have been rearranged in a larger, still stronger chassis, the Model 54-A, especially to meet the demand for a bus with larger seating capacity for city operation.

Model 54-A, 250-inch wheelbase, has ample room for 38 or 41 passengers comfortably seated.

The power plant and driver's seat have been moved forward, considerably lengthening the body space, with only a ten-inch increase in wheelbase. Wider tread front axle gives a short turning radius.

the proven units of the White Six re-combined in a large-capacity bus primarily for city service.

One hundred horsepower delivered at the wheels (with all equipment operating), easy steering; Westinghouse air brakes, clear vision windshield all insure the easy, comfortable handling needed in city service.

It loads fast and moves fast, saving the seconds that count in making rapid city schedules.

Already the Cleveland Railway Company, known among street railways as most careful in buying and most exacting in demands upon equipment, has bought 20 White Model 54-A's.

THE WHITE COMPANY, *Cleveland*

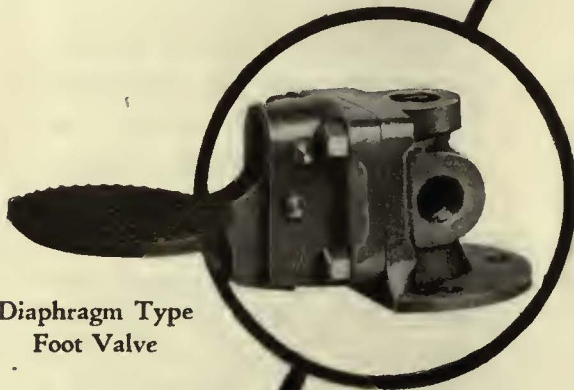
WHITE BUSES

FOURS AND SIXES

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.



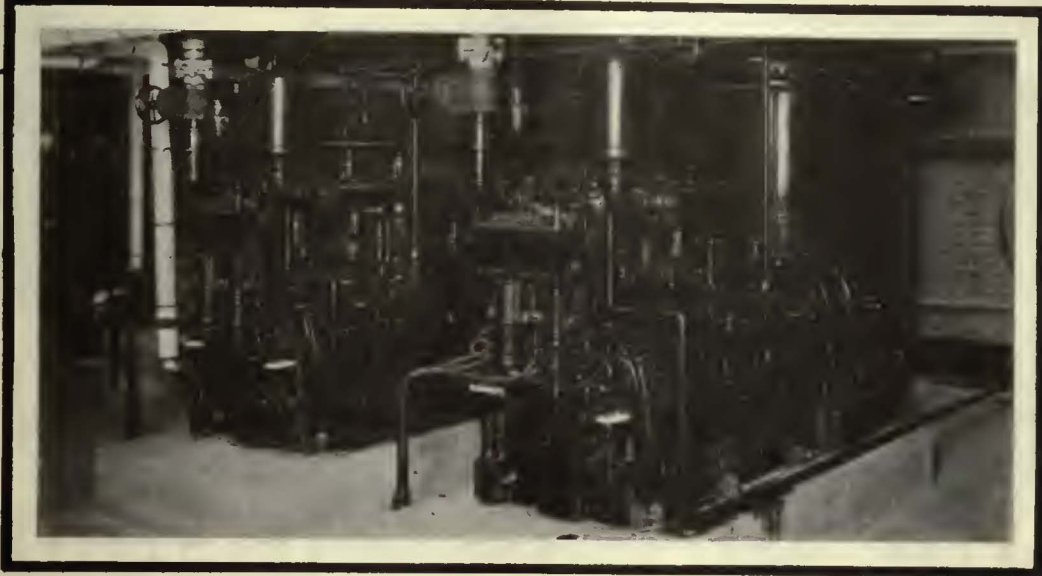
SAFETY CAR DEVICES CO.
OF ST. LOUIS, MO.

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.*

Satisfaction that endures



THE quality of Westinghouse National Air Compressors is a warranty of enduring satisfaction.

Quality is the first thought in design, construction and assembly. This strict adherence to high standards has established a reputation for long life, dependability, and economy of operation.

Because of this, many traction properties are now using Westinghouse-National Air Compressors exclusively in their shops, power houses, and maintenance departments. All types and sizes are available, ranging from 3 to 700 cu. ft. displacement—all "Quality Machines for Quality Service."

WESTINGHOUSE-NATIONAL
Air Compressors
"QUALITY MACHINES FOR QUALITY SERVICE"

WESTINGHOUSE TRACTION BRAKE COMPANY

Industrial Division

General Office and Works

Wilmerding, Pa.



One of the 69 coaches of the Pittsburgh Motor Coach Company, using Goodyear Tires

SAFE TRACTION on the hills of Pittsburgh

Anyone who knows Pittsburgh, Pa., knows that it is far from a normal city for motor coach operation. Up and down steep hills the traffic travels—on grades which would be perilous for passenger-laden coaches equipped with anything less than the surest traction which can be built on a tire.

Recognizing these facts, the Pittsburgh Motor Coach Company equips its 69 coaches with Goodyears—most of them bus balloons.

The famous tractive power of the Goodyear ALL-WEATHER Tread gives new security to brakes. Even when pavements glisten with grease or water, those sturdy, resilient blocks of sharp-edged rubber cut their way through

surface film, and grip the solid ground.

Beneath the tread, in the body of the tire, is the extra vitality of SUPERTWIST. This special Goodyear Cord resists fatigue and the strains of frequent braking at the same time that it adds to comfort by its quick-yielding resilience.

Perhaps your operation is not as rigorous in its demands on tires as this one in Pittsburgh. Perhaps it is more so. Whether your need is superior traction and extra resistance to strain—or simply the toughness and vitality to deliver an extremely low cost per mile—Goodyear Truck Tire Service Station Dealers are equipped to provide you with recommendations, expert and accurate, which show the right tires for your particular hauling duty.

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

Already a

3½ million dollar



That's what the Industry
thinks of the new

Yellow Z 240

Mass Transportation Coach

Syracuse Railway
Coordinated Bus Co.

Buys 3

Public Service
Coordinated
Transport

Buys 254

Montgome
Bus Compa
of Philadelp

Buys 1

Washington
Rapid Transit

Buys 8

Chicago Motor
Coach Company

Buys 30

because

... conventional in
design - - - - and



Western Michigan
Motorbus

Buys 10

B. C. Motor
Transportation
Company of
Vancouver, B. C.

Buys 7

Chicago, Milwaukee
& St. Paul R.R.

Buys 2

O. G. Schultz
Management
Camden, N. J.

Buys 50

Twin City
Motor Bus
Company of
St. Paul

Buys 3

New Orleans
Public Service

Buys 7

Cleveland
Railways

**Buys
5**

built of proven units that
have been time tested in
millions of miles of heavy
duty coach service—

LORAIN

Girder Rails

Girder Guard Rails

Plain Girder Rails

Rail Joints and
Track Accessories

Expansion Joints
for Electrically
Welded Track

Special Trackwork



Switches, Frogs and Crossings

in

Solid Manganese Steel,
Manganese Insert Construction,
Chrome Nickel Steel Insert
Construction and Built-up
Construction of all
heights and weights of rail

The Lorain Steel Company

General Offices: 545 Central Avenue, Johnstown, Pa.

SUBSIDIARY OF

UNITED STATES STEEL CORPORATION



Quality Products

PRINCIPAL SUBSIDIARY MANUFACTURING COMPANIES:

Dependable Service

AMERICAN BRIDGE COMPANY
AMERICAN SHEET AND TIN PLATE COMPANY
AMERICAN STEEL AND WIRE COMPANY

CARNEGIE STEEL COMPANY
CYCLONE FENCE COMPANY
FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

ILLINOIS STEEL COMPANY
MINNESOTA STEEL COMPANY
NATIONAL TUBE COMPANY

THE LORAIN STEEL COMPANY
TENNESSEE COAL, IRON & R. R. COMPANY
UNIVERSAL PORTLAND CEMENT COMPANY

Pacific Coast Distributors—United States Steel Products Company, San Francisco, Los Angeles, Portland, Seattle, Honolulu. Export Distributors—United States Steel Products Company, New York City

Sales Offices:

ATLANTA

CHICAGO

CLEVELAND

DALLAS

NEW YORK

PHILADELPHIA

PITTSBURGH

Reduce Maintenance Cost ~ ~ Increase Revenue

MAINTENANCE cost in large transit companies, operating motor buses and street cars, is one of the most important cost factors directly affecting profits. Successful operators are constantly striving to reduce this enormous expenditure through the installation of modern time saving equipment. ¶You can most advantageously begin in your paint shop . . . spray painting equipment will cut your refinishing costs approximately 50% . . . it will also reduce the number of reserve buses or street cars necessary, and

will permit a greater number of revenue earning days per car-year, through the reduction in the "Out of Service" time required for painting. ¶Does not this demand your immediate investigation? Mahon engineers, who for years have specialized in the scientific development of Spray Booths for every purpose, will gladly cooperate with you in the solution of your problem . . . profit by the wide and varied experience of this highly specialized staff of Spray Booth experts . . . arrange a consultation today—no obligation involved.

THE R.C. MAHON COMPANY
DETROIT, MICHIGAN

*Manufacturers of Spray Booths and Exhaust Stacks, Industrial
Drying Ovens and Blow Pipe Systems*

MAHON

SPRAY BOOTHS & EXHAUST STACKS

• DESIGNED FOR FIRE SAFETY •

Throughout THE LENGTH AND BREADTH of Industry

Just when bronze, earliest of the alloys, came into common usage as bearing metal is difficult to determine. It is a known fact, however, that during the past quarter-century more bronze bearings have been made and used than any other kind.

Thruout the length and breadth of industry lives the conviction that for practical utility and economy there is no substitute for bronze bearings.

The reasons for this preference are readily apparent. Bronze yields smooth, solid, perfect castings in any size and shape. It possesses qualities of self-lubrication, and thus reduces to a minimum the possibility of scoring and seizing shafts.

Ideal bronze withstands compression loads under heat, has adequate tensile strength, elastic limits and moderate Brinell hardness. Coefficient of expansion is uniform. Coefficient of friction is low and abrasive elements are absent at all temperatures.

Withal, bronze bearings for most installations cost substantially less per unit and possess out-of-the-ordinary longevity. When replacement is necessary, it is accomplished easily and economically.



JOHNSON BRONZE CO. WALL CARD	
Size	Stock
1/2" x 1/2" x 1/2"	1000
3/4" x 3/4" x 3/4"	1000
1" x 1" x 1"	1000
1 1/4" x 1 1/4" x 1 1/4"	1000
1 1/2" x 1 1/2" x 1 1/2"	1000
2" x 2" x 2"	1000
2 1/2" x 2 1/2" x 2 1/2"	1000
3" x 3" x 3"	1000
3 1/2" x 3 1/2" x 3 1/2"	1000
4" x 4" x 4"	1000
4 1/2" x 4 1/2" x 4 1/2"	1000
5" x 5" x 5"	1000
5 1/2" x 5 1/2" x 5 1/2"	1000
6" x 6" x 6"	1000
6 1/2" x 6 1/2" x 6 1/2"	1000
7" x 7" x 7"	1000
7 1/2" x 7 1/2" x 7 1/2"	1000
8" x 8" x 8"	1000
8 1/2" x 8 1/2" x 8 1/2"	1000
9" x 9" x 9"	1000
9 1/2" x 9 1/2" x 9 1/2"	1000
10" x 10" x 10"	1000
10 1/2" x 10 1/2" x 10 1/2"	1000
11" x 11" x 11"	1000
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99" x 99" x 99"	1000
99 1/2" x 99 1/2" x 99 1/2"	1000
100" x 100" x 100"	1000

Write for a copy of this handy Wall Card which lists over 600 "in stock" sizes ready for immediate delivery.

JOHNSON BRONZE CO.
NEW CASTLE, PA.

JOHNSON BRONZE

BUSHINGS BEARINGS BAR BRONZE



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LONG PRODUCTS — AUTOMOTIVE CLUTCHES AND RADIATORS

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THE STREET RAILWAYS OF AMERICA BY THE

Pittsburgh Street Railways Co.



YOU MAY BUY A
BEARING AS A
BARGAIN BUT
TRY AND GET A
BARGAIN OUT OF
USING IT

for
Nothing is apt to cost so much
as a bearing that cost so little.



Operating Economies Plus Increased Public Favor Make **SKF** Bearings Paying Investment

THERE'S nothing the matter with this truck now in daily service on the Pittsburgh Street Railways—it just posed for the picture to show that **SKF** Spherical Bearings were going on the job to keep rolling stock running smoothly and maintenance at a minimum. Thirty such trucks are used on 15 new cars with a total of 120 **SKF** Bearings.

Much has been said about modernization to increase profits and revive public

interest in street railways. That **SKF** Spherical Bearings are playing an important part in this new trend is based not on generalities but on proven performance. Their inherent self-alignment, freedom from adjustment and long-life have convinced this company after three years' experience that **SKF** would be the most economical in the long run on these 52 passenger, 49,500 pound cars which often reach a mile a minute speed.

SKF INDUSTRIES, INC., 40 East 34th Street, New York, N. Y.

2277

SKF

Ball and Roller Bearings

Provide for tomorrow's traffic Today



Bethlehem Silico-Manganese Weldable Crossing at Ralph and Gates Aves., Brooklyn, N. Y., on lines of Brooklyn-Manhattan Transit Co.

Silico-Manganese Special Trackwork

The new Bethlehem Silico-Manganese Special Trackwork is remarkably shock- and wear-resisting. Electric railway companies can install this trackwork at heavy-duty locations with confidence that it will stand up—not only under today's traffic but under the still heavier volume of traffic that tomorrow is certain to bring.

The impact and wear-resisting properties of silico-manganese steel are well-established. It has already been accepted as standard for parts subject to shock and wear, as well as for high grade tools. Silico-Manganese steel of tool steel quality, possessing great tensile strength and tough enough to resist the violent impacts of heavy traffic, is used in the manufacture of this new special trackwork.

Bethlehem Silico - Manganese Trackwork—called Design No. 999—is of one-piece construction. The Silico-Manganese Steel Castings can be readily welded and built up in the field. This welding feature is a decided advantage for quick repair work at heavy traffic intersections.

BETHLEHEM STEEL COMPANY

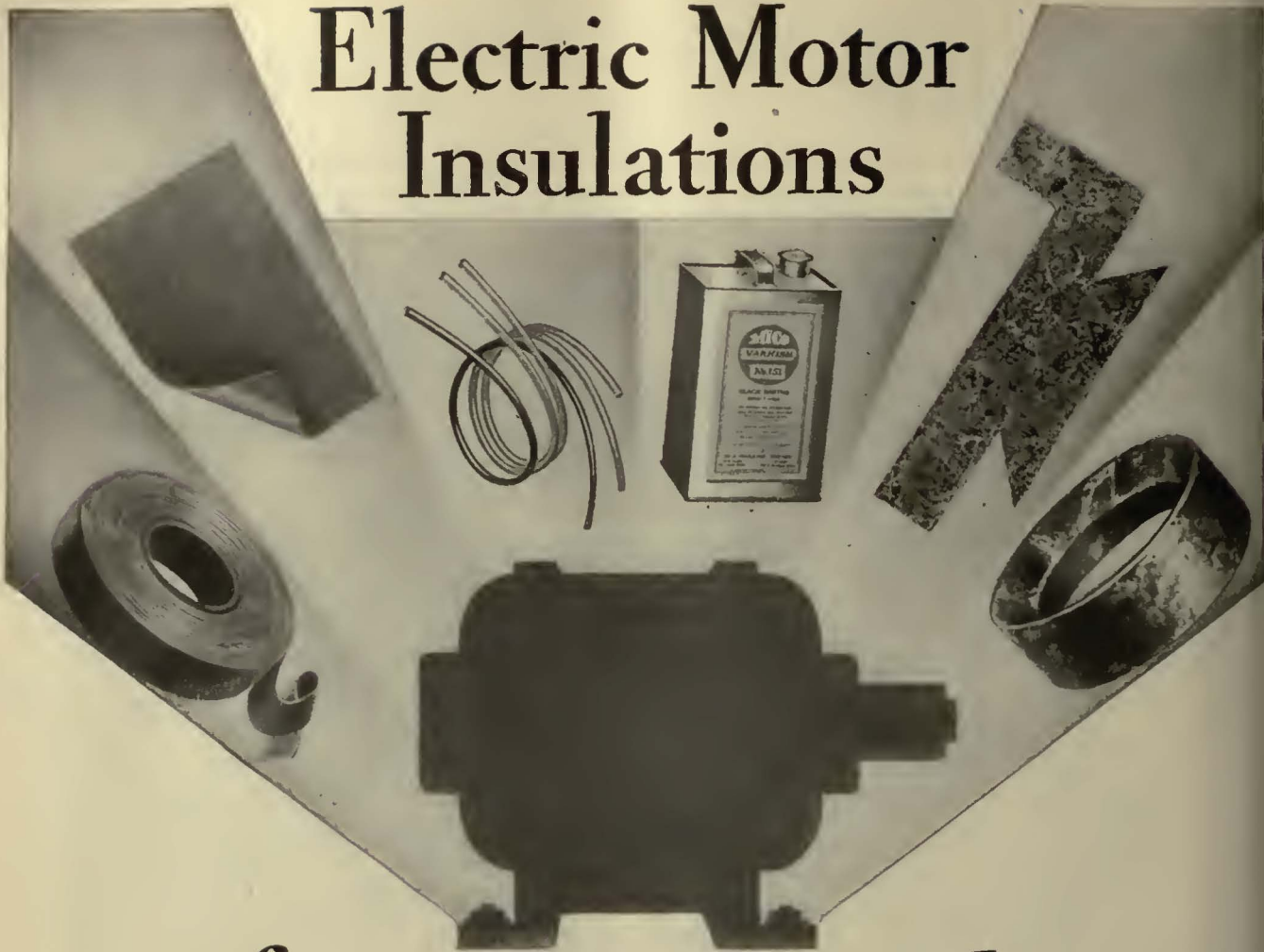
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for every motor type and size!*

Glance at the insulations listed at the right. There is one for every motor need from slot bottoms to phase leads. They are all performance-proved in thousands of motors of every manufacture. Their quality is unvarying, for throughout manufacture—from raw materials to finished products—continuous inspections to most rigid standards are maintained.

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Mico Insulations

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An organization with a long record of achievement in the production of mass transportation equipment introduces the last word in the popular full head room, 29 passenger Parlor Coach

A.C.F.

hall - scott

transportation — *by coach*

The universal mass transportation experience of Q. C. F. has never been so perfectly reflected as in the details of the new P12 Full Head Room Parlor Coach for Chassis Model 508-12. Seating comfort for 29 passengers (exclusive of driver), ample leg room, full size interior baggage racks easily accessible, quarter outside baggage rack, adequate head room, window visibility, loading convenience and exterior and interior beauty meet the high transportation standards which have always governed Q. C. F. construction. Here is *satisfaction* for every coach operator who strives for the most scientific basis of operation: maximum passenger comfort and maximum revenue space.

See the new P12 for yourself. From the *automotive* standpoint you will find Hall-Scott power, speed, acceleration, strength and lowest weight compatible with endurance and long life. And from the *transportation* standpoint you will see the beauty, convenience and comfort that gets business, and holds it.



powered by—*hall-scoville*

Free of the precedents of both truck and car practice
maintained like transportation power units of a
other type—unit assemblies interchangeable—A. C.
coaches stay on the road while shop work is in progress



When it was a CRIME to Look *Ahead*



M c G R A W - H I L L

McGRAW-HILL PUBLISHING COMPANY, Inc., New York - Chicago - Philadelphia

"NONSENSE! Stuff and Twaddle!" said Isaac Newton to what 17th Century despots decreed as knowledge.

"Nonsense!" agreed Robert Boyle.

That was heresy . . . and heretics were treated roughly in those days. So the discoverer of the law of gravity and the father of the law of chemical science, aided and abetted by other truth-seeking rebels, formed a blind-pig scientific society. Its crude experiments, secretly conducted in secluded cellars, were destined to start the world's economic advancement.

Later, when it became lawful to question superstitions, this "Invisible College" was recognized as the Royal Society of London.



How times have changed since the day of Newton and Boyle! Research . . . invention . . . exploration . . . industrial advancement—not tolerated, but *demand*ed by an increasingly sophisticated population. What a premium today upon Vision!

American industry right now is pioneering in the spirit of Newton and Boyle—but with this difference: it is aided and exhorted by an industrial, engineering, trade and business press whose leadership is needed more than ever. For the stupendous accomplishments of industry have themselves become industry's greatest concern, imposing penalties upon engineers, industrialists and the heads

of business . . . penalties for lack of clear vision . . . penalties for not looking ahead.



The McGraw-Hill publications help industry and business look ahead. Some cover the technical, design and executive problems of specific industries. Others specialize on functions common to all industry. Serving the whole sweep of American business, *The Magazine of Business* is edited for the chief executive who is concerned with *policies* as well as methods.

Penetrating basic industries where most new developments originate, each McGraw-Hill publication is a collateral aid to the others. Their united forces serve American business with the facts that are so necessary today in the making of business decisions.

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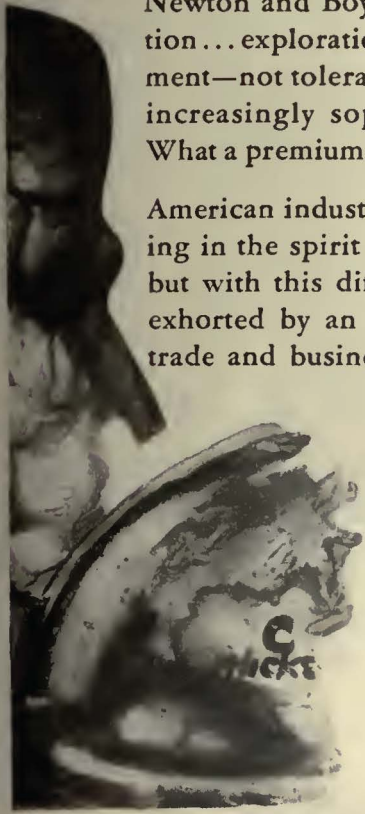
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P U B L I C A T I O N S

Detroit - St. Louis - Cleveland - San Francisco - Boston - Greenville - London





Union Metal installation. Middletown, Conn. Note the heavy loading of the pole at the left.

Middletown Saved Thousands of Dollars

ONE after another, American cities are modernizing their street electrical equipment. Following the lead of Cleveland, Detroit and other large cities, Middletown, Conn., has installed Union Metal Fluted Steel Poles in the downtown district.

Instead of separate poles for each type of service, one set of Union Metal Poles now carries the lighting and power circuits, railway feeders, trolley span wires, traffic signals, police and fire alarm wires and the street-lighting circuit.

Tall, stately poles, spaced at wide intervals, easily bear this heavy loading and offer a sharp contrast to the old method of dozens of unsightly poles to every block. The beauty of this installation has eliminated the demand for underground wires and has saved the thousands of dollars which such construction would have cost.

In many other cities the use of Union Metal equipment has reduced the number of poles along the curb line from 50 to 75 percent—has silenced the underground line agitation. We will be glad to tell you more about how this is accomplished.

THE UNION METAL MANUFACTURING CO.

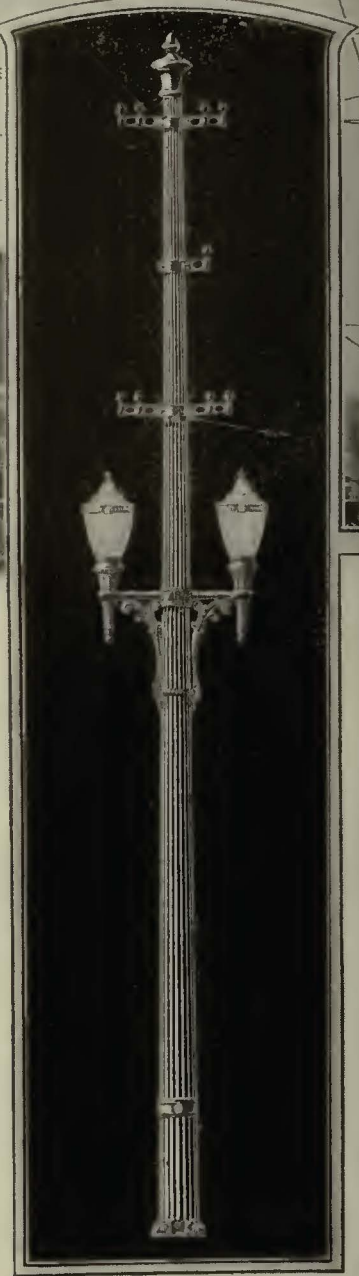
General Offices and Factory: Canton, Ohio

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Offices in all principal cities



Union Metal Design No. 4306
in heights of 30" and 32" used
in Middletown, Conn.

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DISTRIBUTION AND TRANSMISSION POLES



Rolled Steel Wheels
 Coil and Elliptic Springs
 Quenched and
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Keep your equipment
 out of the shops.
 Use parts of - - - - -

“STANDARD” STEEL

STANDARD STEEL WORKS CO.

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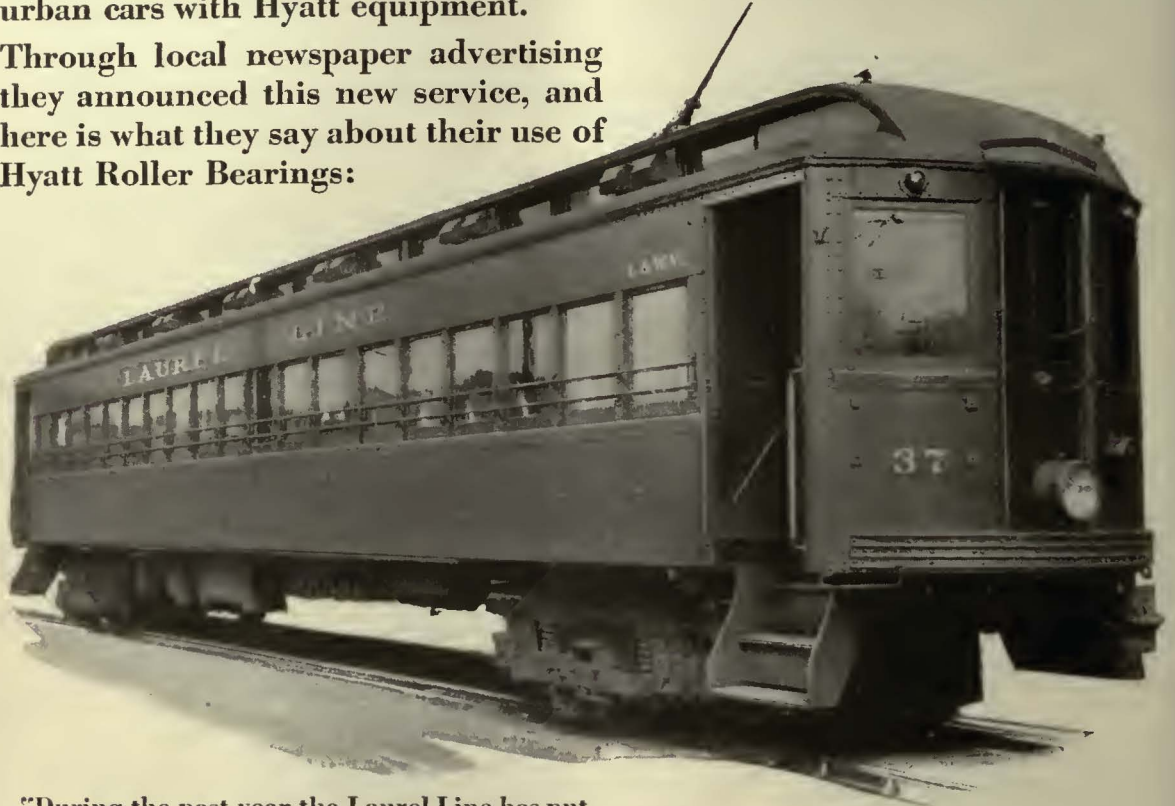
PORTLAND
 RICHMOND

PITTSBURGH
 SAN FRANCISCO
 MEXICO CITY

WORKS: BURNHAM, PA.

THE Lackawanna & Wyoming Valley Railroad, operating frequent fast electric service between Scranton, Pittston and Wilkes-Barre, Pa., recently placed in service the first of their new inter-urban cars with Hyatt equipment.

Through local newspaper advertising they announced this new service, and here is what they say about their use of Hyatt Roller Bearings:



"During the past year the Laurel Line has put into service all-steel passenger coaches, thereby discarding wooden coaches. These modern steel coaches are 64 feet long, and are being completely equipped with Hyatt Roller Bearings, which afford the maximum in comfort, smoother riding and represent the most modern and finest steel coach equipment that it is possible to buy.

Why not ride the comfortable way—the Hyattway. Ride in safety, ride with smoothness—use the Laurel Line regularly."

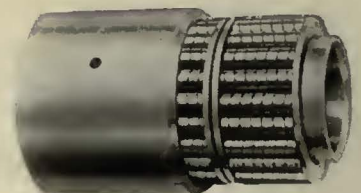
Building public good will with better riding...*provided the Hyattway*... is but one advantage of Hyattized journal boxes. Many operating economies are effected by the employment of these modern bearings, as well.

HYATT ROLLER BEARING COMPANY
Newark Detroit Chicago Pittsburgh Oakland

HYATT
ROLLER BEARINGS
PRODUCT OF GENERAL MOTORS

Hyatts on the Laurel Line

**LACKAWANNA
&
WYOMING
VALLEY
R.R.**



"Canned Experience"

Make use of the other man's experience

That old saying
 about experience being the best teacher is absolutely sound. But most of us recite it without thinking that experience may be of various sorts—the experience of other men as well as our own, "canned experience," if you please, ready for use. Why not take advantage of the experience of other men as far as we can and save not only years of time but many expensive lessons?
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Croft—
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.... Standard Handbook for Electrical Engineers, \$6.00. Nash's Economics of Public Utilities, \$4.00.

I agree to return such books as I do not wish to keep, postpaid, or to remit for them within 10 days of receipt.

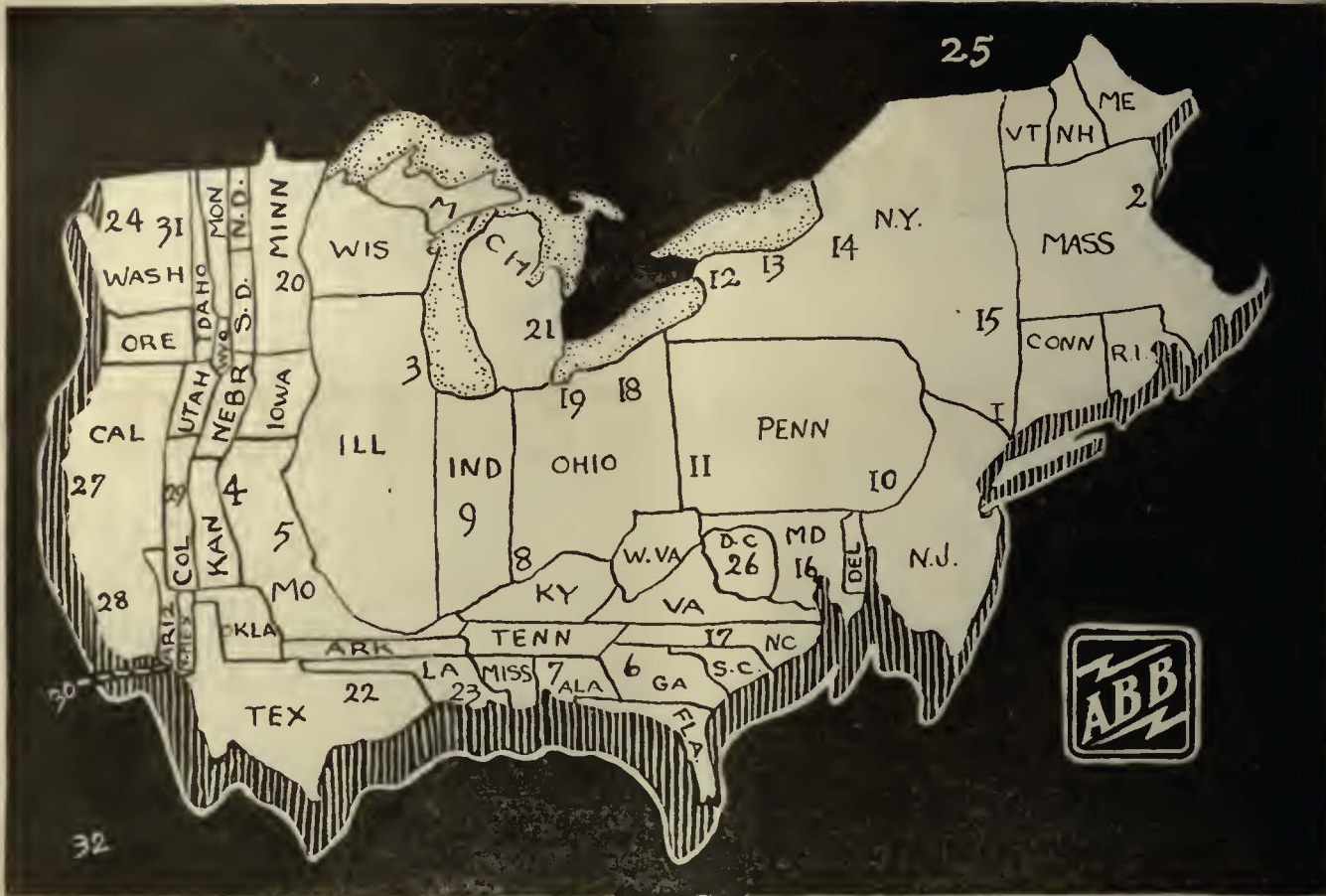
Name

Home Address

City

Position

Name of Company.....E. 3-29



THIS distorted map shows the various states as they would appear if their areas were in proportion to the number of wired dwellings. The numerals indicate the American Brown Boveri representatives listed below. Note how completely they cover the country.

- | | | |
|--|---|--|
| <p>1 American Brown Boveri Electric Corp., Grayhar Bldg., New York City.</p> <p>2 American Brown Boveri Electric Corp., 842 Summer St., Boston, Mass.</p> <p>3 Paul W. Koch & Co., 19 S. Wells St., Chicago, Ill.</p> <p>4 Henry Nixon, Mutual Bldg., Kansas City, Mo.</p> <p>5 W. L. Rose Equipment Co., Planters Bldg., St. Louis, Mo.</p> <p>6 E. A. Thornwell, Candler Bldg., Atlanta, Ga.</p> <p>7 E. A. Thornwell, 810 Brown-Marx Bldg., Birmingham, Ala.</p> <p>8 Beedle Equipment Co., Union Trust Bldg., Cincinnati, Ohio.</p> <p>9 T. H. Hays, 315 Traction Terminal Bldg., Indianapolis, Ind.</p> <p>10 Harris & Butler, Real Estate Trust Bldg., Philadelphia, Pa.</p> <p>11 E. S. Stickle Co., Union Trust Bldg., Pittsburgh, Pa.</p> | <p>12 Schiefer Electric Co., Ellicott Square, Buffalo, N. Y.</p> <p>13 Schiefer Electric Co., 89 East Avenue, Rochester, N. Y.</p> <p>14 Schiefer Electric Co., City Bank Bldg., Syracuse, N. Y.</p> <p>15 Schiefer Electric Co., City Savings Bank Bldg., Albany, N. Y.</p> <p>16 O. T. Hall, 432 North Calvert St., Baltimore, Md.</p> <p>17 Albert Milmow, 217 Latonia Bldg., Charlotte, N. C.</p> <p>18 Verne W. Shear & Co., 46 East Buchtel Ave., Akron, Ohio.</p> <p>19 Verne W. Shear & Co., 425 Bulkley Bldg., Cleveland, Ohio.</p> <p>20 Howard & Geeseka, 1008 Marquette Ave., Minneapolis, Minn.</p> <p>21 F. R. Jennings Co., 2847 Grand River Ave., Detroit, Michigan.</p> <p>22 Paul G. Bentley Co., 805 Allen Bldg., Dallas, Texas.</p> | <p>23 W. J. Keller, 203 Natchez Bldg., New Orleans, La.</p> <p>24 T. S. Wood, Polson Bldg., Seattle, Wash.</p> <p>25 Criswold & Co., Ltd., 1111 Beaver Hall Hill, Montreal, Canada.</p> <p>26 Commercial Engineering Co., 1800 E St., N.W., Washington, D. C.</p> <p>27 Utilities Equipment Corp., 1643 Russ Bldg., San Francisco, Calif.</p> <p>28 Utilities Equipment Corp., 401 Bartlett Bldg., Los Angeles, Calif.</p> <p>29 Franklin Sales Co., 1429 18th St., Denver, Colorado.</p> <p>30 J. E. Redmond, 218 Security Bldg., Phoenix, Arizona.</p> <p>31 Tinling & Powell, 27 Main Ave., Spokane, Wash.</p> <p>32 Manila Machinery & Supply Co., Manila, P. I.
American Brown Boveri Electric Corp., Main works, Camden, N. J.</p> |
|--|---|--|

AMERICAN BROWN BOYER

You Sell

Transportation -

Why not Buy

Transportation



A Motor Coach is the Work It Will



CHRYSLER MOTORS PRODUCT



DODGE MOTOR

SOLD BY DODGE BROTHERS

Only as Good as do Day after Day

*In Dodge Brothers Motor Coaches,
Dodge Dependability puts a plus
value on Safety, Speed, Power,
Quiet and fine Appearance ' ' '*

The profit possible for operators who *sell* transportation is dependent in large measure upon how they *buy* transportation.

Purchasers of Dodge Brothers Motor Coaches buy transportation wisely—can sell it profitably. These purchasers measure appearance, comfort, safety, speed, economy, dependability—all in terms of what these features contribute to the profitable work that a motor coach will do day after day.

Dodge equipment takes them closest to the ambition of every operator—to carry more passengers with more satisfaction and at lower cost.

BROTHERS COACHES

ALERS EVERYWHERE



Living for and not off the Industry....

This expression, used recently of Electric Railway Journal by a well-known electric railway executive,* expresses exactly the guiding policy of the paper during its more than 40 years of service to the Industry.

In those seven words lies the reason why Electric Railway Journal has always been received in the light of a friend and counselor. Behind them is the spirit which was responsible for the recent presentation to this paper of the first Associated Business Papers' Award established in 1927 for Outstanding Editorial Service.

Electric Railway Journal

*Mr. Walter A. Draper, President,
The Cincinnati Street Railway Company.

Last chance —to indicate your subscription choice

For your convenience, we are again outlining the new publishing plan of Electric Railway Journal. There will be 13 issues of the monthly magazine—twelve regular issues and the 13th issue which will be either a Convention Issue or Report Issue depending upon the date of the A.E.R.A. Convention itself.

Electric Railway Journal *News*, to be issued each Saturday except in those weeks in which the monthly publication appears, will supplement the monthly magazine and give to busy executives the important timely news of the industry.

Present subscribers are now offered a choice of:

1. The regular subscription price of the magazine is being reduced from four dollars to three dollars yearly. The price of the *News* will be one dollar for subscribers to the magazine, two dollars for all non-subscribers. If you wish the new monthly—*without* the *News*—your present subscription will be *extended* on a dollar-for-dollar basis.

2. If you are interested in receiving *both* the 13 large monthly issues and the 39 supplementary *News* issues, your subscription will not be extended, but will retain its present expiration date.

You have already seen two copies of the bigger and stronger monthly publication.

You have also received two complimentary copies of the *News* which were mailed to all subscribers, so that they could see for themselves what type of information it furnished. May we now have your subscription choice as outlined?

If we do not hear from you shortly, we will assume that you wish the monthly magazine only, and your subscription will be extended. But if the *News* service can also be valuable to you, please be sure to return this coupon TODAY.

Electric Railway Journal
10th Ave. at 36th St., New York, N. Y.

CHECK ONE:

I wish to receive only the new monthly. Kindly extend my present subscription.

I wish to receive *both* the monthly and the *News*. I understand that the expiration date of my subscription will remain the same.

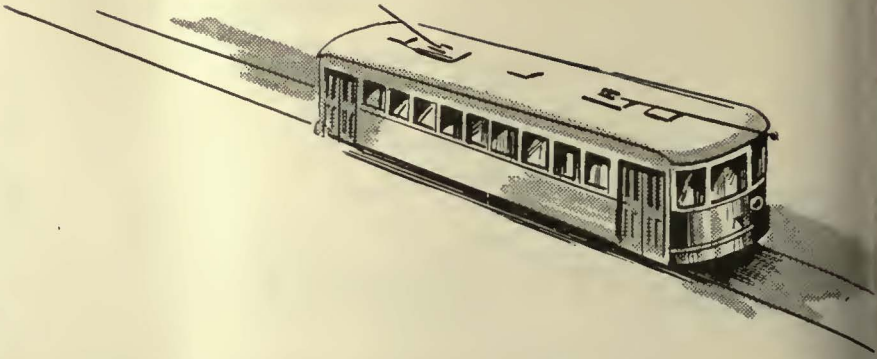
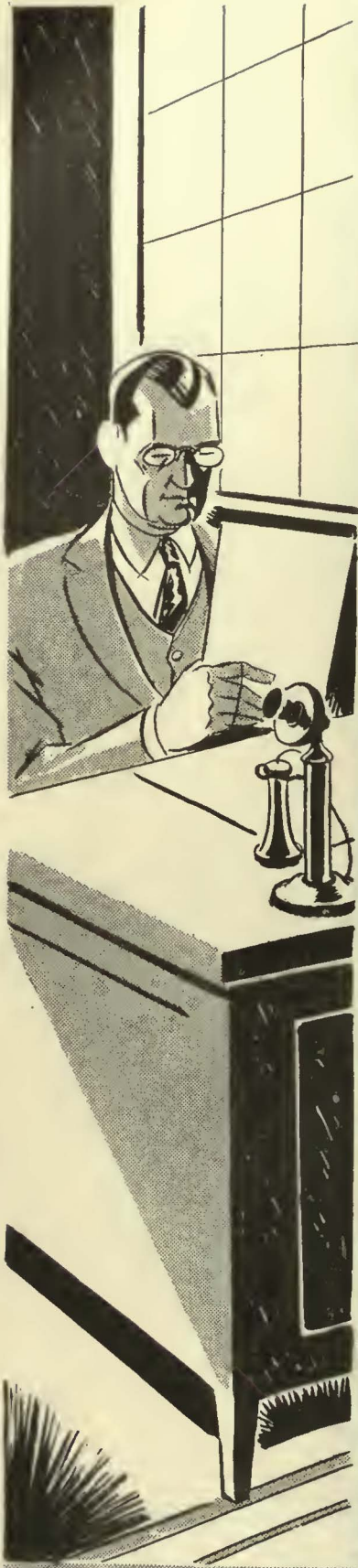
.....

NAME

ADDRESS

CITY STATE

F. E. R. J. 5-29



Brain . . .

A FEW minutes' planning and figuring may save hours of digging and patching.

Probably that is the reason so many companies are turning away from the old-fashioned method of patching rail joints to the newer method of Thermit Welding.

Thermit Welding is not just a better way of joining rails, —it is an entirely different way. For it **ELIMINATES**

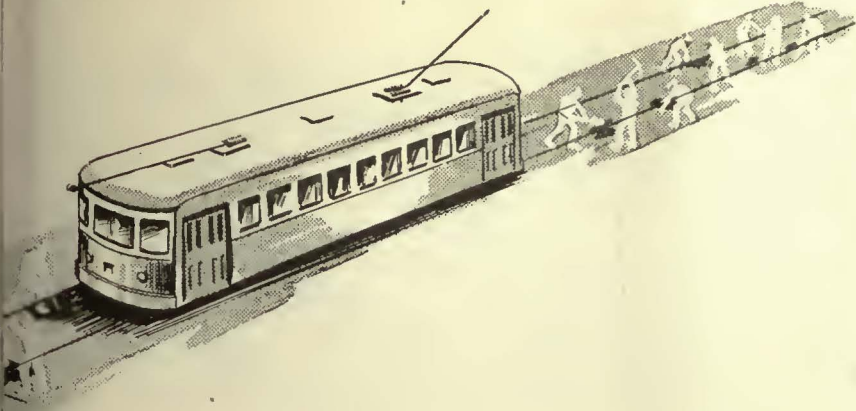


METAL & THERMIT

CHICAGO

BOSTON

120 BROADWAY



replaces Brawn

in track maintenance

THE JOINT. At the same time it eliminates the necessity of ever digging up the pavement and patching.

Consider this when you are planning your crusade against worn rail joints. An ounce of prevention is cheaper than a pound of cure.



CORPORATION
NEW YORK, N.Y. SOUTH SAN FRANCISCO



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.

Is his title backed up with real buying authority?

SALES REPORT
N E DISTRICT

Salesman... Morrison..... Date of Call... 5/18/27.....

Company...
Master Mechanic.....

Our new prospect list is woefully ~~bad~~ ~~at~~ ~~all~~ inaccurate and misleading.

There are as many brands of master mechanics as there are efficiency experts and the title doesn't mean a thing in this territory.

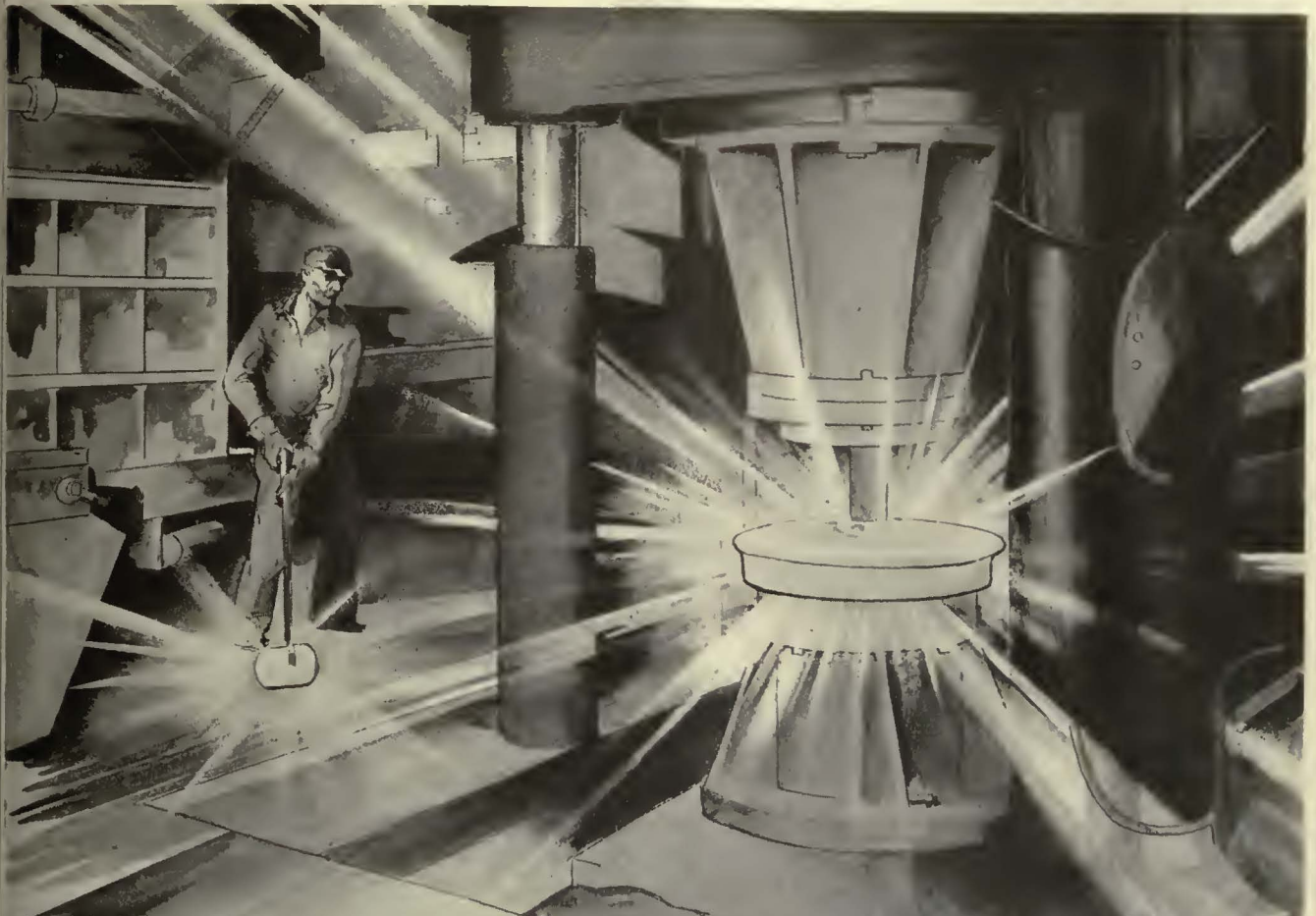
What can you expect from an industrial advertising campaign that is planned to cover a prospect list built on this basis?

THE one reliable method of running down the real buyers is to seek them by actual operating responsibilities. The important thing is not what they are called but what they do.

This principle comes out of McGraw-Hill's years of experience in circulation and editorial service throughout American Industry.

The confusion of titles in industry is discussed on pages 29 to 33 in *Industrial Marketing at Work*. A copy of this book will be delivered to executives interested in selling and advertising to industry.

—The publishers



*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

G A R Y
WROUGHT STEEL WHEELS



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.

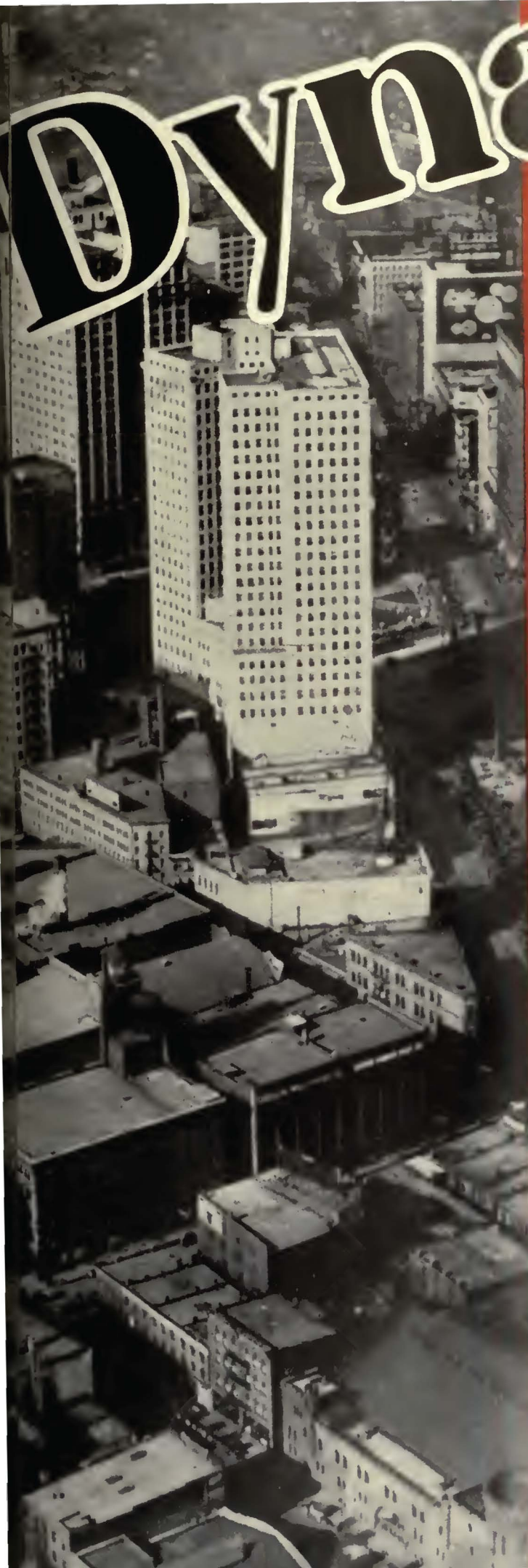
Collier Service car cards are not only a part of Electric Railway Service, but a dependable source of revenue as well.

BARRON G. COLLIER
INC.

CANDLER BLDG.—NEW YORK CITY

Car Card Advertising Almost Everywhere

DYNAMIC



DETROIT

81.85

MILES

of

TWIN

TIE

TRACK

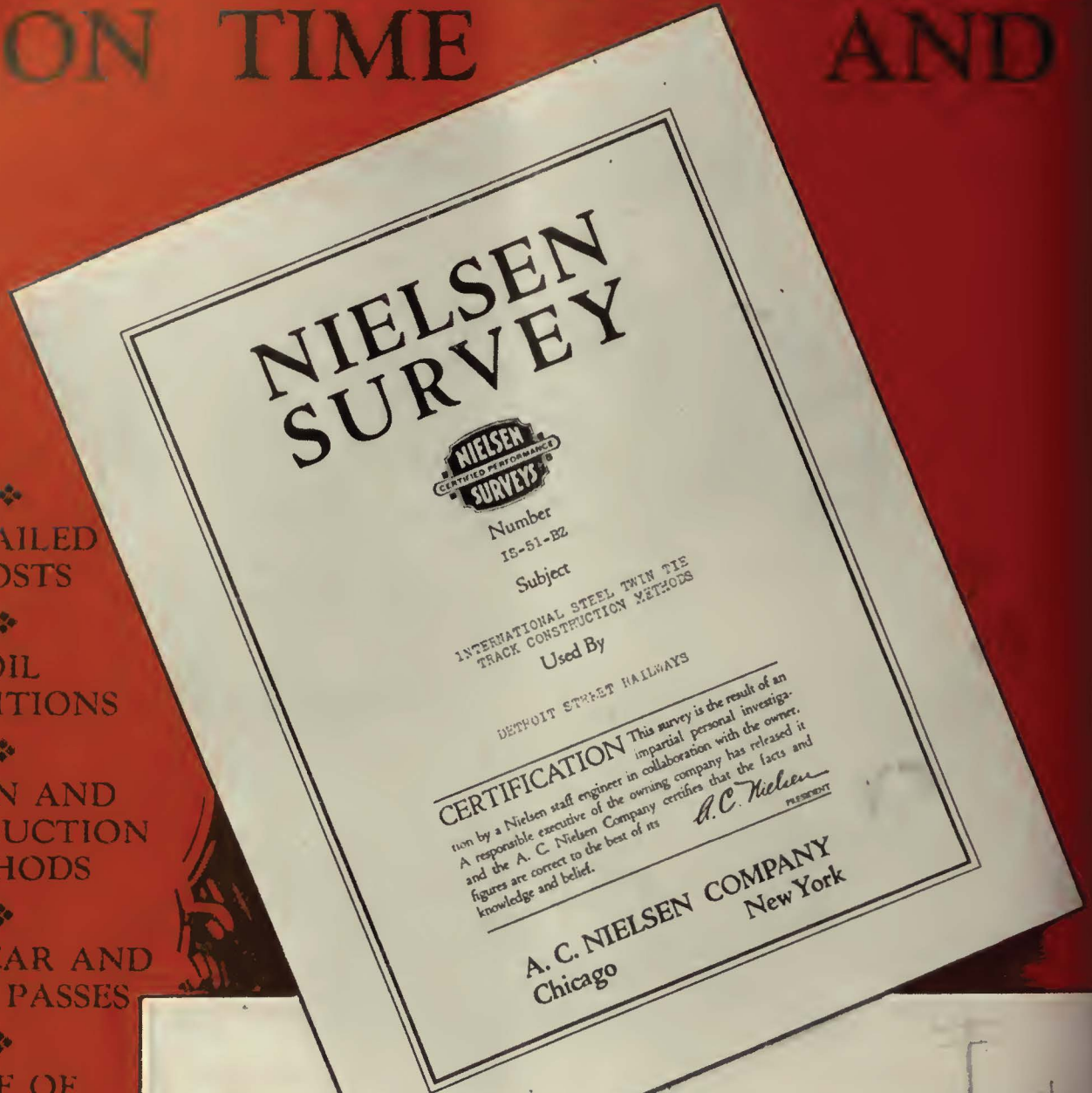
SINCE

1920

NIELSEN
KEY

turn the page

USE THE NIELSE ON TIME AND



- ❖ DETAILED COSTS
- ❖ SOIL CONDITIONS
- ❖ DESIGN AND CONSTRUCTION METHODS
- ❖ RAIL WEAR AND WHEEL PASSES
- ❖ TYPE OF JOINTS
- ❖ TYPE OF PAVEMENT



STEEL TWIN TIE TRACK

SURVEY FACTS TRAFFIC TESTED TRACK plan—

MORE PERMANENT, LOWER
COST PAVED CONSTRUCTION

Steel Twin Tie Construction adopted in Detroit in 1920.
Records show 81.85 miles of Steel Tie Track in service.

Advantages are:

Reduction in amount of excavation and concrete foundation work.

Faster progress and less delay in opening streets to traffic.

Complete elimination of sinking track caused by disintegration or washing out of sand ballast.

Water tight bond between rails and concrete pavement.

No heaving or cracking of paved surface.

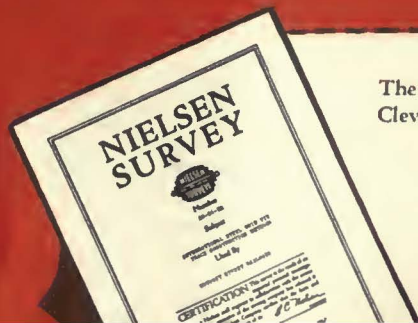
The property is satisfied that rail wear will be the determining factor in the life of the track as none of the track has even approached the end of its usefulness.

—◆—

This report is of vital interest to all Electric Railway Executives, and answers in an unbiased way all questions about Steel Twin Tie Track performance under heavy duty traffic. Five hundred copies of this report are being prepared for mailing. May we send you your copy today?

The International Steel Tie Co.
CLEVELAND, OHIO

THE BASE OF
MODERNIZATION



The International Steel Tie Co.
Cleveland, Ohio

Send us the NIELSEN DETROIT SURVEY.

Name

Title

Company



Presenting
CONSOLIDATED
CAR HEATING
EQUIPMENT—

VISIBLE THERMOSTAT — keeps nothing under cover. Insures even heating—saves current. (Shown at left.)

HEATING ELEMENTS — in various styles and sizes to meet any requirement. Open and closed coil types—motor resistor heaters. (Shown below.)

ELECTRIC CAR HEATERS — standard models designed for panel or cross seat installation—Electric Blast Heaters—Motorman's Cab Heaters—Window Sill Heaters to keep motorman's window free from frost, snow or sleet.

CONSOLIDATED CAR-HEATING COMPANY, INC.

NEW YORK

ALBANY

CHICAGO

American Steel & Wire Company ARCON RAIL BONDS

"Trade Mark Registered"



PATENTED

Arcon "A" Bond in detail and installed

A NEW principle of design is embodied in Arcon Rail Bonds. *This is the open terminal.*

The open terminal has many distinct advantages. All terminals provide for *easy* arc manipulation. The end of the copper conductor is approximately one-eighth of an inch from the rail, and located in an open space which insures per-

fect welding of the copper wires. The sloping surface of the terminal after welding is a novel and important feature in arcweld bonds.

Be convinced by a practical demonstration which we will gladly give you at your convenience.

Prices and literature mailed upon request.

AMERICAN STEEL & WIRE COMPANY

Subsidiary of United States Steel Corporation

CHICAGO.....208 S. La Salle St.
CLEVELAND.....Rockefeller Bldg.
DETROIT.....Foot of First Street
CINCINNATI.....Union Trust Bldg.
MINNEAPOLIS—ST. PAUL.....
Merchants Nat'l Bank Bldg., St. Paul

ST. LOUIS.....506 Olive Street
KANSAS CITY.....417 Grand Ave.
OKLAHOMA CITY.....First Nat'l Bank Bldg.
BIRMINGHAM...Brown-Marx Bldg.
MEMPHIS.....Union and Planters Bank Bldg.

NEW YORK.....30 Church St.
BOSTON.....Statler Bldg.
PITTSBURGH.....Frick Bldg.
PHILADELPHIA.....Widener Bldg.
ATLANTA.....101 Marietta St.
WORCESTER.....94 Grove St.

BALTIMORE.....32 S. Charles St.
BUFFALO.....670 Ellicott St.
WILKES-BARRE...Miners Bank Bldg.
DALLAS.....Presbyterian Bldg.
DENVER.....First Nat'l Bk. Bldg.
SALT LAKE CITY, Walker Bank Bldg.

UNITED STATES STEEL PRODUCTS COMPANY, San Francisco, Los Angeles, Portland, Seattle

PITTSBURGH



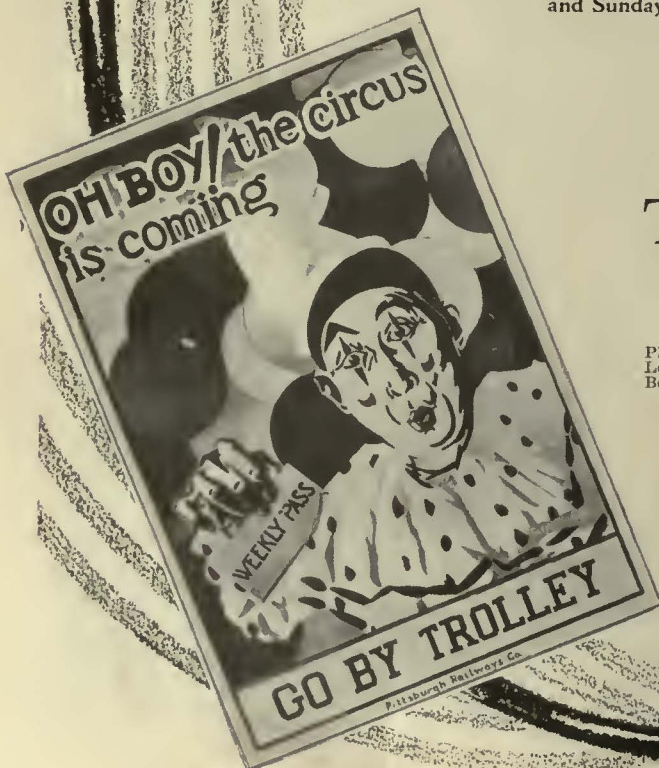
These unique posters, in attractive colors, were employed by The Pittsburgh Railways to drive home the sale of weekly and Sunday passes.

Advertises the Weekly Pass

THE Pittsburgh Railways began using weekly and Sunday passes in 1925. At that time we helped them select a type of pass best adapted to the problems of that city. The years following have shown a great rise in popularity for this form of fare collection. Pittsburgh is advertising the passes because they realize the advantages to the operating company. They are:

- Cash in advance.
- Elimination of change-making during rush hours.
- Control of fare at one source.
- Greater number of passengers carried due to attractive rate.

Globe experience should be of great value to you in adopting and initiating a pass system. Let us acquaint you with our service in all types of paper fares.



GLOBE TICKET COMPANY PHILADELPHIA

Factories
Philadelphia
Los Angeles
Boston

New York
Jacksonville

Syracuse
Baltimore
Cincinnati

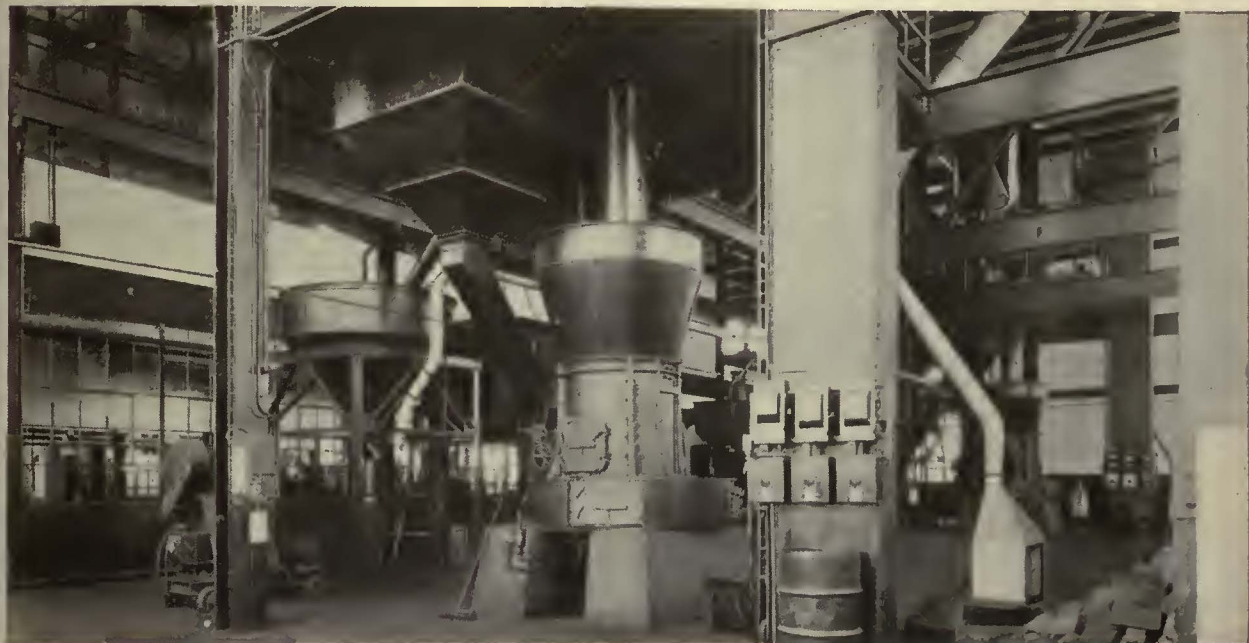
Sales Offices
Cleveland
Pittsburgh
Springfield, Mass.



◆◆ BEHIND THE PYRAMIDS—5 ◆◆



It takes more than CARBON to make a brush



Part of crushing and milling equipment

OUT of the fiery furnace come hard blocks of practically pure carbon, but these are not brushes and useful brushes could not be sawed out of them.

The blocks are crushed into small bits in a powerful machine. Another machine grinds the carbon into fine flour. The laboratory, as usual, tests each step. The flour, for instance, must meet rigid tests for electrical resistance and fineness.

Not only is this flour tested, but, to insure uniformity of the product, the output from several mills is mixed and blended after it has been passed by the laboratory.

Thus once more a basic form of carbon is

produced in a very pure, exactly uniform, scientifically controlled state.

This is but one example of the thorough control we exercise over the smallest detail of manufacture. This control is your assurance and ours, too, that any given grade of National Pyramid Brushes will always be the same, for by exactly duplicating the conditions of manufacture we duplicate the grade. Standard performance thereby is assured. The NCC brushes that are giving you such perfect service today can be replaced with precisely similar ones at any time in the future. The Data Sheet System makes shipments speedy and accurate.

An interesting moving picture film illustrating in detail the processes used in the manufacture of carbon brushes will gladly be shown on request to any organization of engineers or students.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide **UCC** and Carbon Corporation

Carbon Sales
Division



Cleveland, Ohio

Branch Offices and Factories

Jersey City Pittsburgh Chicago Birmingham San Francisco



One of the cars to which Simplex
Clasp Brakes have been applied

SIMPLEX MULTIPLE UNIT CLASP BRAKES

Railroads would not purchase passenger cars without "Simplex Clasp Brakes."



Why not specify "Simplex Multiple Unit Motor and Trailer Truck Clasp Brakes" for Gas — Electric and Electric Cars.

Send us your inquiries for information and designs.

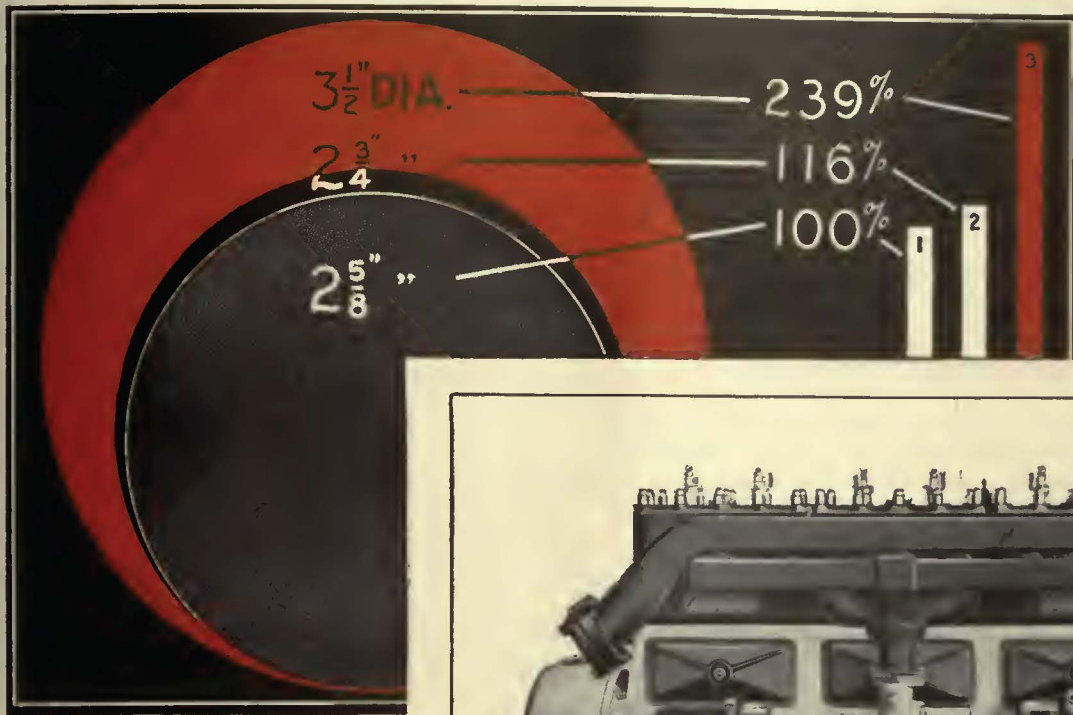
The mechanically correct Brake for a Modern Car.

AMERICAN STEEL FOUNDRIES

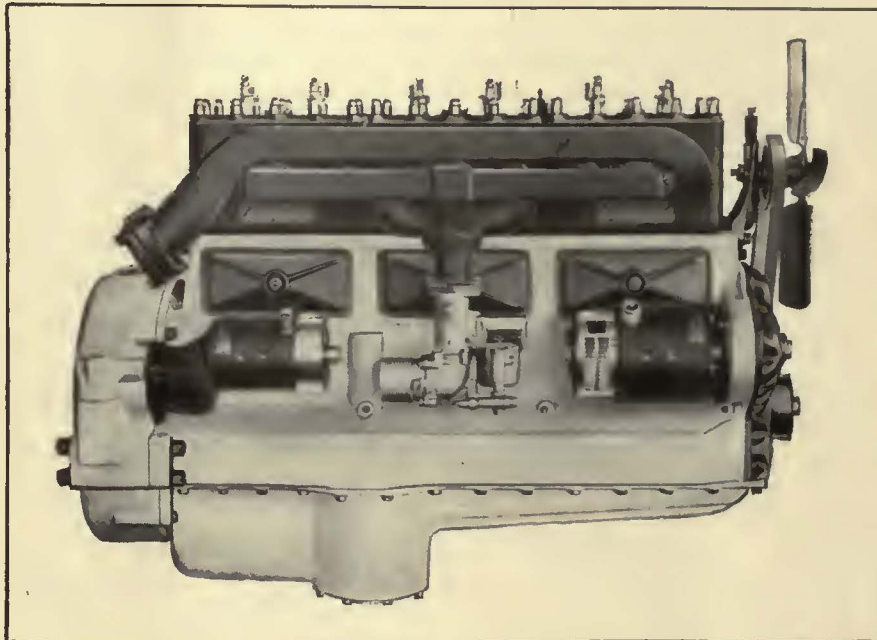
NEW YORK

CHICAGO

ST. LOUIS

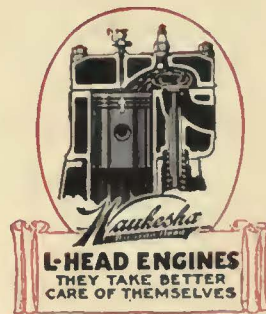


The above diagram shows crankshaft sizes of three well known big six engines, with diameters of 2 3/8-in. and 2 3/4-in.—and Waukesha's crankshaft, 3 1/2-in. White lines show their relative stiffness. If shaft No. 1 is considered 100% satisfactory, then shaft No. 2 has an excess strength of 16% and the Waukesha shaft No. 3 has 139% excess strength.



the crankshaft *that never fails*

---huge and thick-cheeked---of chrome nickel steel, heat treated---supported on four arch trussed bearings---Waukesha's 3 1/2-inch crankshaft guarantees positive dependability under even the severest service requirements. Never has this Waukesha crankshaft been known to fail. Thousands of miles without a bearing adjustment is not exceptional---it's a fixed habit with Waukesha. That's only ONE REASON why the most modern motor coaches are powered with Waukesha RICARDO HEAD Long Life Engines. Write Automotive Equipment Division for Bulletin No. 710.



Cuts operating costs!

Even before you've charged a single battery on your Rectigon it has helped to lay the foundations for greater battery charging economy for you. The first cost of the Rectigon is low. The installation cost is low. No special provisions for its installation are required and one man can have it ready to operate in less than an hour.

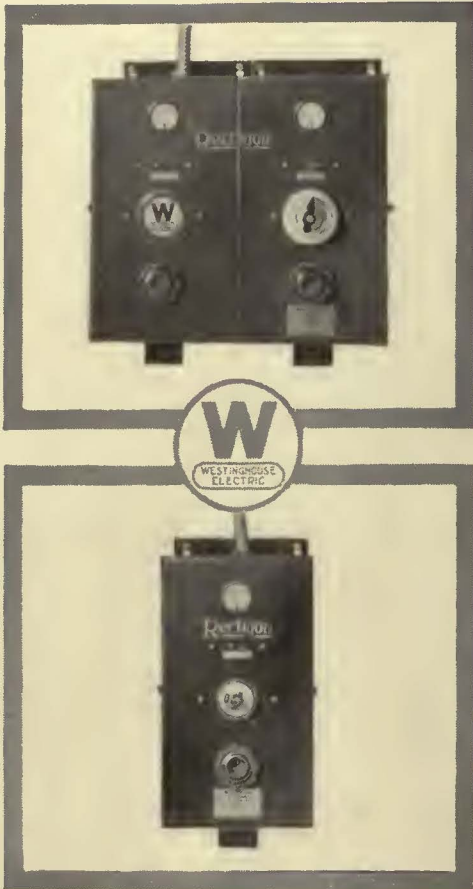
Installed and operating, the Rectigon continues to pile up a record for low operating costs. Its efficiency — higher than in any other type of charging equipment — means that more of the power you pay for reaches the battery. You profit there. Long and uniform bulb life, nothing to wear out or deteriorate, no special maintenance cost — these factors are a further help in keeping operating costs low and battery charging efficiency high.

You will be interested in the booklet, "More Power to the Battery." Write for a copy.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
Merchandising Department East Pittsburgh, Pa.

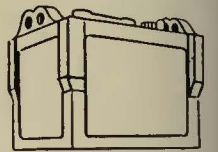
Westinghouse

Use only genuine Westinghouse Bulbs for replacements



Rectigons are made in two sizes, 15 and 30 battery capacity, at \$75 net and \$135 net, respectively.

... each battery



charged with this rectigon



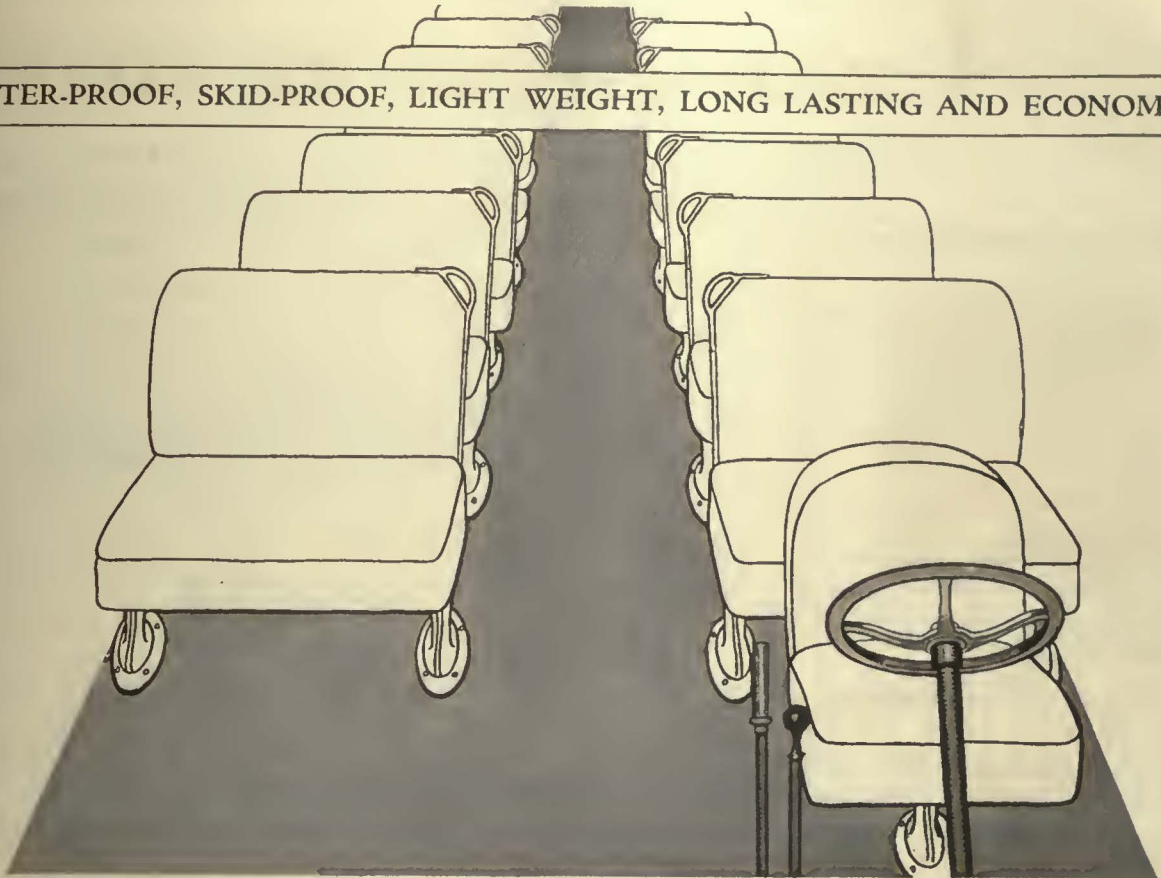
and this bulb



gives you

a lower charging cost

WATER-PROOF, SKID-PROOF, LIGHT WEIGHT, LONG LASTING AND ECONOMICAL



Keep your Bus Floors *always* New at *minimum* cost with J-M MASTICOKE

J-M MASTICOKE provides a floor which will last the life of your busses at *one low cost*. Its tough, resilient composition is made to withstand the wear of millions of footsteps. The vibration of thousands of miles of travel will not crack it. J-M Masticoke will eliminate floor repairs from your maintenance bills.

This modern bus flooring will also add materially to the appearance of your busses. It is furnished in dark gray and six attractive colors to harmonize with interior finish. It never grows shabby—its good appearance will help keep your busses always looking spic and span.

Skid-proof—Water-proof

Passengers will not slip on Masticoke Flooring. Whether new or old, its anti-skid tread is effective

in any weather. J-M Masticoke is thoroughly water-proof, is unaffected by acids, and gives complete protection to the floor structure it covers.

J-M Masticoke is easily cleaned by simply flushing with water. It dries quickly and is odorless. It will not retain dust, dirt or germs. It is fire-retardent and also acts as a valuable insulation against the cold.

Tested Service

J-M Masticoke Flooring has long given satisfactory service on busses as well as railroad coaches and Pullman cars. More and more bus fleet owners are using this flooring to reduce costs. Johns-Manville service to busses includes insulation for side walls and roofs, clutch facings, packings, brake blocks, and lining. Return the coupon below and get the full particulars on this modern economical flooring.



Johns-Manville

SERVICE TO
BUS TRANSPORTATION

JOHNS-MANVILLE CORPORATION
Electric Railway & Motor Bus Division
New York Chicago Cleveland San Francisco Toronto
(Branches in all large cities)
Please send me full particulars on J-M Masticoke Bus Flooring.

Name.....
Address.....

SB-115-5

In These Days of Traveled Highways

With automobiles, trucks, buses speeding along the Nation's highways, the necessity of avoiding crossing accidents becomes acute.

Protect *your* crossings and passengers with Nachod Highway Crossing Signals. They warn two ways—by bell and flashing lights. They greatly reduce the liability of costly law suits with their attendant loss of prestige and good will.

The red flashing projectors give a brilliant and arrestive indication. They are actuated entirely from the trolley power and at the highest car speeds. The separate motorman's pilot tells him the signal is working when he passes the starting contactor.

Write us for quotation, specifying whether lights and bell, or lights only are desired; whether for a single or double track crossing and give sketch if there are any switches in the protected zone. Yellow caution lights near base may be omitted if desired. All *four* projectors may be mounted on *one* standard.



Nachod Highway Crossing Signal with flashing red lights and bell. An installation with two standards on the Galveston-Houston Interurban Railway.

N-A-C-H-O-D Spells Safety Nachod and United States Signal Co., Inc., Louisville, Ky.

We Also Manufacture

Turn-right Signals, Single Track Permissive and Absolute Signals, Stub End Signals, Rear Protection Signals, Annunciator Signals, Headway Recorders.

—for Zone Fare Collections



THE COIN
AUTOMATICALLY AND
VISIBLY RECORDS THE FARE
ON BOTH THE FARE BOX AND
REGISTER



The New Three coin fare box

Zone fare collections are exceedingly simplified with the new Johnson Three Coin Electric Fare Box.

Nickels, dimes, and quarters are all deposited in the same slot and recorded on the same register.

In Johnson Electric Fare Systems the coin does the work—automatically and visibly, registering the amount paid. Electric fare registers also fit in with the Modern DeLuxe car interiors. Concealed wiring, attractive fare boxes and registers, plus the fact that they give you greater speed and accuracy should make them your choice on new or old equipment.

Johnson Fare Box Company

CHICAGO
4619 Ravenswood Ave.

NEW YORK
2 West 61st St.

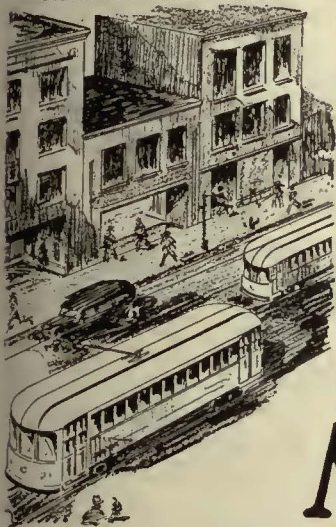
Over 6,000 Type J Electric
Fare Boxes have been placed
in service in the last 4 years.



Standardize on these products because of their economy



MORE-JONES
Armature Babbitt Metal



MORE-JONES Quality Products are highly economical from the standpoint of first and last cost as also from every angle of service efficiency. Fifty-five years of service in the railway field has enabled us to fully meet your requirements. Take advantage of our experience and the unexcelled and uniform quality of MORE-JONES products.

National Bearing Metals

Jersey City, N. J.
Portsmouth, Va.

Corporation
St. Louis, Mo.
New York, N. Y.

Pittsburgh, Pa.
Meadville, Pa.



MORE-JONES
Trolley Wheels and Harps



"Tiger" Bronze
Axle and Armature
Bearings

MORE-JONES QUALITY PRODUCTS

ALL types of City and Interurban cars of latest design and Modern construction are built by—

CUMMINGS CAR AND COACH CO.

Successors to McGuire-Cummings Mfg. Co.

111 W. Monroe St.
Chicago, Ill.



PORTER'S

NUT SPLITTERS—CHAIN CUTTERS BOLT CLIPPERS—SHEAR CUTTERS

A Porter Nut Splitter will remove a battered, frozen or rusted nut from a bolt with less labor, without "jamming" the bolt threads and in less time than it takes to prepare a monkey wrench for the work.

Porter's Nut Splitters come in two types and several sizes. The type pictured above operates with the handles parallel to the bolt. Another type cuts with handles at right angles to the bolt. Both are portable and may be used in any position and in spaces otherwise difficult to work.

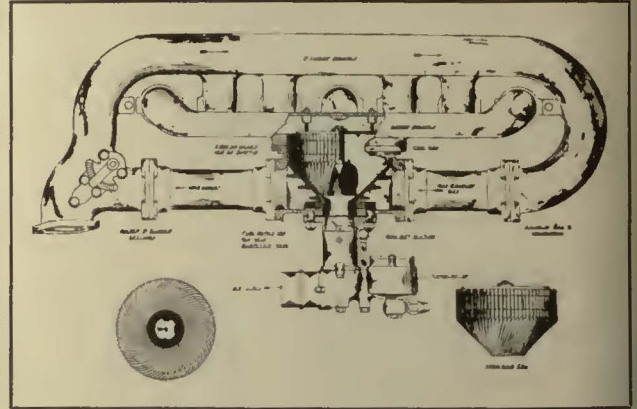
*Write for illustrated folder on Porter's Tools—
Nut Splitters, Chain Cutters, Bolt Clippers
and Shear Cutters*

H.K. Porter, Inc. 24 Ashland St., Everett, Mass.

Porter's Tools cover a wide range of uses in all types of industry. On Construction work, in factories and shops they save time, save labor and are extremely efficient. They are portable—operate anywhere and in any position.



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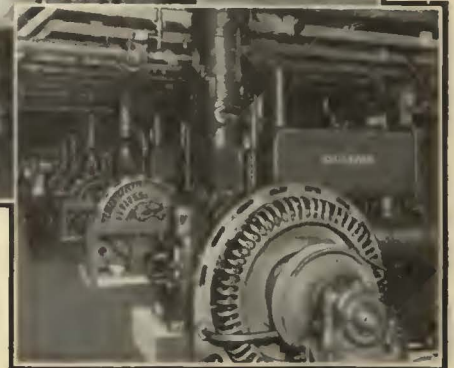
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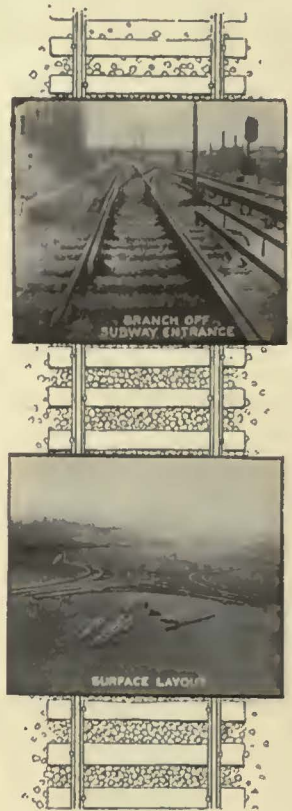
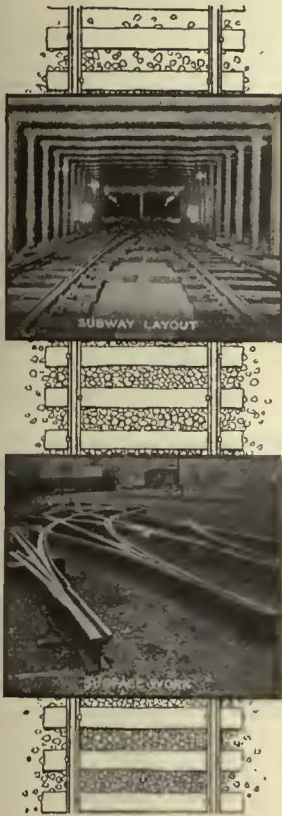
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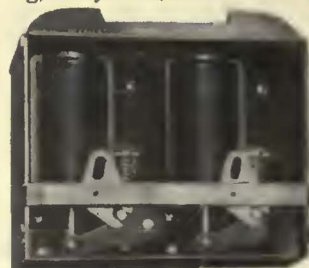
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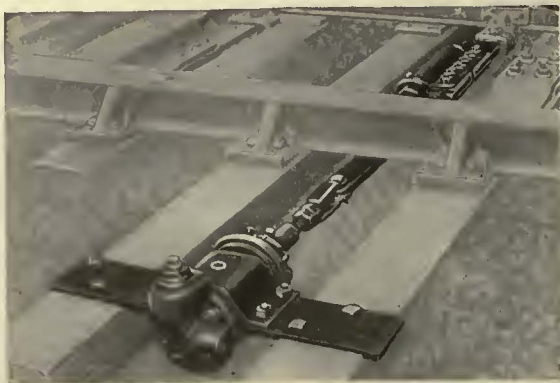
These are called grounding clamps, but you can use them on the wire for welding, grinders and other track work.

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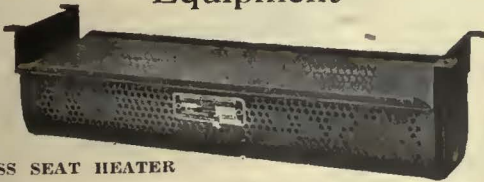
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Interrupting capacities and factors of safety beyond what has hitherto been available.

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Just off the press.

Watch subsequent issues of the Electric Railway Journal for additional data on ROLLER-SMITH Oil Switches and Circuit Breakers.

ROLLER-SMITH COMPANY

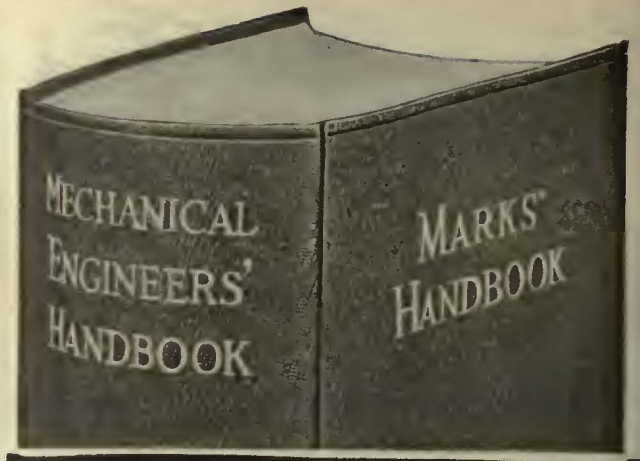
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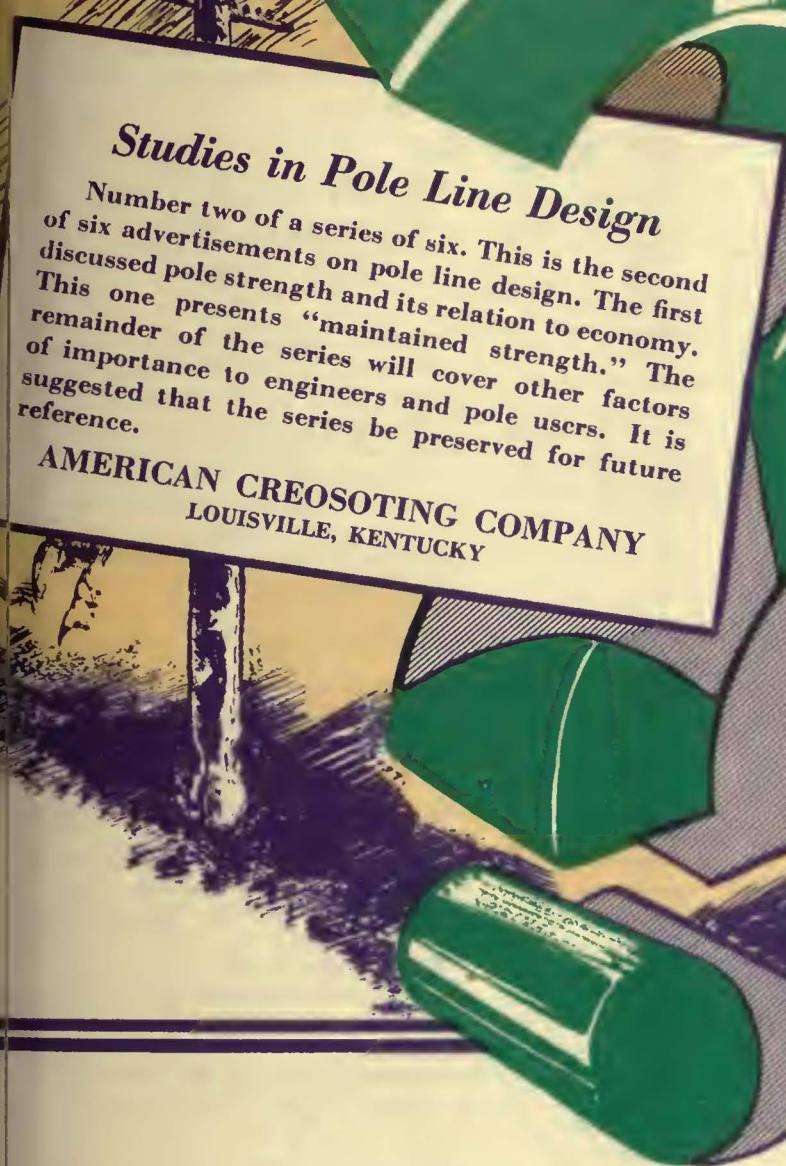
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WHEN DO POLES BREAK



Studies in Pole Line Design

Number two of a series of six. This is the second of six advertisements on pole line design. The first discussed pole strength and its relation to economy. This one presents "maintained strength." The remainder of the series will cover other factors of importance to engineers and pole users. It is suggested that the series be preserved for future reference.

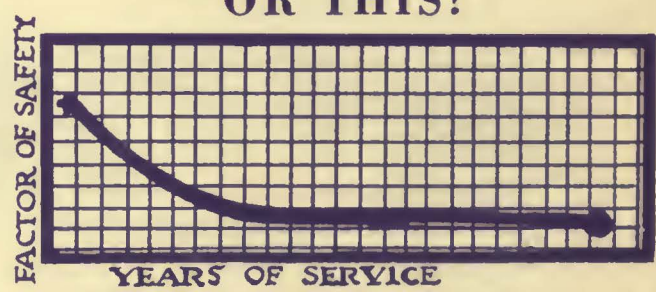
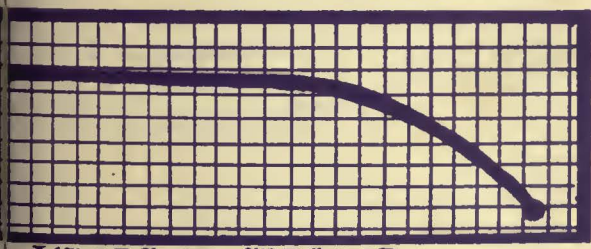
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CAUTION
THIS POLE IS
DUE TO BREAK
NEXT MONTH

Is the Age-Strength Curve

LIKE THIS

OR THIS?



YEARS OF SERVICE

YEARS OF SERVICE

Rate of Deterioration in Wood Poles is a Vital Factor in Pole Line Economics

When Do Poles Break?

The simple analysis in the first study of this series showed that a pole breaks when its moment of resistance is less than the combined moments of bending or, in other words, when its factor of safety is less than one. Assuming no change in loading, the maximum bending moment is fixed throughout the life of the pole. If the new pole was properly selected, its moment of resistance exceeded this maximum bending moment by a safe margin. Failure will only occur, therefore, when the moment of resistance has decreased to less than the bending moment—or, in other words, when the strength of the pole has deteriorated.

Why Do Poles Lose Strength?

Like all other structural materials, wood poles are subject to deteriorating influences as time goes on. Decay is usually the agency which eventually reduces the strength of wood poles to the point of failure. Decay is a breaking down of the cell structure caused by fungus growth. This growth is slow or rapid, depending on various factors such as the character of the wood, presence of moisture, contact with the earth and the protective measures adopted.

How to Control Rate of Deterioration

Of the factors which effect deterioration in poles, the climatic and soil conditions are fixed by the location of the line. The only way to control this deterioration, therefore, is either to select wood which does not

decay readily or to use protective means to insure the same result. Wood naturally resistant to decay is practically out of the market for pole use. The only choice, therefore, is between a rapidly decaying untreated pole or one that is protected by impregnation so that decay does not affect it appreciably for long periods.

Effect of Treatment on Pole Strength

As pointed out in the previous study, southern yellow pine is the strongest species of wood available for poles. Its structure is also more adaptable for preservative treatment than any other wood used for structural purposes. This treatment does not impair the natural strength of pine as demonstrated in tests conducted by the Forest Products Laboratory, the Engineering Experiment Station at the University of Illinois and the Atchison, Topeka and Santa Fe Railway. The strength of treated poles is usually more uniform than that of untreated.

Effect of Deterioration Rate on Factor of Safety

In selecting poles to give maximum economy, it is necessary to use a factor of safety large enough to insure against untimely failure but not so large as to add excessive cost to the line. Engineers are coming to realize that comparable estimates of untreated and treated poles can only be made when a factor of safety is selected to correspond with the rate of deterioration of each pole. The pole that loses strength rapidly should have a higher factor of safety at the beginning than one which maintains its strength for a long period. It is

not enough to assume a longer life for the untreated pole. Adequate treatment not only insures a greater total length of service, but also provides a higher factor of safety against failure throughout the entire life of the pole. For comparable results, therefore, an untreated pole must have a higher factor of safety when new than a treated one. This obviously means the use of larger untreated poles than the strength when new would indicate and gives treated poles a still further advantage in a careful economic study.

Do Treated Poles Maintain Their Strength?

The above discussion assumes that preservative treatment results in maintaining the original strength of a pole throughout its life. The engineer or pole user who has not had opportunity to test this fact in his own experience is obliged to depend on the evidence available from other users and from impartial agencies which have conducted tests on poles after many years of service. There is ample evidence that creosoted southern yellow pine poles 20, 30 and even 40 years old do have practically the same strength as new. Typical among such tests are the following:

Ten Creosoted Southern Yellow Pine Timbers, after service of 29 years, tested at Tulane University in 1912 showed the modulus of rupture varying from 3350 to 7890 lbs. per square inch. Similar tests on timbers 34 years old at Lehigh University showed a range in the modulus of rupture from 4300 to 6700 lbs. per square inch. Engineers who have studied these and numerous other similar tests are convinced that as long as the creosoting is effective in preventing decay, the strength of the pole is practically constant.

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.

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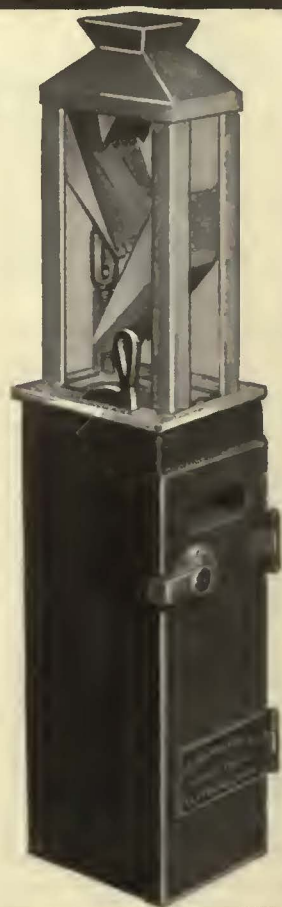
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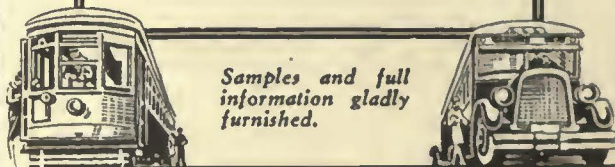
—the car curtain and upholstery material that pays back its cost by many added years of service. Since 1897 there has been no substitute for Pantasote.

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R.J.

POSITION VACANT

WANTED master mechanic, Western short line interurban A.C. operation; state complete experience and salary expected. Address P-175, Electric Railway Journal, 883 Mission St., San Francisco, Calif.

POSITIONS WANTED

EXECUTIVE ENGINEER, in the best years of my life; 10 years' electric railway experience on large properties, also familiar with bus maintenance, now employed, but desire to make change for personal reasons. PW-174, Electric Railway Journal, 883 Mission Street, San Francisco, Calif.

EQUIPMENT superintendent, seven years' experience as superintendent of equipment with large operating company; seeking similar position with operating company or connection with railway supply company. Thoroughly familiar with street railway problems both from engineering and operating standpoint. Member American Society of Mechanical Engineers. PW-171 Electric Railway Journal, 7 So. Dearborn St., Chicago, Ill.

STREET railway man—32, college graduate, qualified by 10 years' experience on outstanding system operating modern cars and buses, open for connection affording opportunity of advancement. Familiar all phases transportation and equipped to act in position of executive nature. Best health, will go anywhere and available short notice. PW-173, Electric Railway Journal, Tenth Ave. at 36th St., New York.

STUDENT graduating from engineering school this year would like a position in electric railway business. PW-172, Electrical Railway Journal, Tenth Ave. at 36th St., New York.

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Electric Railway Journal, published weekly at New York, N. Y., for April 1, 1929.

State of New York }
 County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared C. H. Thompson, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Electric Railway Journal and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., Tenth Ave. & 36th St., N. Y. C. Editor, Charles Gordon, Tenth Ave. & 36th St., N. Y. C. Managing Editor, John A. Miller, Jr., Tenth Ave. & 36th St., N. Y. C. Business Manager, Louis F. Stoll, Tenth Ave. & 36th St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as

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those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 10th Ave. & 36th St., N. Y. C., Stockholders of which are: James H. McGraw, 10th Ave. & 36th St., N. Y. C. James H. McGraw, Jr., 10th Ave. & 36th St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Malcolm Muir, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, 10th Ave. & 36th St., N. Y. C. Curtis W. McGraw, 10th Ave. & 36th St., N. Y. C. Donald C. McGraw, 10th Ave. & 36th St., N. Y. C. Harold W. McGraw, 10th Ave. & 36th St., N. Y. C. Joseph H. Bragdon, 10th Ave. & 36th St., N. Y. C. Anne Hugus Britton, 10th Ave. & 36th St., N. Y. C. Mason Britton, 10th Ave. & 36th St., N. Y. C. Edgar Kobak, 10th Ave. & 36th St., N. Y. C. Grace W. Mehren, 2440 Lake View Ave., Chicago, Ill. J. Malcolm Muir & Guaranty Trust Co. of New York, 140 Broadway, N. Y. C., Trustees for: Lida Kelly Muir, F. S. Weatherly, 271 Clinton Road, Brookline, Mass. Edwin S. Wiseley, 10th Ave. & 36th St., N. Y. C. Goldman, Sachs & Co., 30 Pine St., N. Y. C., a Partnership, Partners of which are: Waddill Catchings, 30 Pine Street, N. Y. C. Arthur Sachs, 30 Pine Street, N. Y. C. Walter E. Sachs, 30 Pine Street, N. Y. C. Howard J. Sachs, 30 Pine Street, N. Y. C. Sidney J. Weinberg, 30 Pine Street, N. Y. C. Henry S. Bowers, 30 Pine Street, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder

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appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only).

McGRAW-HILL PUBLISHING COMPANY, INC. C. H. THOMPSON, Secretary.

Sworn to and subscribed before me this 29th day of March, 1929.

[Seal.] H. E. BEIRNE, Notary Public N. Y. Co. Clks No. 97, Reg. No. 1B84. Kings Co. Clks No. 646, Reg. No. 1089. (My Commission expires March 30, 1931.)

WANTED TO BUY

CARS

Some Used One-Man Light-Weight Safety Cars.

W-170, Electric Railway Journal 7 So. Dearborn St., Chicago, Ill.

WANTED

ELECTRIC RAILWAYS AND EQUIPMENT

Electric Railways, Overhead Trackage and Equipment. Highest cash prices paid. Expert satisfactory work guaranteed.

Among the other work just completed we have recently dismantled the entire trackless trolley line of Staten Island, New York and over 200 miles of overhead and some trackage of the Worcester Consolidated and Springfield Street Railway abandoned Suburban lines.

THE ALLITE CORPORATION

636-638 Broadway, New York, N. Y.

WANTED

5000

MOTORS

We are in the market for 5,000 G. E.
motors of the following types:

G. E. Nos. 57, 58, 80, 87,
67, 49 and 1000.

How many of these have you for sale?

The prices we will pay for these
motors are good.

If you have any to sell, communicate
with us at once.

L. Schiavone & Bonomo Bros. Inc.
Jersey City, New Jersey

FOR SALE

78 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

THESE "Searchlight" ads show the intimate contact of this advertising with the entire transportation industry:

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Executive—

Exceptional men always available.

Designing—

Automotive engineers, body designing and production.

Operating—

Garage foremen, equipment superintendents.

Equipment

Wanted—

Buses wanted by many companies.

For Sale—

Offerings of used buses by manufacturers, manufacturers representatives and operators.

Business Opportunity

Bus lines for sale everywhere

YOU

- may have the employment or equipment that is wanted.
 - may have similar or other wants to fill.
 - may be interested in the Business Opportunities advertised.
 - may be interested in the Used Buses advertised.
 - will find similar advertising a big help in filling your own wants.
- Make a point of checking these pages every month!

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.

Do You Need Good Used Equipment?

BIRNEY CARS

All types motor equipment in excellent condition. We also have modern light weight double truck steel cars, both city and interurban types. Write for details.

POWER HOUSE EQUIPMENT

Power house equipment both 25 and 60 cycles. Fine offerings of Rotary Converters and generator sets.

FARE BOXES
All Types
also
Shop Equipment

*"Our integrity
is
your guarantee."*

MOTORS

Exceptional offerings in modern motors—308CV4, G247, 264, 258 and 101B. Also large assortment of older type motors in stock.

ELECTRIC LOCOMOTIVES SNOW FIGHTING EQUIPMENT

Let us tell you about our bus offerings. City and interurban types.

BUSES

Air compressors, controllers and parts.

Heavy Lathe

36 in. x 16 ft. I. H. Johnson extra heavy duty lathe. Ideal for turning car wheels. Triple geared. Has direct motor drive including motor.

Ask for our Catalog

Miles Machinery Co.

Saginaw W. S., Mich.

FOR SALE

- 12—G. E. 258c Motors.
- 4—G. E. 202 Motors.
- All in Excellent Condition.
- 4—12 v. Johnson Electric Fare Boxes Registering Dimes only, with Registers.
- 5—12 v. Johnson Electric Fare Boxes Registering Dimes and Nickels, with Registers.

J. W. GERKE

303 Fifth Ave., New York, N. Y.

FOR SALE

- 2800—273/125 Sec. 0-in. Rail Brace Tie Plates
- 2884—103/287 Sec. 7-in. Rail Brace Tie Plates

WORCESTER CONSOLIDATED ST. RY. CO.
Purchasing Department
2257 Main Street, Springfield, Mass.

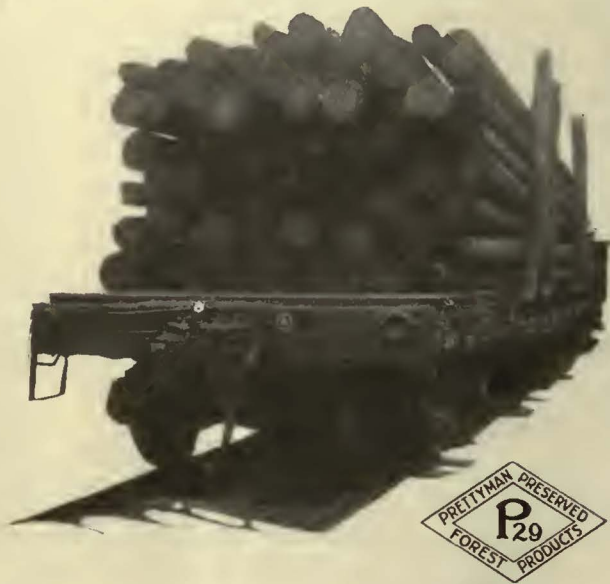
G. T. ABEL

393 Seventh Ave., New York City, N. Y.

"Sole Distributors for SIMPLEX SAFETY DEVICES"

Watch the
SEARCHLIGHT SECTION
for Equipment-Opportunities

And now . . . even better pole service



To improve our service to pole customers, we have collected a standard surplus stock of 10,000 straight, sound Southern Yellow Pine poles in a variety of sizes and lengths.

We have your size, already air-seasoned . . . ready for framing and pressure creosote treatment to your specifications upon receipt of your order.

Your emergency requirements or your periodical purchases will be handled with a speed and precision you did not believe possible.

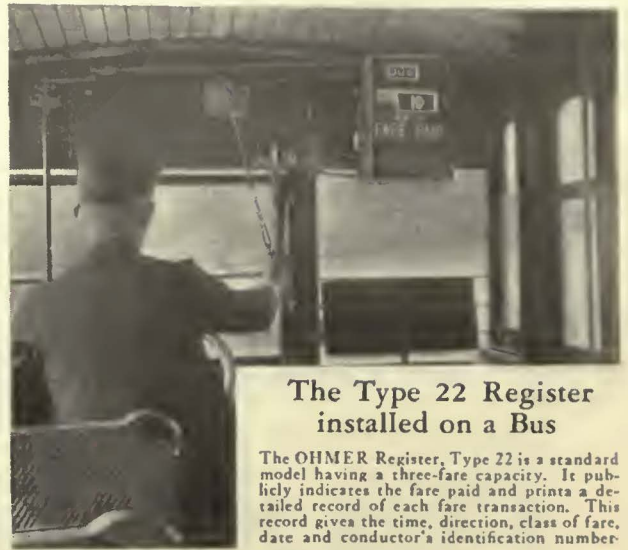
J.F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

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The Type 22 Register installed on a Bus

The OHMER Register, Type 22 is a standard model having a three-fare capacity. It publicly indicates the fare paid and prints a detailed record of each fare transaction. This record gives the time, direction, class of fare, date and conductor's identification number.

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The OHMER Register, Type 22, though a pioneer in the field, is still a standard model. On buses, electric railways, toll bridges and ferry boats it accounts for each cash transaction. It gives positive profit control... prevents losses from carelessness, indifference and temptation... saves time, money and labor. It speeds up your service and enables you to take care of more passengers.

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Dayton, Ohio, U. S. A.

OHRMER
REG. U.S. PAT. OFF.
Fare Registers

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Note the spacious inside luggage rack, which can be secured at a small additional cost.



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Like other Bender creations, this semi-luxe coach is a business builder—it makes first time riders want to ride again. It gives comfort to passengers and long, dependable service to operators.

Although of striking appearance and equipped to please particular operators, it is offered at a price easily within reach of practically every operator.

Of the pay-enter type, it has one door for passengers on the right front and emergency door at left rear. Seats 33 passengers in stationary seats. Can carry seven folding aisle chairs with one seat alongside driver, making a total seating capacity of 41. Plenty of inside aisle space for standees.

Here's comfort, convenience, a touch of luxury at a moderate price. A popular coach of a type that many operators are finding highly profitable.

We shall be glad to tell you more about it.

THE BENDER BODY CO.
W. 62nd and Denison, Cleveland, Ohio



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In introducing the first single-end, eight-wheel MASTER UNIT Car in the United States, the Louisville Railway Company has set the pace in the advancement of electric railway service. Here is a type of car that embodies proven principles of construction. New standards of appearance, comfort and operating economy have been employed with the result that this car leaves little to be desired as a mass transportation vehicle.

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 AMERICAN CAR CO. — C. C. KUHLMAN CAR CO. — WASON MAN'G CO.
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Pacific Coast Representative: Rialto Bldg., San Francisco

Brill MASTER UNIT Cars



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The quiet, smooth-riding comfort of cars equipped with Timken Worm Drive Trucks may be depended upon to attract more passengers to ride more often; at the same time that it is sending down operating and maintenance costs. A great basic improvement, worth every railway man's close study. THE TIMKEN - DETROIT AXLE COMPANY, DETROIT, MICH.

SPACE 13

Convention of the
Canadian Electric
Railway Association

Montreal—June 5-6-7

Timken Headquarters
WINDSOR HOTEL