ELECTRIC RAILWAY JOURNAL

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Chicago, North Shore & Milwaukee R. R.....	Chicago to Milwaukee	87.19	13	2 hrs.	43 59

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Electric Railway Journal

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Consolidation of
Street Railway Journal and Electric Railway Review

CHARLES GORDON, *Editor*

Vol. 73, No. 17 *Pages 755-818*

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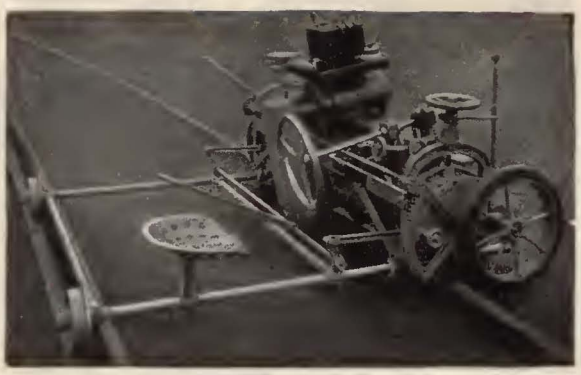

Improved Atlas Rail Grinder

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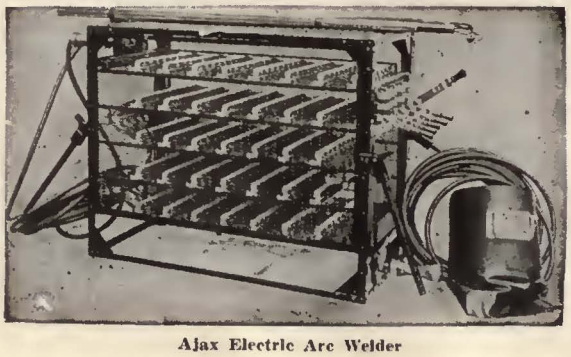

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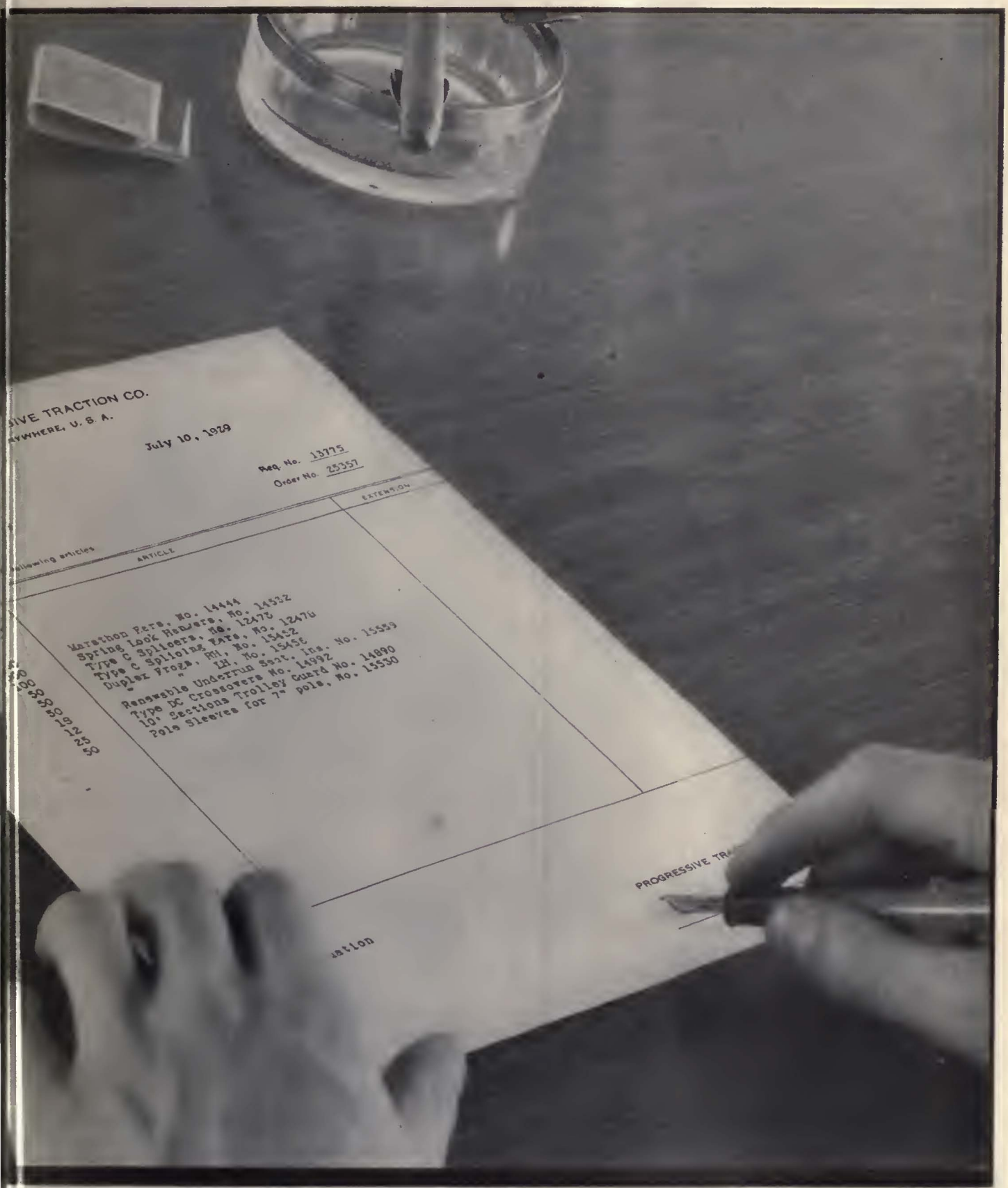

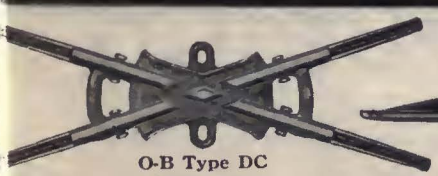

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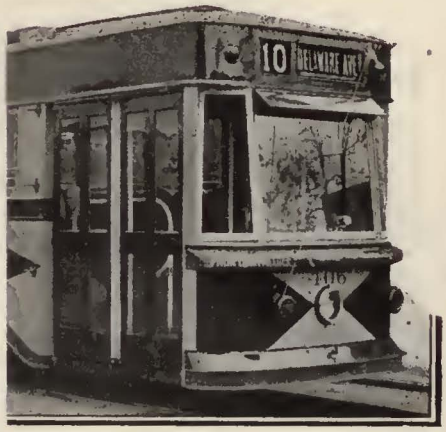
Hunter-Keystone Illuminated Signs "tell the public where you're going" night and day. They consist of specially printed roller curtains which are turned or regulated by a small crank handle so that any one of the ten or more destination names may appear. They are mounted in sheet steel cases or they may be built into the car structure.

Let us send you complete information about Hunter-Keystone Illuminated Signs and about other Keystone Equipment found in the modern well-equipped car.



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Faraday Passenger Signal Systems

Type FB

Type CB

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Faraday Signal Systems make a definite bid because of their RELIABILITY and long service. You can't go wrong in installing them.

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the public won't ride the trolleys?

Constant improvements in equipment to meet the changing needs of traffic maintain the position of the street railway as the safest, most convenient and most popular form of urban transportation. Treadle-ization is one of the most important of such improvements.

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IS HE COMFORTABLE IN YOUR CARS?

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When a chair at home is too near the heat or too far from the light, it can easily be *moved* into proper relation. But the seats, lights, windows and heaters on a trolley car are in a *fixed immovable position.*

Once uncomfortable upon a car — always uncomfortable. It is necessary, therefore, to bring these factors into right relation at the start and a Hale and Kilburn seating engineer, working with you from the beginning of the design of the car, will assure the maximum degree of final comfort.

We have half a century's experience to aid, not only in providing the most practical *arrangement* of these comforts, but in providing the most practical and comfortable type of *seat* for every type of city and inter-city service.

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"A Better Seat for Every Type of Modern Transportation Service"

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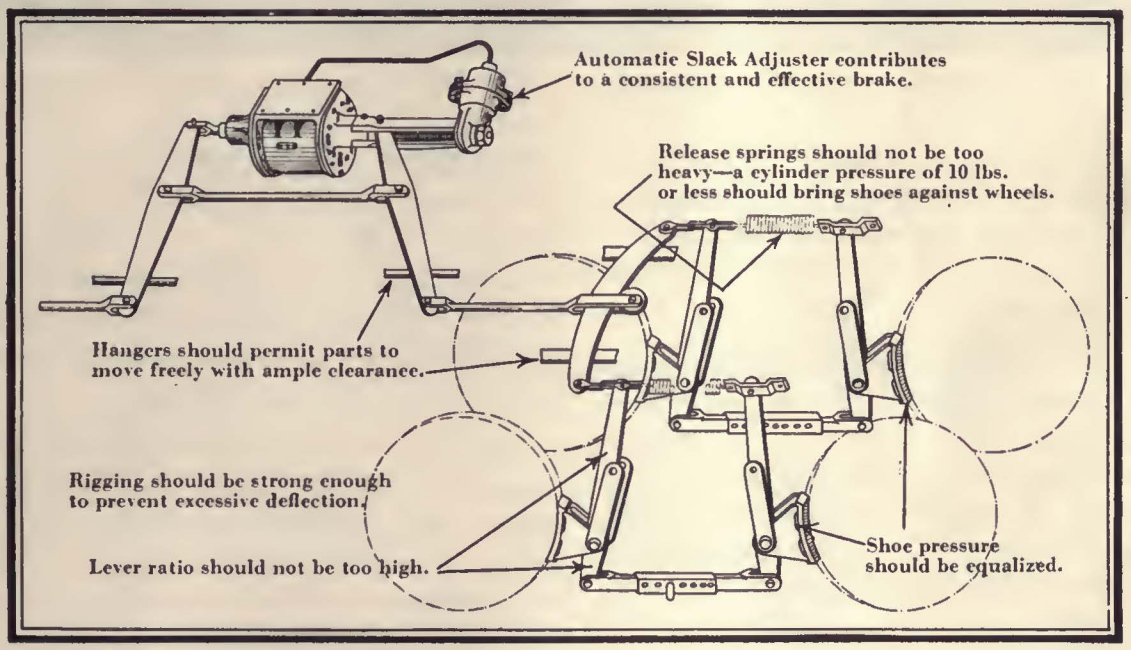
7 STEPS TO SHORTER STOPS

1 Quicker Application
2 Increased Braking Force
3 More Efficient Rigging
4 Improved Maintenance
5 Variable Load Brake
6 Proper Brake Shoes
7 Adequate Rail Sanding

Have you Taken them?

Step 3

Brake rigging of correct design and construction—which permits transfer of cylinder effort to brake shoes with minimum loss and without delay—is another means of shortening stops.



The common brake rigging faults of heavy release springs, weak construction, excessive friction or interference, high lever ratio, and lack of equalization, cause sluggish, ineffective, and uncertain brake operation.

It will pay you to investigate the condition of brake rigging on your cars. Our engineers are available for consultation and assistance.

WESTINGHOUSE TRACTION BRAKE CO.
General Office and Works, Wilmerding, Pa.

WESTINGHOUSE TRACTION BRAKES

"Road delays due to tire trouble cut in half"

48 motor coaches of the East St. Louis Railway Company and affiliated companies, East St. Louis, Illinois, are on Goodyear Tires

As tangible evidence of the extra values derived from the use of Goodyear Tires and Goodyear service, the following statement stands out in a letter from an official of the East St. Louis Railway Company:

"It is my understanding that road delays due to tire trouble have been cut in half on account of operating with one make of tire, with repairs under the supervision of Goodyear repairmen, as compared with what we were doing when we had many makes of tires on our buses and took care of our own repairs."

The "one tire" named was Goodyear. During the year ending Oct. 31, 1928, the 48 buses with Goodyear tires made 1,751,326 miles—a distance great enough to make this experience significant to any fleet operator.

* * *

Naturally, the transportation of passengers calls for maintained schedules. Freedom from roadside delays is an asset in good-will, worth considering in the choice of tires.

In part, as pointed out, it may be traced to the expert attention of Goodyear Truck and Bus Tire Service Station Dealers. But wide experience also shows that the extra vitality, the extra resistance to fatigue secured in Goodyear Tires by the use of Supertwist, contributes materially to the long life and dependable performance which these tires deliver.

For every Goodyear Cord Bus Tire there is an equally fine Goodyear Tube, built especially to the needs of bus service

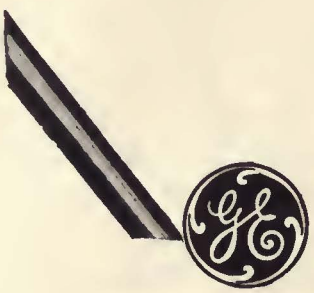
GOODYEAR

—reconditions car trucks

RAILWAY operators find in arc welding a means of reconditioning and reclaiming worn and broken parts at a fraction of the cost of replacement. Type "F" welding electrode is especially suited for this work because it can be applied in awkward positions with uniformly good results. For example, many damaged parts of car trucks are now welded at the drop-pit without dismantling the car.

Practically every part of a railway truck can be welded satisfactorily with Type "F"—side-bearing plates, side-truck frames, brake-shoe heads, bolt or pin holes in the brake rigging, and cup joints, to mention only a few. All the "slid-flat" or flaked-out places on the rolled-steel wheels, as well as on the sharp-flanged wheels, can be similarly reconditioned at low cost and with little loss of time.

Learn more of G-E welding electrodes from the G-E Welding Electrode Distributor near you or Section E-508, Merchandise Department, General Electric Company, Bridgeport, Connecticut.



In simplicity, reliability, and ease of operation G-E arc-welding sets are unequalled. They are available in all sizes, all types—for either hand or automatic operation—for one or more operators.

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GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

Will these Suggestions

Are you changing any routes?

If conditions are such as to require major changes on any of your street-car routes, it will pay you to investigate the advantages of trolley buses. The only additional right-of-way work would be placing the second trolley wire, which can be strung at a small cost since the overhead is already up.

Under most conditions, the trolley bus has the lowest operating cost of any railless vehicle. Its advantages also include unlimited power, fast acceleration (with PCM control), quietness, speed on grades, and flexibility.

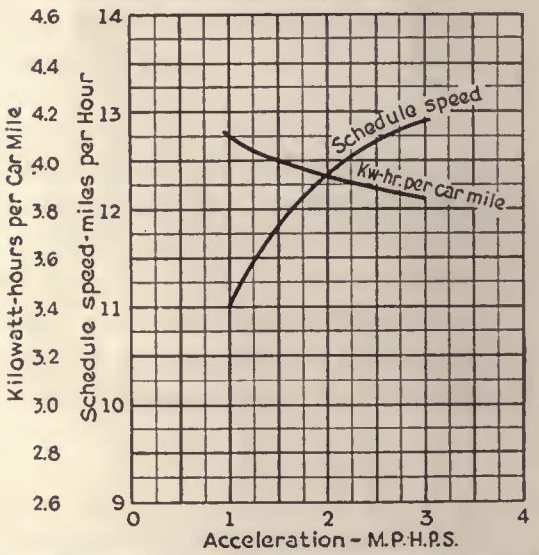
The 15 trolley buses recently purchased by the Utah Light and Traction Company for Salt Lake City are equipped with G-E motors and type PCM control.

A faster acceleration that saves power

Cars equipped with PCM control accelerate faster than those equipped with any other control—yet they use less power under identical operating conditions. The reason for this apparent inconsistency is shown by the following curves.

As the acceleration is increased, the free-running speed of the car is reached more rapidly, resulting in increased

7 Stops per mile. Duration of stops, 8 seconds. 550 volts. 2.5-m.p.h.p.s. braking. Weight of car equipped, less load, 36,000 lb. Passenger load, 4,000 lb. Four 50-h.p., 600-volt motors. 69/14 gearing. 26-in. wheels. Maximum theoretical schedule. No coasting. No leeway.



Schedule speed—energy curves for various rates of acceleration in city service

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Electric Railway Journal

Consolidation of
Street Railway Journal and Electric Railway Review

CHARLES GORDON, *Editor*

Volume 73 New York, August, 1929 *Number 17*

Reviving the Will to Win

WHEN the will to win permeates an organization from top to bottom, victory is already half won. This truth has been recognized by military leaders from the time of Alexander the Great on down to the days of Pershing and Foch. Examples are not lacking to show that this axiom applies with equal force in the affairs of every day life.

A few years ago the spectacular achievements of electrical engineering were attracting much attention and many opportunities for improvement in the design of steam locomotives were being overlooked. Because of the wonderful progress of electricity, the morale of the mechanical engineers was relatively low. They were disheartened but they were not beaten. With grim determination they pushed the design of superheaters, automatic stokers, boosters and other devices that greatly increased the efficiency of the steam locomotive. Today steam and electricity are competing on a new basis. Continued progress will be made in electrification, but the day has apparently not arrived when the steam locomotive will be generally superseded by electricity on our trunk line railroads. Had not the steam locomotive designer challenged the advent of electricity with improvements previously undreamed of, the iron horse of the poets would today be definitely on the way out. It is greatly to the credit of these designers that the challenge of competition found them just starting to fight.

A close parallel to this can be found in the local transportation industry. Widespread public attention has been attracted by the spectacular development of the bus, while the street car has come to be regarded as a back number. Although bus service has actually replaced car service on only a very small part of the track mileage of the country, the contrast in appearance between old run-down cars and new up-to-date buses has created the impression that the day of the electric railway is passing. The attitude of the public has been contagious and many electric railway men themselves became discouraged—to say nothing of the builders of cars. Apparently sight was lost of the fact that attractive modern vehicles, comfortable, speedy and quiet can be built to run upon rails as well as upon rubber tires.

Of course, this is easier said than done. Difficulties are real and numerous in the way of improving the performance of street cars to the extent to which they must be improved if they are to survive. But these difficulties are not insurmountable. Evidence of a reviving confidence in the future of the electric railway is quite apparent. So also is the evidence that the field for the motor bus is far broader than that anticipated for it during its early days, and that replacement of unprofitable rail mileage is a secondary rather than a primary field for the automotive vehicle. When the problems facing the industry are attacked in a spirit of confidence, apparent difficulties may be expected to give way before courage and determination. Here again, the will to win is half the battle.

Legislation Needed to Check Cut-Rate Taxicabs

THOUGH taxicabs offer a type of transportation service closely approximating that of a private automobile, the extensive promotion of flat and cut-rate taxicab operations in the past two years has lowered the standard of this industry, much to the regret of the legitimate cab companies, which are striving to maintain this vehicle in its proper place. Wherever cut-rate taxis have started up, price wars have followed, resulting in some instances in an increased volume of taxi riding but with losses to all established transportation agencies giving local service. The experiences have proved that semi-private vehicles cannot be operated permanently at rates of fare comparable to those charged by mass transportation vehicles, and that the whole set-up is economically unsound. But in spite of the many failures under cut rates and the agitation against this kind of operation these operators have continued to expand until at the present time they exist in approximately sixteen large cities and 122 smaller cities throughout the country.

Legitimate taxicab companies have been the principal sufferers from this evil, but the electric railways also have been affected, in some cases rather seriously. In line with their objective of carrying a large number of riders at a small fare the cut-rate cabs have really turned "jitney," paralleling the street car lines and picking up their passengers. The cab rates in some cities actually are lower, when four people ride, than are those of the street car. Naturally the cut-rate cabs collect much revenue that properly belongs to the railways.

It is the opinion of H. A. Innes-Brown, editor of *Taxi Weekly,* who spoke on this subject at the recent C.E.R.A. meeting and whose paper is abstracted elsewhere in this issue, that the only solution to the problem is to secure protective legislation. Moreover, to be really protective this legislation should be sought by the street car companies as well as the legitimate taxicab companies. Local council ordinances ruled out the jitneys in most cities but only after the jitneys had seriously harmed the railways. Similar legislation, as suggested by Mr. Brown, is just as necessary at the present time to check this second jitney peril.

It is always unfortunate when transportation agencies leave their own proper field in search of business that really does not belong to them. The net result usually is a lowering of their standard of service and a reduction in revenue for the other agencies with no increase in their own net income. Cities in which cut-rate cab companies are now operating will suffer from impaired service

from both the legitimate taxicab companies and the electric railways in the long run if they do not take steps to end this disastrous attempt to sell transportation for less than it costs.

Complete Analysis Proves Value of Equipment Replacement

PERHAPS the most complete record ever compiled of the results obtainable through the replacement of obsolete, heavy rolling stock by light equipment of more modern design, is published elsewhere in this issue in an article by F. W. Bacon, vice-president International Utilities Company. The results are of particular interest and significance because they represent a complete historical record giving a comparison of income and expense for old and new equipment on a combined interurban and city system, on which a complete replacement of all existing rolling stock was made.

Nor are these the only considerations that commend these tabulations to the earnest attention of the entire industry. Second only in importance to the completeness of the record, is the fact that this whole analysis deals with exactly the type of property that has been the subject of the most serious question in discussions regarding the future of electric railway operations. The city lines of the Kentucky Traction & Terminal Company are located in a community which even in the "booster" figures of the Chamber of Commerce is credited with a population of only 60,000. The interurban lines are of the type which radiate from this comparatively small city, into surrounding rural territory.

Moreover, the economies usually available in a change from two-man to one-man operation do not enter into the results on this small city property, for the change to one-man operation had been made a number of years before new equipment was purchased, and all figures, both for the five-year period with old equipment and for the five years with the new cars, are based upon one-man operation. Finally, it is worthy of special note that the old cars which were replaced were not the heavy double-truck units so commonly in use, but were single-truck cars weighing only 26,350 lb. In the light of these significant facts, therefore, Mr. Bacon's article seems to justify careful study by every operating executive who is giving attention to the possibility of equipment improvements.

Earning Power as a Basis of Security

SIGHT should not be lost of the nice financial point made in the decision rendered recently by Supreme Court Justice Rodenbach, in which he authorized the New York State Railways to abandon the Rochester and Sodus Bay line and parts of lines in Syracuse, Utica and Sherrill. The question involved was the substitution of property under the terms of a mortgage given to secure an issue of bonds. For the bondholders, the Security Trust Company of Rochester questioned the right of the railway to discontinue the lines. It wanted to be sure that the letter of the mortgage under which it acted in behalf of the bondholders would be met under the changes proposed.

The mortgage agreement did not directly mention abandonment of any part of the system, but Justice Rodenbach pointed out that there could be no question that discontinuance of useless and unprofitable lines was to be expected. In his opinion, the use of the property would be clogged to an unnecessary extent by forcing maintenance of the lines it was intended to abandon. In this particular case he felt the bondholders were safeguarded since the public authorities had recognized the changed conditions and had readjusted fares to meet the change.

Even more important than that was the opinion of the court to the effect that holders of bonds secured by mortgage on physical property were required to co-operate in the readjustment to the new conditions. This was not intended as a rebuke to the trustee. It was the kind of an expression of opinion the trustees desired, restricted as they had been under the terms of the indenture securing the bonds. Of course, there will be salvage from the sale of the abandoned railway lines. From this source officials of the New York State Railways hope to realize $70,000, and they have signified their willingness to turn this amount over to the trustees, together with stock in seven allied bus lines which the railway will control.

As pointed out briefly in ELECTRIC RAILWAY JOURNAL NEWS for June 22, this case serves to emphasize again the fact that it is not so much the actual property back of their bonds to which the bondholders may look, but rather to the earning capacity of that property. It was an interesting issue upon which the court passed—interesting from both the practical and the academic points of view.

Developing Men as Well as Machinery

MEN and machinery! These two things tersely sum up the whole of the transportation industry and of its problems as well. What thought and effort have been devoted to the machinery! What fortunes have been spent on research and improvement, more research and more improvement! Today street cars run almost unbelievable distances without a failure, dwarfing the records of the much-advertised endurance fliers and commercial automobiles. Substations run automatically, almost without the touch of a human hand. Track has been improved time after time and become better and better, as the result of the expenditure of millions of dollars in research.

But human research has lagged. Employees have offered themselves, or the personnel department has gone outside the gates and hired them, never expecting to find the perfect man to match the perfect machine. In a measure this is right, for of course the perfect man does not exist. But after the man is hired, even if he is the best we can get, he is also as good as he can be made?

In isolated spots careful selection of employees along the well-established principles of psychology has brought a better grade of men, better suited to take up transportation work. Nearly all companies have realized the necessity of a brief period of training to adjust the raw material to the new and unfamiliar tasks. But almost always the training has stopped at this point and has failed to carry on educational and developmental work to broaden the employee, intensify his interest in his job, and fit him into the scheme of the industry so rationally that he knows he is part and parcel of it. Many have followed the maxim: "To educate a nigger is to spoil a good mule driver," and that to initiate a motorman or conductor into the problems of the company he works for is to unsettle him, make him dissatisfied and make him feel too good for his job.

Not all men react alike to education and training.

But with proper selection at the time of hiring, no fear need be entertained as to the effect of future instruction and education. The employees need to know the business because they are the salesmen of the service. So far as 99 per cent of the customers are concerned, these men are the only representatives that they ever know or even see. Like it or not, they discuss the affairs of the company together. Why not have them well informed, accurately informed, painstakingly informed, so that they may present our business to our customers as we would do it ourselves were we to meet them?

After all, the success of this industry is particularly dependent on the performance of its men. One side supplies the capital or the management, or perhaps both; the other makes the direct contact with the public. One side supplies the machinery and the vision; the other gives the man power without which they would be useless. Men and machinery. Machinery and men. And the one must be developed as well as the other.

Drivers of Hard Bargains May Suffer Most

IT SEEMS incredible that ideas should persist in the matter of franchise grants that have been unsound for more than a quarter of a century. But such ideas do persist among the representatives of the public chosen to office. This is particularly true in cities of moderate size, in several of which grants are now under negotiation. It is not so much the radical who would drive a hard bargain, but rather the small business man, the very man who ought to know better.

Instead of looking at the situation as a business proposition, deciding the amount and character of service best designed to meet the requirements of the community and then making terms that will enable the company to give that service, the process too often is reversed. There is little in the proceedings of the modern business concept that both parties should gain from a contract. The principle that there is a mutuality of interest between the negotiators in a franchise hearing, rather than the idea of barter and trade, needs constant reiteration. There is no such thing as a low franchise bid. The trials and tribulations of the past with railway receiverships prove that no organization can continue indefinitely to render service at a loss. Service tends unmistakably to seek the level of the liberality or lack of liberality of the franchise itself.

Change Needed in Concept of Utility Regulation

RECENT developments in the power industry have focused public attention to an unusual extent upon the subject of utility regulation. Much of the discussion which has been heard sounds like an echo from the dark ages, when the object of regulation was restrictive and punitive, rather than constructive. Many of the self-appointed guardians of the public welfare seem to feel that because private interests are making attractive profit the public is being gouged. Henry Ford, in a recent interview in the *Electrical World,* disputes that assumption. He insists upon the modern conception of business fair dealing, that the reward for initiative and enterprise is a secondary consideration, provided that both parties profit from the transaction.

With the local transportation industry, the problem is different but not less important. Power is a vital and necessary service, but so also is transportation. Although the public has much at stake, its attention is more difficult to attract because the problem is one of relieving the industry in difficulty in contrast with that of controlling one which is expanding rapidly. Nevertheless it is apparent that the public is the greatest sufferer through the inability of community transportation facilities—under the conditions imposed—to keep pace with growing community requirements.

Proceedings before regulatory commissions with respect to local transportation are limited largely to the age-old ground of valuation, and the right to earn a fair return. But in many instances the primary question is not one of right to earn but of ability to earn. Local transportation encounters today a new factor which demands a radical change in the whole concept of regulation. That is competition. And it is obvious that any business is hopelessly handicapped in meeting competition unless it is permitted that necessary flexibility with respect to rates which is essential in meeting the inroads of unregulated competitors. In any such vital facility as community transportation, the public interest lies in regularity, reliability, safety and character of service. The public interest also demands that the facilities available be permitted to keep pace with growing community requirements. Without a sound financial basis, no enterprise can accomplish these objectives. It seems high time, therefore, that while the public is considering the deficiencies of present regulatory policy, the need for a changed concept to permit greater flexibility in the management of local transportation be given the attention which its importance warrants.

More Speed for the Locals

FEATURED in advertising, manned by selected employees, and favored by the dispatcher, the interurban limiteds are the pride of the road. So that they can get through in the fastest possible time, work trains, freight trains, and passenger locals must give way and take to the sidings. The cars used on the limited runs often have been specially designed for this purpose. They are provided with easy riding trucks, powerful motors, wide windows, upholstered seats and other refinements directed toward passenger comfort and convenience. All of which is as it should be and in line with present-day tendencies. This kind of service has done much to uphold the prestige of the interurbans and to offset the inroads of automobile and bus competition.

But would it not be well also to give attention to the matter of speeding up the local trains and bringing these cars up to the standard that is provided for the limiteds? Those who ride the locals constitute a numerous element of the patronage at all seasons of the year. As a class they are people of influence in their respective communities whose good will it is desirable to cultivate. Most assuredly they would react favorably to improved service either in the way of greater comfort or greater speed. While it may not be possible to provide parlor cars, it will nearly always be possible to speed up a local schedule. By speeding a little here and cutting a siding there; by taking advantage of every possible opportunity to gain a moment's time—in the main by clear-cut instructions to the motormen to "hit the ball," and by tightening up the schedule accordingly, the trains can be sent over the road in faster time, and the passengers impressed by the fact that they are receiving the faster service for which there is so general a demand.

Despite severe automobile competition these lightweight interurban cars of the Kentucky Traction & Terminal Company paid for themselves in three years

Passenger comfort combined with attractive simplicity feature the interior of the lightweight one-man operated interurban

Complete Car

New cars on 70-mile interurban in rural territory return investment in three years and in five years on 17-mile city property in community of 60,000. Detailed summary of operating results over ten-year period presents unusually complete analysis of new car economics

By

F. W. BACON

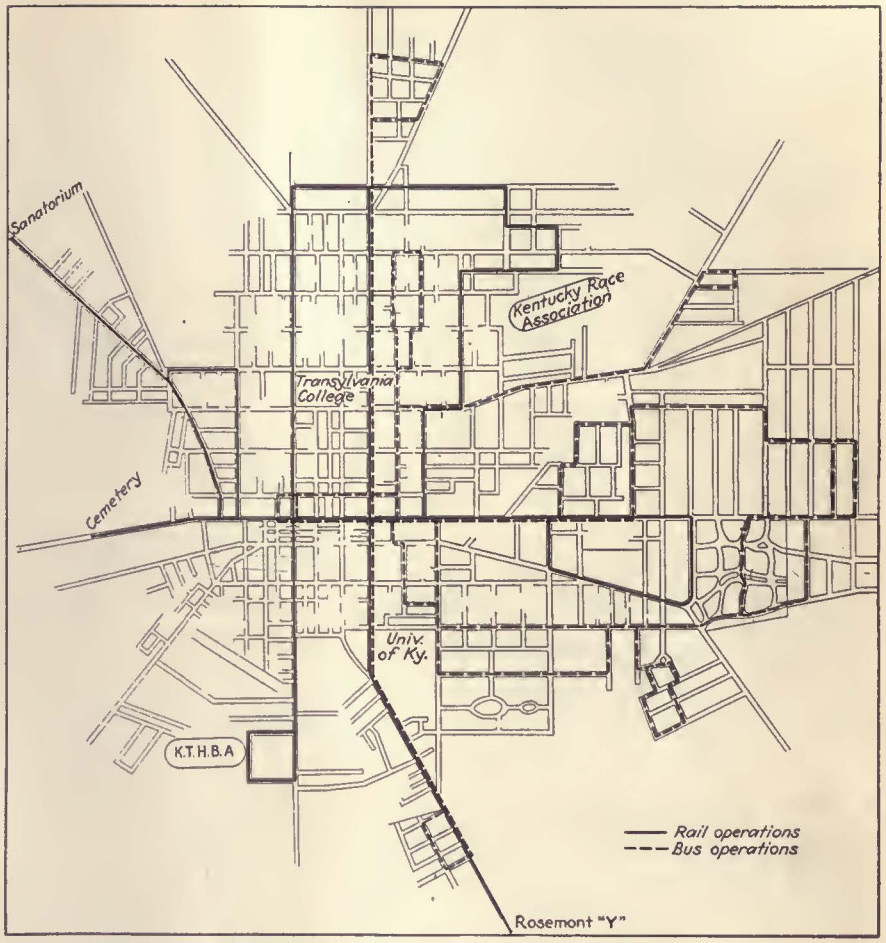
Vice-President International Utilities Company

DURING a continuous period of eighteen years, the Kentucky Traction & Terminal Company, which I represent, has owned and controlled the public utility properties comprising power and light, local transportation and ice, serving exclusively the city of Lexington, Ky., and surrounding territory. Consequently, we have had a very major interest in the development of the city and its immediately tributary territory. The transportation property comprises some 70 miles of interurban system (divided into four lines radiating out from Lexington) and 17 miles of city trackage. Prior to 1922 there was in operation on the interurban a standard type of car weighing approximately 35 to 40 tons, of the design in common use at that time, and operated with two men. In the city the cars were a common type of single-truck equipment. They weighed 13½ tons and had been operated with one man for a number of years before they were replaced.

On a property of this size, facing the rapid growth in automobile competition, it was obvious that the possibilities for the development of transportation business were limited. The maximum length of ride on the city lines is not more than 1 mile, and under these conditions the effect of direct automobile competition and, in addition, their tendency to pick up passengers waiting for street cars, is particularly severe. Nevertheless, this company was faced with its responsibility for maintaining efficient, modern, comfortable and attractive transportation service in the community whose good will it has continued to enjoy for many years and with whose destiny its other utility properties, as well as its transportation system, are intimately associated. Here, then, was a problem of keeping faith with the community and at the same time keeping operating costs and fixed charges on the transportation

lines within the limits of the volume of business that could be expected.

We were convinced that frequent and convenient headway is essential in any transportation service which may be expected to win a fair response from the public. We recognized, likewise, that with the old equipment available, it was impossible to provide the character of transportation service which we felt the public had a right to expect; or to hold operating costs at a point which would permit the property to continue to maintain reliable transportation service in the community. Consequently, we decided to replace all of the existing equipment on the entire property—both interurban and city lines. The replacement was made on the interurban in 1922. The cars selected were of a light-weight double-truck type to be operated by one man. Twelve of these were purchased, and all of the old equipment was either sold or scrapped. In the following year the cars on the city lines were all replaced with 27



Although the maximum length of ride in Lexington is only 1 mile, new lightweight cars have produced a substantial increase in patronage and revenue and have returned their cost in five years despite jitney and bus competition. Buses of the Kentucky Coach Company now carry more than 1,800,000 passengers per year. The buses parallel two important rail lines

Replacement in Lexington Returns Investment in Five Years

light-weight, single-truck one-man cars of a special design, in which careful attention was given to features of passenger comfort and attractiveness. The total investment was $306,999.

Since this property now furnishes a rather complete example of an entire replacement of equipment on both an interurban system and a small city operation, for which results are available over a sufficient period of time to afford a fair basis for drawing conclusions, it should be of interest to the industry to set up a comparison of operating results over a period of years before and after the acquisition of the new equipment, so far as it is possible to set up such a comparison and to attach significance to the figures. Obviously, the question of greatest interest is whether or not the investment in new equipment was justified. We are quite convinced that it was. In fact, if we had attempted to continue operation of the interurban lines with the old equipment, this part of the property would have long since been abandoned. Had that been made necessary, the million passengers now handled annually by these lines would have been forced to use other forms of transportation at a probable increased cost of transportation service. We feel that had this become necessary it would have been against the general interests of Lexington and its surrounding territory, in which, as the operators of power and ice utilities, we have a considerable stake. On the

TABLE I— COMPARATIVE CHECK ON ALL FOUR INTERURBAN LINES OF AUTOMOBILE AND BUS OPERATION DAILY AVERAGE

Daily average of automobiles, buses and passengers as shown by check of five (5) days, same hours, same men making the check and at the same points each year 1912 to 1928.

	Automobiles	Per Cent Increase	Passengers	Per Cent Inc. or Dec.	Average Passengers per Automobile	Licenses Issued Lexington
August, 1912....	291	....	935	....	3.21	.....
August, 1921....	2,321	697.5	5,614	500.4	2.41	4,717
June, 1924.....	2,817	21.3	6,125	9.1	2.17	9,485
May, 1925.....	3,841	36.3	8,698	42.0	2.26	10,577
May, 1926.....	3,847	0.1	7,960	*8.4*	2.07	11,534
September, 1926	4,519	17.4	10,476	31.6	2.31	.....
September, 1927	5,464	20.9	12,596	20.2	2.30	12,350
September, 1928	5,649	3.3	12,477	*0.9*	2.20	13,472

BUSES AND BUS PASSENGERS DAILY AVERAGE, ALL DIVISIONS

	Buses	Per Cent Inc. or Dec.	Passengers	Per Cent Inc. or Dec.	Average Passengers Per Bus
May, 1925.....	61	....	432	....	7.1
May, 1926.....	78	27.8	621	43.7	9.7
September, 1926....	80	2.5	610	*1.7*	7.6
September, 1927....	79	*1.2*	658	7.8	8.3
September, 1928....	78	*1.2*	655	*1.4*	8.3

city lines the results have been such that we feel that the service has been put upon a basis on which it can be perpetuated for the community, despite the limited earning power of a street railway system in a city of approximately 60,000 population.

CAR INVESTMENT LIQUIDATED ON BOTH INTERURBAN AND CITY LINES

On the most conservative basis of comparison with the old cars, the investment in the interurban equipment was liquidated within three years. This has been accomplished despite an average annual reduction in gross revenue of approximately 5 per cent. On the city lines the new car investment was liquidated within approximately a five-year period. I want to make it quite clear that the transportation property of this company as a whole is not a money-making enterprise even in its present form. It is with considerable difficulty that we are able to make the property self-sustaining, due to its limited scope of operations. When you look at our earning statement today, including intercompany charges and depreciation, etc., a casual observation would lead to the conclusion that it is a decided liability. This, however, is not the case; efficient and economical transportation service is a necessity to this community, vital to its development and welfare, and although the railway does not contribute directly to the earning power of the combined operations after paying its interest and its proportion of the general overhead we regard the transportation system as a real asset to the combined properties. While the investment in new cars has not contributed any collectible return, it has, through putting the property on a self-sustaining basis and through its general effect upon the public's attitude, contributed in a very real way to the interests of the company.

Taking up now the specific analysis of the effect of the new equipment on the interurban lines, the immediate effect of comfortable light-weight cars and improved service increased the gross revenue during the first year following the replacement. A competing bus service, however (since acquired by this company), and steady, increased use of private motor vehicles, has had the effect of causing a decrease in gross averaging about 5 per cent a year. Therefore, it is of particular interest to note that on the interurban lines the liquidation of the investment in new cars over a period of three years has been accomplished entirely through operating economies, and the investment has proved to have been justified despite a gradual loss in gross business.

To give a fair idea of the extent of the competition

TABLE II—INTERURBAN DIVISION INCOME STATEMENT THREE YEARS NEW CAR OPERATION VERSUS THREE YEARS OLD CAR OPERATION

	Total Three Years Actual New Car Operation July 1, 1922, to June 30, 1925			Total Three Years Actual Old Car Operation July 1, 1919, to June 30, 1922			Increase or Decrease, New Operation Over Old Operation			Assuming Old Equipment Had Been Continued in Service 1922-1925 at Former Cost per Car-Mile			
	Amount	Per Cent of Gross Earnings	Per Car-Mile in Cents	Amount	Per Cent of Gross Earnings	Per Car-Mile in Cents	Amount	Per Cent	Per Car-Mile in Cents	Amount	Cost per Car-Mile	Increase or Decrease Over New Car Operation	Per Cent
Passenger revenue.....	$907,888.38	100.0	0.350	$978,087.79	100.0	0.507	*$70,199.41*	*7.2*	*0.157*	$907,888.38	0.350	.....	.....
Operating expenses:													
Ways and structures.....	174,334.58	19.2	.067	159,689.33	16.4	.083	14,645.25	9.2	*.016*	215,305.40	.083	$40,970.82	19.7
Equipment.....	43,372.09	4.8	.017	55,236.35	5.6	.029	*11,864.26*	*21.5*	*.012*	75,227.19	.029	31,855.10	42.3
Power.....	128,704.60	14.2	.050	160,581.64	16.4	.083	*31,877.04*	*19.8*	*.033*	215,305.40	.083	86,600.80	40.2
Conducting transporation..	188,670.03	20.7	.072	176,048.61	18.0	.091	12,621.42	7.2	*.019*	236,057.73	.091	47,387.70	20.1
Traffic.....	9,197.37	1.0	.003	4,735.72	.5	.002	4,461.65	94.2	.001	5,188.08	.002	*4,009.29*	*77.2*
General and miscellaneous.	76,896.60	8.5	.030	90,843.30	9.3	.047	*13,946.70*	*15.4*	*.017*	*76,896.60	.030	.....	....
Total operating expenses	$621,175.27	68.4	.239	$647,134.95	66.2	.335	*$25,959.68*	*4.0*	*.096*	$823,980.40	.318	$202,805.13	24.6
Net operating revenue.....	286,713.11	31.6	.111	330,952.84	33.8	.172	*44,239.73*	*13.4*	*.061*	83,907.98	.032	*202,805.13*	*241.7*
Taxes—local.....	61,751.00	6.8	.024	54,175.89	5.5	.028	7,575.11	14.0	.004	54,175.89	.021	*7,575.11*	*13.9*
Gross income.....	$224,962.11	24.8	.087	$276,776.95	28.3	.144	*$51,814.84*	*18.7*	*.057*	$29,732.09	.011	*$195,230.02*	*656.6*
Interest charges on new equipment at 7½ per cent	28,734.63	3.2	.011	.....	.....	.....	28,734.63	100.0	.011	.....	.....	*28,734.63*	*100.0*
Gross income after interest charges on new equipment	$196,227.48	21.6	.076	$276,776.95	28.3	.144	*$80,549.47*	*29.1*	*.068*	$29,732.09	.011	*$166,495.39*	*559.9*

*Car-miles basis not used.

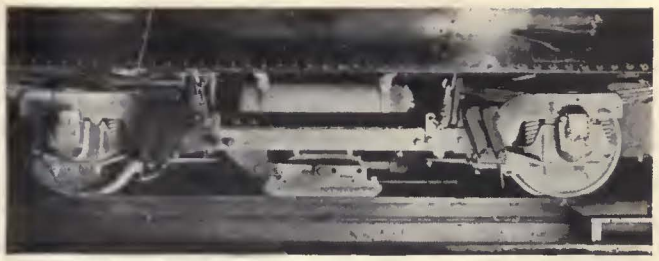
Cost of cars.....	$127,709.52			.....			.....	....					
Passengers, car-miles.....	2,594,041			1,929,377			664,664	34.4					
Revenue passengers carried	3,696,772			3,657,852			38,920	1.1					
Revenue per passenger in cents.....		24.5			26.7		*2.2*	*8.2*					
Number of track-miles.....		67.67			67.67		....	.....					

Average yearly savings account of new equipment..... $55,498.46
Average yearly return on investment before interest charges..... 50.9%
Average yearly return on investment after interest charges..... 43.5%

Twelve new interurban cars were installed during the period from Feb. 8, 1922, to March 5, 1922.
Change from two to one man operation of cars was made between Feb. 11 and 24, 1922.
Weight of old interurban cars 75,600 lb.
Weight of new interurban cars 25,100 lb.
Fares: Effective June 10, 1918, cash rate increased from 2½ cents to 3 cents per mile, and mileage rate increased from 2 cents to 3 cents per mile.
Effective Aug. 21, 1920, cash and mileage rates increased from 3 cents to 3⅛ cents per mile.
Effective Dec. 1, 1921, cash rates were reduced from 3⅛ cents to 3½ cents per mile, and tickets rates reduced from 3⅛ cents to 3 cents per mile.
There is an additional saving of $30,000.00 yearly in the operation of the new interurban cars due to the reduction in the power house kilowatt demand being released for commercial purposes.

encountered, there is presented herewith in Table I the results of periodic checks of highway traffic made since 1912. Each check was made for a period of five consecutive days from 6 a.m. to 6 p.m., and shows the number of motor vehicles and the passenger movement per day on roads between points served by our interurban lines. The checks were made at the same points each year, during the same hours and by the same men. It will be noted that in 1927 and 1928 there was an average of approximately 12,500 passengers carried daily by automobiles between points served by the four interurban lines. The average number of passengers per car varied between 2.2 and 2.3. Although there was a slight increase in the number of automobiles between 1927 and 1928, there was a slight decrease in the number of passengers riding in them. There has likewise been a slight decrease in bus passengers, and there are indications that for the time being, at least, the conditions have become static.

Table II presents a detailed summary of operating statements on the interurban before and after the substitution of new equipment. There is also presented in this table, for comparison, a summary of what the statement would have been during the period for the new equipment, had the old equipment been continued in operation. It is assumed for purposes of comparison that the same service had been given with old equipment as was given with the new, and that the gross revenue would have been the same as it has been for the new equipment. Obviously, an analysis of the financial results with new equipment on this basis, in an effort to determine the justification for the investment in new cars, is indeed very conservative. There is every reason to believe that



The unique air-magnetic track brake developed on this property has made possible increased speed with safety and has effected large reductions in accident cost. The illustration shows the equipment mounted on the single truck of the city cars

the gross revenue would not have been the same had the old cars been continued in service. In fact, we are quite convinced that it would have been much lower, and that with the higher attendant operating costs, these interurban lines would have long since been abandoned. Table II shows a comparison of the three-year period immediately preceding the installation of new cars, with the three years immediately following. These figures do not show the economy resulting from the light-weight equipment in the form of reduced power station demand, which released generating capacity for the sale of commercial power amounting to $30,000 per annum.

Gross Increased On City Lines

In Table III there is presented a comparison of operating statements for the city lines over a five-year period with old and new equipment. Prior to the installation of new cars it had been found impossible to increase the

TABLE III—LEXINGTON CITY DIVISION INCOME STATEMENT FIVE YEARS NEW CAR OPERATION VERSUS FIVE YEARS OLD CAR OPERATION

	Total Five Years Actual New Car Operation Jan. 1, 1924, to Dec. 31, 1928			Total Five Years Actual Old Car Operation July 1, 1918, to June 30, 1923			Increase or Decrease, New Operation Over Old Operation			Assuming Old Equipment Had Been Continued in Service 1924-1928 at Former Cost per Car-Mile			
	Amount	Per Cent of Gross Earnings	Per Car-Mile in Cents	Amount	Per Cent of Gross Earnings	Per Car-Mile in Cents	Amount	Per Cent	Per Car-Mile in Cents	Amount	Cost per Car-Mile	Increase or Decrease Over New Car Operation	Per Cent
Passenger revenue	$1,434,341.24	100.0	0.276	$1,218,056.41	100.0	0.304	$216,284.83	17.8	*0.028*	$1,434,341.24	0.276	.....	.....
Operating expenses:													
Ways and structures	146,200.46	10.2	.028	181,166.91	14.9	.045	*34,966.45*	*19.3*	*.017*	233,949.92	.045	$87,749.46	37.5
Equipment	81,416.89	5.7	.016	73,846.43	6.1	.018	7,570.46	10.3	*.002*	93,579.96	.018	12,163.07	13.0
Power	80,684.65	5.6	.016	103,515.52	8.5	.026	*22,830.87*	*22.1*	*.010*	135,171.06	.026	54,486.41	40.3
Conducting transportation	375,614.82	26.2	.072	336,514.58	27.6	.085	39,100.24	11.6	*.013*	441,905.40	.085	66,290.58	15.0
Traffic	20,152.40	1.4	.004	9,530.71	.8	.002	10,621.69	111.4	.002	10,397.77	.002	*9,754.63*	*93.8*
General and miscellaneous	118,865.81	8.3	.022	129,039.16	10.5	.033	*10,173.35*	*7.9*	*.011*	*$118,865.81	.022	.....	.....
Total operating expenses	$822,935.03	57.4	.158	$833,613.31	68.4	.209	*$10,678.28*	*1.3*	*.051*	$1,033,869.92	.198	$210,934.89	20.4
Net operating revenue	$611,406.21	42.6	.118	$384,443.10	31.6	.095	$226,963.11	59.0	.023	$400,471.32	.078	*$210,934.89*	*52.7*
Taxes—local	96,029.35	6.7	.018	87,417.11	7.2	.022	8,612.24	9.8	*.004*	87,417.11	.017	*8,612.24*	*9.8*
Gross income	$515,376.86	35.9	.100	$297,025.99	24.4	.073	$218,350.87	73.5	.027	$313,054.21	.061	*$202,322.65*	*64.6*
Interest charges new equipment at 7½ per cent	67,232.85	4.7	.013	.....	.....	.....	67,232.85	100.0	.013	.....	.....	*67,232.85*	*100.00*
Gross income after interest charges on new equipment	$448,144.01	31.2	.087	$297,025.99	24.4	.073	$151,118.02	50.9	.014	$313,054.21	.061	*$135,089.80*	*43.2*
*Car-mile basis not used.													
Cost of cars	$179,289.72			.....			.....						
Passenger car-miles	5,198,887			3,996,731			1,202,156	30.1					
Revenue passengers carried	21,318,283			19,276,730			2,041,510	10.6					
Revenue per passenger in cents	6.7			6.3			.4	6.3					
Number of track-miles	16.02			16.02			.....	....					
Average yearly savings account of new equipment												27,017.96	
Average yearly return on investment before interest charges												22.6%	
Average yearly return on investment after interest charges												15.1%	

Twenty-seven new city cars installed during the period June 24, 1923, to Sept. 2, 1923.
Weight of old city cars, 26,350 lb.
Weight of new city cars, 16,000 lb.
Fares: Effective Nov. 18, 1917, cash fare increased from 5 cents to 6 cents; Metal tokens from 4½ cents to 5⅝ cents.
Effective June 14, 1920, cash fare increased from 6 cents to 7 cents; Metal tokens from 5⅝ cents to 6¼ cents.
Effective Dec. 21, 1927, cash fare increased from 7 cents to 8 cents; Metal tokens from 6¼ cents to 7½ cents.

Lexington Board of Commerce Population Statistics
1923—50,000 1926—56,801
1924—48,641 1927—57,312
1925—55,000 1928—59,808

There was no reduction in station demand account of installation of the new city light weight cars, due to air and magnetic brakes, increased speed and other electrically operated safety devices.
All operations, both with old and new equipment were one man.

revenue; in fact, the property was steadily losing ground in the face of growing automobile competition. It should be noted particularly that there has been an increase of 30.1 per cent in passenger car-miles operated for the five-year period with new equipment, compared to the preceding five years with the old cars. This brought an increase of 17.8 per cent in gross revenue, and an increase of 10.6 per cent in the number of revenue passengers carried. All of this is based upon a ten-year comparison—five years with old equipment and five years with the new cars. Operating expenses decreased only 1.3 per cent. The costs per car-mile, however, were

TABLE IV—KENTUCKY COACH COMPANY INCOME STATEMENT FROM JUNE 1, 1925, TO DEC. 31, 1928

	Seven Months Dec. 31, 1925		Twelve Months Dec. 31, 1926		Twelve Months Dec. 31, 1927		Twelve Months Dec. 31, 1928		Total Three Years and Seven Months	
	Amount	Per Bus-Mile	Amount	Per Bus-Mile	Amount	Per Bus-Mile	Amount	Per Bus-Mile	Amount	Per Bus-Mile
Passenger revenue	$19,157.03	0.145	$93,415.42	0.159	$123,824.43	0.163	$139,155.90	0.181	$375,552.78	0.167
Operating expenses:										
Maintenance of plant and equipment	9,547.46	.072	40,061.93	.068	53,340.89	.071	47,854.08	.063	150,804.36	.067
Operating garage expenses	5,841.43	.044	28,808.57	.049	32,019.98	.042	31,775.13	.041	98,445.11	.044
Conducting transportation	6,138.52	.047	24,321.58	.041	31,814.87	.042	34,423.80	.045	96,698.77	.043
Traffic promotion	640.89	.005	866.32	.001	891.15	.001	1,055.29	.001	3,453.65	.002
General and miscellaneous	4,291.74	.033	7,970.18	.014	10,251.52	.013	13,791.83	.018	36,305.27	.016
Total operating expenses	$26,460.04	.201	$102,028.58	.173	$128,318.41	.169	$128,900.13	.168	$385,707.16	.172
Net operating revenue	*$7,303.01*	*.056*	*$8,613.16*	*.014*	*$4,493.98*	*.006*	$10,255.77	.013	*$10,154.38*	*.005*
Taxes—local	1,157.53	.008	2,191.06	.004	5,426.11	.006	6,396.50	.008	15,171.20	.007
Gross income	*$8,460.54*	*.064*	*$10,804.22*	*.018*	*$9,920.09*	*.012*	$3,859.27	.005	*$25,325.58*	*.012*
Interest charges on investment at 7 per cent	1,053.36	.008	6,285.88	*.011*	9,555.64	.013	11,593.96	.015	28,488.84	.012
Gross income after interest charges	*$9,513.90*	*.072*	*$17,090.10*	*.029*	*$19,475.73*	*.025*	*$7,734.69*	*.010*	*$53,814.42*	*.024*
Return on investment before interest charges, per cent	*$2.8*		*12.0*		*7.3*		2.3		*6.1*	
Cost of investment	25,796.45		89,798.41		136,509.18		165,628.05		417,732.09	
Passenger bus-miles	131,730		588,605		761,406		766,817		2,248,558	
Revenue passengers carried	293,113		1,426,214		1,869,922		1,805,807		5,395,056	
Revenue per passenger	6.6		6.6		6.6		7.7		7.0	

Fare is the same as charged on street railway and transfers are accepted by the rail system.

Before the inception of the Kentucky Coach Company there were thirteen independent buses operating in the City of Lexington in competition with the city cars, and present bus operation parallels part of city car operations.

TABLE V—TRACK AND ROADWAY MAINTENANCE COST AND STATISTICAL DATA
ALL DIVISIONS

Year	1921	1922*	1923**	1924	1925	1926	1927	1928
Superintendence	$5,264.92	$4,918.67	$6,377.90	$7,136.80	$5,851.56	$6,792.62	$7,004.38	$6,935.06
Ballast	1,094.32	849.21	1,434.32	1,558.10	173.92	421.91	243.08	614.25
Ties	25,619.88	24,264.11	8,288.90	16,443.65	12,861.64	9,061.69	13,029.33	11,135.52
Rails and rail fastenings	2,279.28	2,617.19	3,148.60	691.54	819.91	985.30	1,425.35	271.76
Special work	2,250.24	5,853.64	443.61	3,556.34	1,056.54	947.84	2,667.19	859.42
Track and roadway labor	27,066.89	25,005.85	27,857.16	26,528.41	23,742.38	19,286.88	24,968.34	20,346.39
Paving	5,703.11	4,851.01	10,286.72	10,093.71	9,457.13	2,483.93	3,163.59	3,464.35
Miscellaneous expenses, including sanding, removing snow, etc	6,620.52	8,159.82	6,305.63	7,605.46	6,943.34	6,471.02	4,754.72	3,658.09
Bridges, trestles, culverts, crossings, etc	2,581.79	2,959.87	7,436.54	8,760.47	3,928.80	4,301.10	3,613.01	2,269.48
Total	$78,480.95	$79,479.36	$71,519.38	$82,364.48	$64,835.22	$50,752.29	$60,868.99	$49,554.32
Per cent of gross revenue	11.9	14.3	11.9	13.6	11.1	8.5	10.3	8.6
Car-miles operated	1,619,090	1,750,197	1,922,051	1,930,137	2,025,674	2,214,062	2,251,170	2,228,612
Maintenance cost per car-mile operated	$0.049	$0.045	$0.037	$0.042	$0.032	$0.023	$0.027	$0.023
Number of miles of track	93.79	91.33	83.69	89.35	89.35	89.33	89.33	89.33
Total cost per mile of track maintained	$836.77	$870.24	$854.57	$921.81	$725.63	$568.14	$681.40	$554.73
Total car and passenter ton-miles of tare	38,178,884	33,142,318	25,824,807	20,766,743	21,318,600	23,406,211	23,746,784	23,484,862
Number of ties used	28,466	20,562	6,973	13,261	9,893	6,663	10,022	8,593
Cost per tie	$0.90	$1.18	$1.18	$1.24	$1.30	$1.36	$1.30	$1.30
Cost of ties based on present market value of $1.30	$37,005.80	$26,730.60	$9,064.90	$17,239.30	$12,861.64	$9,061.69	$13,029.33	$11,171.03
Miles of paved single track	18.70	18.70	18.70	18.70	18.70	18.70	18.70	18.70

*First year light-weight interurban equipment. **First year light-weight city equipment.

TABLE VI—SIX YEAR COMPARATIVE ACCIDENT STATEMENT COVERING COLLISION ACCIDENTS, PEDESTRIAN, VEHICLE AND STOCK

Interurban	1923 Straight Air	1924 Straight Air	1925 Straight Air	Average 1924–1925 Straight Air	1926 Seven Months Straight Five Months Air Magnetic	1927 Air Magnetic	1928 Air Magnetic	Average 1927–1928 Air Magnetic	Per Cent Increase or Decrease Average Years 1924–1925 Compared With 1927–1928
Miles operated	846,950	853,242	945,181	899,211	1,061,929	1,090,183	994,018	1,042,100	15.8
Number of accidents	66	71	90	80	94	58	67	62	*22.5*
Amount of money spent for claims	$9,577.01	$7,131.43	$5,208.12	$6,169.77	$3,960.61	$2,272.40	$2,711.64	$2,492.02	*59.6*
Average cost per accident	145.10	100.44	57.86	79.15	42.13	39.10	40.47	39.78	*49.7*
Miles per accident	12,832	12,017	10,502	11,259	11,297	18,796	14,836	16,906	50.1
Speed, miles per hour	18.8	19.3	19.6	19.4	20.2	20.2	20.2	20.2	4.1

Combined Cities	Seven Months Hand Brake Five Months Straight Air	Straight Air	Straight Air	Average 1924–1925 Straight Air	1926 Eleven Months Straight Air One Month Air Magnetic	Air Magnetic	Air Magnetic	Average 1927–1928 Air Magnetic	Per Cent Increase or Decrease
Miles operated	1,076,668	1,085,317	1,134,446	1,109,881	1,174,017	1,171,457	1,113,571	1,142,514	29.4
Number of accidents	365	306	262	284	291	264	231	247	*13.0*
Amount of money spent for claims	$3,468.88	$3,424.10	$7,293.84	$5,358.97	$4,049.63	$963.74	$1,727.80	$1,332.27	*75.1*
Average cost per accident	9.50	11.18	27.83	19.50	13.91	3.54	7.48	5.51	*71.7*
Miles per accident	2,949	3,546	4,330	3,938	4,034	4,391	4,825	4,608	17.1
Speed, miles per hour	7.7	8.2	8.0	8.1	8.6	8.8	9.0	8.9	9.8
Automobile registration	.....	9,485	10,577	10,031	11,534	12,350	13,472	12,911	28.6

Actual money saved on collision accidents 1927–1928, two full years operation with magnetic brakes, as against 1924-1925 without magnetic brakes	$15,408.91
Estimated number of applications per annum based on check made September and October, 1927, which indicate an average of 1½ applications per car per day based on 30-car operation	14,604
Estimated number of accidents prevented by use of the magnetic brake as reported by operators for 1927	125
Estimated number of accidents prevented by use of the magnetic brake as reported by operators for 1928	197
Actual decrease in front-end accidents in two years' comparison	109
Estimated reduction total	431

The total maximum cost of any one accident in the past five years was $1,250.

reduced from an average of 20.9 cents for the old equipment, to 15.8 cents average over the five-year period with new cars, or a net reduction of 24.4 per cent. All operations in this comparison, both before and after the installation of new cars, were one-man. The net result of the investment in new cars has been (after deducting interest at the rate of 7½ per cent on the new cars) to increase the gross income 50.9 per cent over the five-year period, while at the same time permitting service to be increased 30.1 per cent. The net annual return on the investment in new cars was 22.6 per cent. It seems quite obvious, therefore, that the investment in new equipment was amply justified.

But even the summary given in Table III does not tell the whole story of the showing made by the new equipment. During the five-year period of operation with new cars, severe jitney competition developed in Lexington. This was accompanied and followed by 5-cent, at random, bus competition, paralleling the rail lines in the city and running to points beyond. In 1925 this was cleaned up through the installation by our company of a modern bus system, which now operates approximately 766,000 miles per year and carries more than 1,800,000 passengers. Much of this operation is in the direct territory of the railway, while some of the routes reach into areas beyond the rail lines. The important fact, in considering the question of the results accomplished with new cars on the railway, is that although the bus system has built up new business of its own, a considerable portion of its traffic is directly competitive with the railway lines. A summary of the bus operations is presented in Table IV.

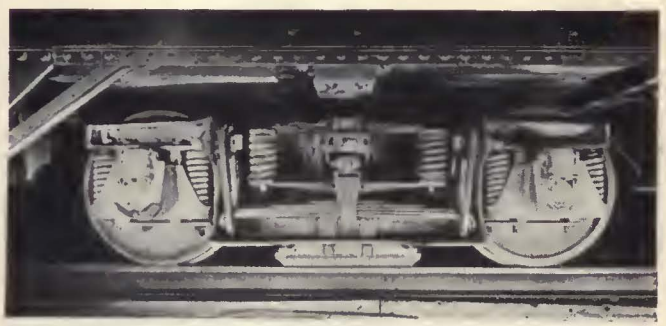
Track Life Extended and Maintenance Reduced

Still another phase of the experience on this property seems worthy of particular note. In all studies of the possible economies to be expected through the purchase of modern light-weight equipment, the factor of track life and track maintenance are major items upon which it is extremely difficult to make even approximate estimates. Our experience, therefore, extending as it does over a period of more than five years with a complete replacement of cars, helps to throw additional light on the possibilities for track economies through the operation of light-weight equipment. In our particular situation, covering all the depreciable values in the track and roadway department, we estimate that the substitution of lighter cars has extended the life of this structure 50 per cent. We value this property—rail fastening, special work, bridged ties and paving (all the actual depreciable property in the track and roadway department)—at $1,083,000. Based on these values we estimate that the reduction in depreciation amounts to $18,058 per year, which would be properly creditable to the return on the investment in new cars.

Table V gives a summary of the total track and roadway maintenance on this property for the past eight years, and also certain statistical facts with respect to the track department. The figures include all divisions, both interurban and city lines. They are set up to show the year 1921, the last year in which operation was entirely with old equipment. In 1922 the interurban cars were changed, and in 1923 new cars were operated on the city lines as well. For the remaining five years, 1924 to 1928 inclusive, all operations were with new equipment. The statement indicates a reduction of approximately $20,000 per year in the total expenses of this department. Of this amount, our organization estimates that the direct economy which may properly be credited to the light-weight equipment is slightly more than $15,000 per year, or approximately 5 per cent on our total car investment of $306,999.

Track Saving Alone Justifies Investment

Adding together the amount creditable because of increased life of track through decreased wear and tear with light-weight equipment, and the direct reduction in maintenance cost, the total saving is approximately $33,000 per year, or 10.7 per cent on the cost of the new cars. On the basis of a permanent property, therefore, the investment in new cars is justified by the figures for track economies alone. The facts of outstanding interest in Table V are not only the reduction in total cost, but in the track cost per car-mile operated, which is about half the former figure. The ton-mile information given is approximate only, but on the basis shown represents about a 40 per cent decrease despite considerably increased car mileage. The costs for maintenance per mile of track during the latter periods shown in Table V —with increased age of the structure—in comparison with earlier years, seem of particular interest and significance.



New trucks built by the Cincinnati Car Company, are designed so that the air-magnetic track brake is carried between the wheels

One feature of the equipment on both interurban and city cars on this property is of enough special interest to seem worthy of particular mention. This is the success achieved in the reduction of accidents and accident costs after more than two complete years of experience with a special auxiliary magnetic track brake which was applied to all of our new cars during the year 1926. The development of the equipment followed continuous and persistent though vain efforts to reduce the number of accidents and the accident liability on the property. We finally came to the conclusion that there was need for some more positive means of stopping cars in an emergency than that afforded by the conventional air brake. After considerable study, and in collaboration with the engineers of the Cincinnati Car Company and the General Electric Company, there was perfected a special type of air-magnetic track brake which gives the motorman of a car marginal braking capacity, in the event of emergency, 30 per cent to 35 per cent above that of his air brakes alone, regardless of rail conditions.

Full details of this equipment were given in an article in the July 17, 1926, number of Electric Railway Journal. Our pupose in this development was primarily that of reducing accidents—fulfilling to the limit of our ability a moral obligation to the public and to our passengers. In addition to this humanitarian objective was the desire to reduce the cost and losses which invariably result from accidents regardless of where the actual

TABLE VII—COST OF INSTALLATION, MAINTENANCE, OPERATION AND DEPRECIATION AIR-MAGNETIC BRAKES

Installed 53 equipments May 17,1926, completed Dec. 26, 1926

Investment cost installed	$26,602.43
7 per cent on capital investment (two years 1927-1928)	3,724.34
4 per cent depreciation on magnetic brakes (two years 1927-1928)	2,128.20
Increase maintenance cost of air and magnetic brake equipment for years 1927-1928 over straight air-brake equipment year 1926	376.42
Total	$6,228.96
Total savings on collision accidents (years 1927-1928 over years 1924-1925)	15,408.91
Total maintenance depreciation and interest	6,228.96
Total savings after interest and depreciation charges	$9,179.95
Actual return on magnetic brake investment without crediting saving for 431 accidents that may have been prevented, per cent	48.5

responsibility lies. After two years of experience with all cars equipped with this device, there is presented in Table VI a five-year record of accident statistics and costs for the property.

Table VI shows large reductions in the number of front-end accidents following the installation of the track brakes in 1926. It shows, in addition, reduction of accident costs on both the interurban and city lines. These results were achieved despite increases of 15.8 per cent in car mileage operated on the interurban and 29.4 per cent on the city property. At the same time there was an increase of 28.6 per cent in the number of motor vehicle licenses issued in this immediate territory. The record shows an actual reduction of 109 accidents from collision with pedestrians or vehicles. In addition, motormen's reports indicate 322 collision accidents prevented through the use of the magnetic track brakes in emergency.

A summary of the actual financial results of the installation of this special brake equipment is given in Table VII. Briefly, the total cost represented an investment of $26,602. After deducting all charges we figure that this installation has actually earned a return of 48½ per cent in the direct reduction of accident cost, without attempting to assign any monetary value to the prevention of 431 collisions or potential collisions. No allowance is made in these figures for the saving in catastrophe insurance. Entirely on the basis of the performance of this brake equipment, the insurance companies have made a reduction in the rate for catastrophe insurance applicable to this property from $2 to $1.40 per $1,000 of revenue.

Because this equipment was designed and installed on our cars after they had been in service for several years, it was necessary to carry the brake on an outrigger on the double-truck cars. On a new car installation today, the brake can be included in the original design of the trucks, making a more satisfactory installation and reducing the cost considerably. Nevertheless, with only minor changes and improvements, the design as originally worked out for the Lexington property has proved entirely successful mechanically and has not materially increased maintenance costs. Total air-brake maintenance in 1926 was $2,538. With the auxiliary track brakes installed and in operation during 1927, the cost of all brake maintenance was $2,680. In 1928, total brake maintenance costs were $2,773, the increase of $235 being almost entirely accounted for by a damage cost of $153 resulting from a motor vehicle running into the side of a car.

An important maintenance feature resulting from the use of the track brakes is the almost total elimination of flat wheels and the increase of mileage obtained from wheels on both interurban and city equipment.

As used on this property, the track brake is used wholly as an auxiliary brake. Judging from a check which we made in 1927, it is estimated that the average number of applications per year will run between 14,000 and 15,000. In our practice there is no restriction on the use of the magnetic brake.

Twelve light-weight double-truck interurban cars and 27 single truck city cars replaced all of the equipment formerly in service. This represented an investment of $306,999. In addition, a modern bus service was developed to replace former jitneys

Short Signal Cycles

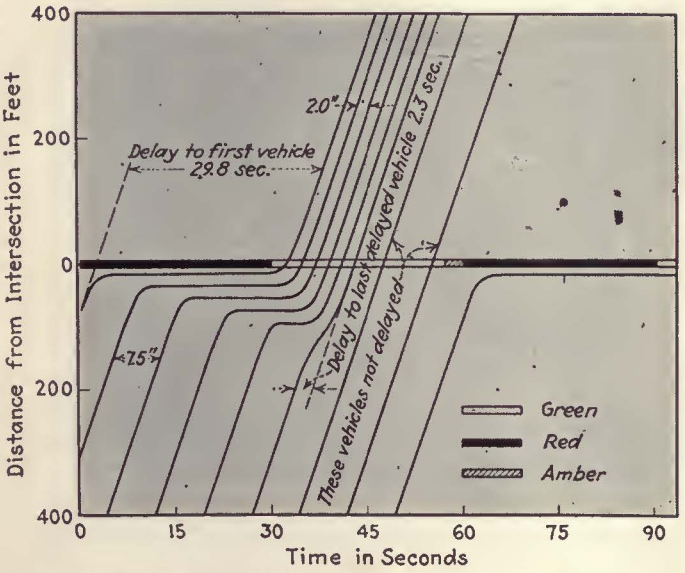
SPEED UP TRAFFIC

By

HAWLEY S. SIMPSON

Traffic Engineer, Essex County, N. J.

EXPERIENCE with automatic signals has demonstrated many inherent inefficiencies, and much attention is now being directed to the economics of traffic movement at the intersection, which constitutes the critical point of any street system. Through this area passes twice the traffic per lane which approaches on the intersecting streets, and it thus becomes absolutely essential that the most efficient movement of traffic at such points be obtained if traffic stagnation is to be forestalled. One of the greatest, yet most common, extravagances in modern road construction is to invest large sums in super-wide highways, while allowing traffic to be throttled in a "bottleneck" at every important intersection. In general it has been found that the shortest interval which will permit pedestrian traffic to cross with ease is the most efficient interval.



Vehicular movement at street intersection equipped with automatic signals, showing effect of signals in reducing intervals between vehicles—assumed conditions 480 vehicles per hour moving at 20 m.p.h.; signal cycle, red 30 seconds, amber 3 seconds and green 27 seconds

To obtain the maximum efficiency of traffic movement every heavy traffic intersection should be studied with the view to determining whether traffic signals should or should not be used, or whether the grades should be separated. If traffic signals are considered, it can in general be stated that but two factors should be analyzed and two questions answered, namely:

1. Will the installation reduce the accident toll?

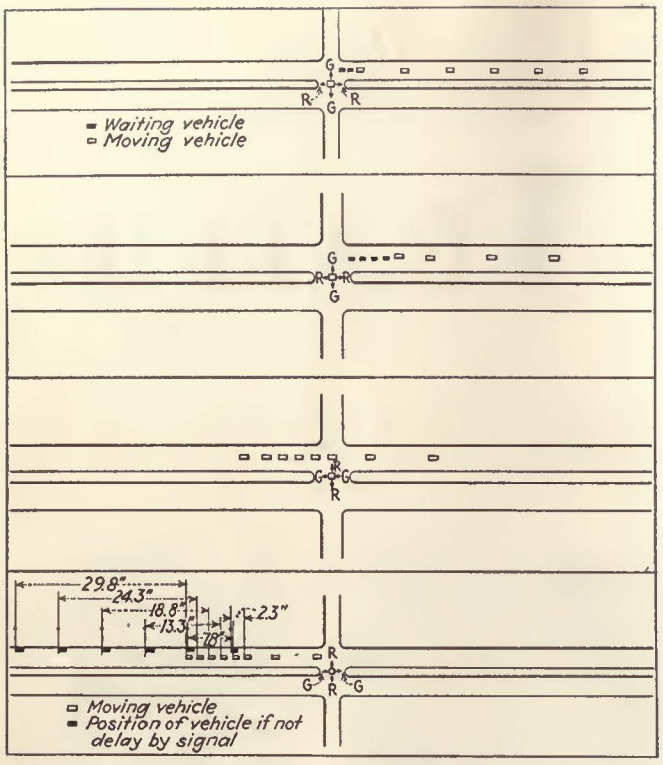
2. Will the installation reduce the volume of vehicular delays below that experienced without traffic signal control?

The first question would receive a negative answer from many engineers in instances where traffic volume is not heavy. Accident records of intersections where the hazard increased materially following traffic signal installation, often show the hazard returning to pre-signal level after the signal's removal. An analysis by the writer of accidents at 52 intersections in twelve municipalities in New Jersey showed an accident reduction of about 35 per cent following automatic signal installation when traffic through the intersection exceeded an average of 1,000 vehicles per hour from 8 a.m. to 6 p.m. But when traffic was below an average of 800 vehicles per hour the analysis indicated that automatic signals were not effective in reducing the number of accidents.

Mathematical analyses made recently of automatic traffic signals installed and operated at intersections of light traffic volume have shown unwarranted vehicular delays. Therefore, before a signal installation is decided upon, a careful study of the probable effect of a traffic signal on both the accident situation and the traffic flow should be made. When this is done, and it is determined that signals are economically warranted, the further question arises as to what would be the most efficient cycle.

Vehicular movement can be expedited to a marked degree by the proper selection of time cycles of automatic traffic signals. It has been found that the most efficient time interval is the shortest interval that will allow pedestrian traffic to cross the street with ease.

In progressive signal systems, the length of the cycle is quite rigidly indicated by the distance between the signalized intersection and the vehicle speeds to be maintained. At isolated intersections and in synchronous systems the length of cycle may range between wide limits. Cycles now used vary from a minimum of about 40 seconds to a maximum of 180 seconds.



Spacing of vehicles before and after passing through signaled intersection, showing delays caused by operation of signals

In order to determine the relative efficiency of various length cycles, the writer has developed formulas from which the accompanying graphs are drawn, and which may be used to determine the theoretical average minimum delay at an isolated signalized intersection under any condition of traffic volume or cycle. Briefly stated, the formulas sum up the delays to each individual vehicle, thus arriving at the total intersection delay. More specifically, the delay to the first vehicle arriving on the stop signal equals the red period, plus a portion of the preceding amber period, plus an acceleration loss, minus a variable to account for the average condition of arrival at the intersection. The delay to succeeding vehicles will always equal the delay of the preceding vehicle minus the difference in time spacing between arriving and leaving vehicles, or 7.5 seconds and 2.0 seconds, respectively, as shown on the chart on page 765. The delay to all vehicles will equal the sum of the delays to the first and last delayed vehicle multiplied by one-half the number of delayed vehicles.

These facts may be readily understood by an examination of this chart, which shows the detailed delays to each vehicle in one lane on one street with an average movement of 480 vehicles per hour. Under the conditions assumed, eight vehicles will pass in each lane in one signal cycle. Of these eight, five will come to a full stop and one will be required to slow down, the delays ranging from 29.8 seconds to 2.3 seconds and totaling 96.3 seconds. Only two vehicles will not be delayed. A series of charts on this page shows the same conditions with vehicles on only one side of the main thoroughfare. The first shows the position of the eight vehicles 15 seconds after the beginning of the display of the red signal, two of the vehicles already having stopped, one slowing down and five approaching. The second shows their position at the end of the red period and the beginning of the green period, four vehicles stopped, one practically stopped and three approaching. These vehicles immediately begin to move and at the end of 15 seconds of the green period all vehicles are in motion, as shown on the third chart, but in the meantime the fifth car has had to stop and the sixth slow down due to the necessity for the first four to accelerate and space themselves at a safe distance.

The fourth chart shows the position of the eight cars, all moving, at the end of the green period. There is also shown the position which the first six cars would have had if there had been no signal at the intersection. The delay to each is shown in seconds, the sum equalling 96.3 seconds.

Incidentally, this figure also demonstrates one of the reasons why signals increase the efficiency of the street system when traffic is heavy. The six delayed vehicles occupied 1,320 ft. of street space when approaching the intersection at 20 miles per hour and required 45 seconds to pass any point. The grouping effect of the signal resulted in the cars being more closely spaced on leaving the intersection, occupying only about 352 lineal ft. of street space, and requiring only 12 seconds to pass a point; an increase in efficiency which warrants the delays imposed when the volume of cross traffic demands it.

A comparison of the relative volumes of delays per hour produced by various length cycles with varying traffic volumes is presented in the chart on page 767. The statistics are computed for only one lane in one direction under the special condition noted in the title of the chart. The total delays for one hour at an intersection may be computed by scaling the delays to each lane from the diagram, provided the cycle is divided evenly between red and green. The same relative increase in delays when long cycles are used will occur regardless of the proportions into which the cycle is divided.

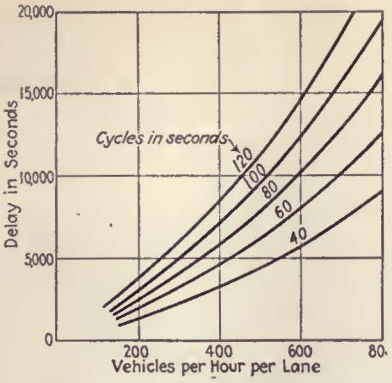
In order to determine the probable accuracy of the formulas and assumptions, field surveys were analyzed by W. B. Powell, consulting engineer, Buffalo, at three signalized intersections. The computed delays using the above mentioned formulas varied from the observed delays by less than two and one-half per cent. Mr. Powell concluded that traffic volume did not warrant traffic signal operation which fact is amply supported by the statistics, while a detailed study of the cycles used gave the following additional conclusions:

1. The cycles were badly proportioned between red and green.
2. The lengths of cycle were somewhat excessive (70, 75 and 80 seconds).
3. The amber period for such light traffic should have been three seconds, rather than five seconds.

If the same length cycles had been proportioned so that the green periods were proportional to the traffic—but no period less than 20 seconds—the delays would have been reduced to 75 per cent of that observed. If a 60 second cycle had been used allowing 40 seconds green on the main street, 20 seconds on the cross street and a three second amber, the delays would have been further reduced to 61 per cent of the actual delay, but the delay to main street traffic would have been somewhat higher in proportion and such a change might not have been justified. This is a very practical illustration of the economic losses due to the unnecessary use of signals in combination with careless or unstudied regulation of the timing.

The conclusion from this study is the evident efficiency of the use of the shorter cycles. The reasons are

apparent by study of the charts. When vehicles are stopped and waiting at the intersection and are ready to proceed at the capacity spacing, it becomes uneconomical to use the cross street for vehicles moving at greater spacings. This conclusion might be carried to the extreme, and cycles of a few seconds selected as most efficient, but such reasoning must be tempered with judgment, and consideration given to the rights of pedestrians. The green period must be sufficiently long to permit a group of pedestrians to cross the highway without vehicular interference. An average speed of pedestrian travel may be taken as 5 ft. per second, fixing 12 seconds as the time required to cross a 60-ft. pavement. There must be allowed some clearance to permit more than one pedestrian to make the crossing and to allow for vehicular interference from turns. This allowance may be assumed as 8 seconds, fixing the minimum practical length of the green period at 20 seconds.



Total delays per hour with various lengths of signal cycle — assumed conditions; red is half the total length of cycle and amber is 3 seconds

Another and by no means unimportant argument favoring the shorter cycles is introduced by consideration of another element of the pedestrian problem. With very long cycles, as in New York City, the pedestrian cannot be expected or even forced to wait at the curb, as was recently tried, until the green light appears, but will attempt to thread his way through heavy moving traffic, with an attendant increase in accident hazard, and a reduction in the efficiency of the intersection brought about by the unregulated conflict between pedestrians and vehicles simultaneously attempting to move at right angles to each other. Shorter cycles have been found to be productive of greater pedestrian observance of traffic signals with the attendant benefits.

In conclusion, it is apparent that the use of automatic signals cannot but produce delays totaling many vehicle hours per day, in some cases absolutely without necessity, but where studies prove the economic advisability of the use of signals, analyses should be made to determine the shortest and the most efficient cycle that will be practicable.

Third Regional Meeting Held at Boston

BASIC problems facing the electric railway industry were discussed at the third regional conference held at Boston, Mass., on July 10 under the auspices of the Advisory Council. About 40 electric railway executives from the New England territory attended the meeting. This was the third regional conference of this type, the first having been held in San Francisco in February and the second in St. Louis in April.

At the outset of the meeting J. N. Shannahan, chairman of the Advisory Council, announced the selection of Charles Gordon, editor of ELECTRIC RAILWAY JOURNAL, to be managing director of the American Electric Railway Association to fill the vacancy created by the resignation of Lucius S. Storrs. The chairman then called upon Mr. Gordon to give his views on the problems confronting the industry. According to Mr. Gordon there is no panacea for the troubles of the electric railways. He pointed out the need for arousing the interest of business men in the problems of local transportation by stressing the relation between transportation and business development and property values. In conclusion Mr. Gordon expressed his abiding faith in the industry and predicted substantial future development.

During the discussion it was emphasized that every effort should be made to arouse business men to realize they have a vital interest in the successful operation of their local transportation systems. The public does not understand the situation because too many railway managements have been inarticulate. Fundamentally the public is even more interested in the soundness of its transportation than the security holders themselves, according to Mr. Shannahan. When the public is properly informed its attitude may be counted upon to be fair. As a result of the work of the management at Omaha, an extremely unfavorable situation has been completely changed during the past two years and the company restored to favor with the public. His experience there convinced him that other similar situations can be successfully worked out if approached in the right way.

Edward Dana, general manager of the Boston Elevated Railway, said that while the total annual traffic on the system shows a slight decline, the weekday traffic has increased. This presents a serious problem, but does not indicate any decreasing need for public transportation service. He emphasized the need for rapid transit extension. C. V. Wood, president of the railways in Springfield and Worcester, pointed out that transportation must be made more salable by being made attractive. Speed is the most important factor. In 1863 the average speed of the Worcester Street Railway was approximately 8 m.p.h. It is not much better today. Special attention should be given to increasing the speed of operation.

To improve its position materially an electric railway must select a definite objective, according to George Clifford, division manager of Stone & Webster. He cited examples among the Stone & Webster properties to show results when this principle is followed. The human element is important. Employees should be educated to know their business and to make favorable contacts with the public. Prof. A. S. Richey also stressed the importance of securing co-operation from platform men.

Considerable discussion centered around the subject of taxicab operation. Elton S. Wilde, president of the Union Street Railway, New Bedford, expressed the opinion that regulation of taxicabs is highly desirable.

When this is done it may become expedient for the electric railways to enter this field. Henry Page, general manager of the Worcester Consolidated Street Railway, discussed the taxi situation in Worcester and emphasized the need of regulation, as did several other speakers.

W. B. Spencer, executive assistant United Electric Railways, Providence, suggested that this industry would do well to undertake an extensive advertising campaign to popularize its product. A. J. Boardman, general manager Eastern Massachusetts Street Railway, discussed the need for greater co-ordinated effort among the companies. Fred Gordon, general manager Cumberland County Power & Light Company; O. M. Lord, vice-president York Utilities Company, and A. D. Kendrigan, general manager Manchester Street Railway, all discussed problems confronting their companies.

National Motor Bus Division Reorganized

REORGANIZATION of the National Motor Bus Division was the outstanding result of the third annual meeting held at Buffalo on July 1 and 2. A. M. Hill, chairman, recommended that the work for the ensuing year should be primarily aimed at development of accurate and useful information on the tax situation affecting the industry throughout the country. Upon his suggestion, a special committee was appointed which was given responsibility for co-operating with other agencies working on the same problem. It was recommended also to have all state regulatory bus laws codified in index reference volumes. This was prompted by the fact that many members of the division are operating across state lines or connecting with other interstate operations. This creates a real need for up-to-date information on the status of state regulations.

The opinion was advanced that highway transportation should be regulated on its own merits, without regard to its effect on other forms, because trouble on the highway is increasing and the effect of bus traffic on the railroad is slight and is steadily growing less. It was stated that it was fortunate that the interstate bus bill failed of passage at the last session of Congress, because the power to regulate interstate commerce rests only with Congress and should not be delegated to the state, as was provided in the bill.

In a report submitted by the legislative committee it was said that while interstate legislation had been the outstanding problem, state regulations had also received a great deal of attention. State bus associations, state legislatures and regulatory authorities have received assistance in the preparation of laws and regulations. It is believed that this work will help establish uniformity in state regulatory practice.

Trailer buses are receiving more attention than in the past. They will double passenger capacity with but slight increase in the maintenance requirements, it was said. The possibilities of light-weight metals in reducing heavy weight are illustrated in a new seat developed for airplane service by the Aluminum Company of America. This is 40 in. wide and weighs only 24 lb., complete with upholstery. It was stated that the design might have to be made stronger and, therefore, heavier for bus application, but even then it was thought that the weight could be reduced approximately 50 per cent.

San Francisco Chosen for 1930 Convention

THAT the 49th annual convention of the American Electric Railway Association will be held at San Francisco, Cal., was decided at a meeting of the executive committee on July 12. The desirability of holding a convention on the Pacific Coast has been under discussion for several years, and it was felt that it would be particularly appropriate to hold it there next year. The exact date of the 49th convention was not fixed by the committee, but it was decided that it should be held some time in June. This departure from the usual practice of holding the convention during the early fall was made in order to permit delegates attending the railway convention to attend also the annual convention of the National Electric Light Association, which will be held at San Francisco in June. Whether the A.E.R.A. convention will be held immediately before or immediately after that of the N.E.L.A. was not decided.

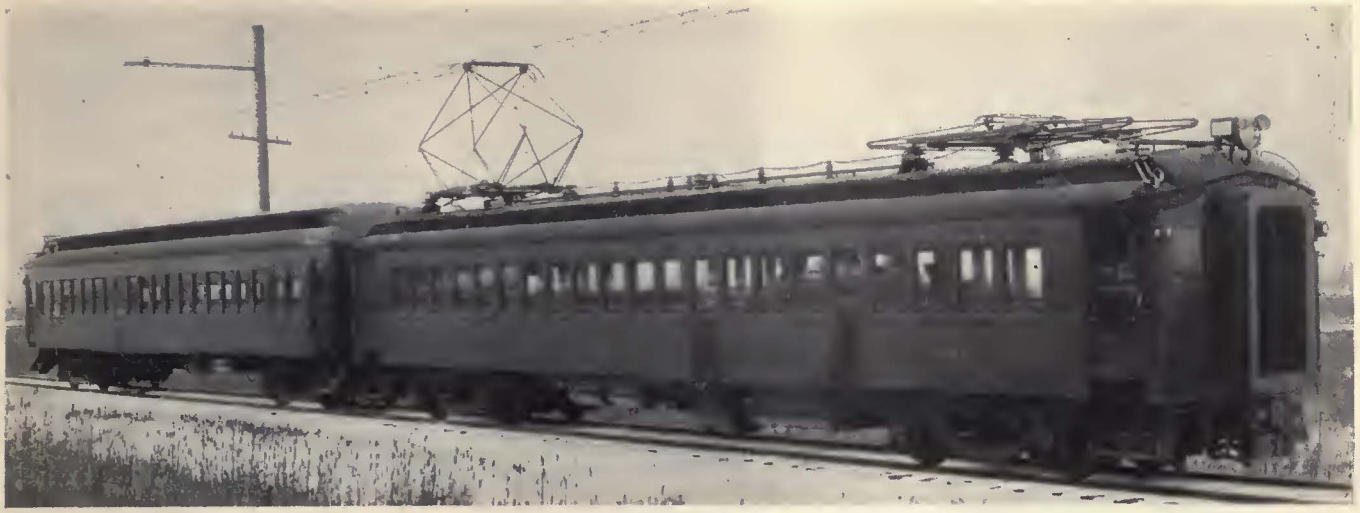
In accordance with the custom that has been followed for some years past, the meeting of the executive committee was held on board the steam yacht *Florida*, belonging to Barron Collier. In the absence of the president and the first vice-president of the association, J. H. Hanna, second vice-president, presided. J. N. Shannahan, chairman of the Advisory Council, announced the selection of Charles Gordon, editor of ELECTRIC RAILWAY JOURNAL, as managing director of the association. The appointment was formally made and approved by the committee. Mr. Gordon expressed his appreciation and spoke of the wonderful opportunity of leadership in an industry with an investment of $6,000,000,000.

At the outset of the meeting, J. W. Welsh, general secretary, announced that he had been offered a position with the Cleveland Railway which he desired to accept. The suggestion had first been made a long time ago, he explained, but he had felt that he could not consider it at the time when the association was without a managing director. Since the selection of a new managing director by the Advisory Council, he felt free to accept the offer of the Cleveland Railway and submitted his resignation to take effect Sept. 1. Mr. Welsh's resignation was accepted with regret by the executive committee, and a special committee was appointed to prepare a statement of appreciation for the services he has rendered the association during his tenure of office.

Routine reports were presented by numerous committees. An interesting discussion occurred concerning the appointment of a committee on fare research. It was the consensus of opinion that such a committee could render the industry an important service.

For officers during the coming year the nominating committee made recommendations as follows: President, Paul Shoup, Pacific Electric Railway; first vice-president, J. H. Hanna, Capital Traction Company; second vice-president, C. E. Morgan, West Penn Railways; third vice-president, G. A. Richardson, Chicago Surface Lines; fourth vice-president, J. H. Alexander, Cleveland Railway; treasurer, Barron Collier.

To fill the vacancies in the executive committee effective to the end of the association year, the nominating committee recommended W. H. Wood, president Virginia Electric & Power Company, to fill the unexpired term of J. H. Alexander, and Thomas Conway, Jr., president Cincinnati, Hamilton & Dayton Railway, to fill the term of D. W. Snyder.



A sample two-car unit for the Lackawanna electrification on the test track

Lackawanna Electrification

Plans Completed

General plans for this 160-mile suburban electrification are complete and contracts are being let for the equipment and construction. Multiple-unit trains will give suburban service on the Morristown line from Hoboken to Dover and on the branches to Montclair and Gladstone

PLANS for the electrification of the Lackawanna Railroad between the Hoboken, N. J., terminal and Dover via Morristown, as well as the branches to Gladstone and Montclair, now are virtually complete. The main line from Hoboken has three tracks as far as Millburn and two tracks from there to Dover. The Montclair branch has two tracks all the way from the Roseville Avenue junction, while the Gladstone branch from Summit to Gladstone is a single-track line. The entire project involves 70 miles of route and 160 miles of single track, including main track, yards and sidings. While many details remain to be worked out, bids for the major parts of the work, such as the overhead construction, the cars and the substations, will soon be taken and contracts will be let in the very near future.

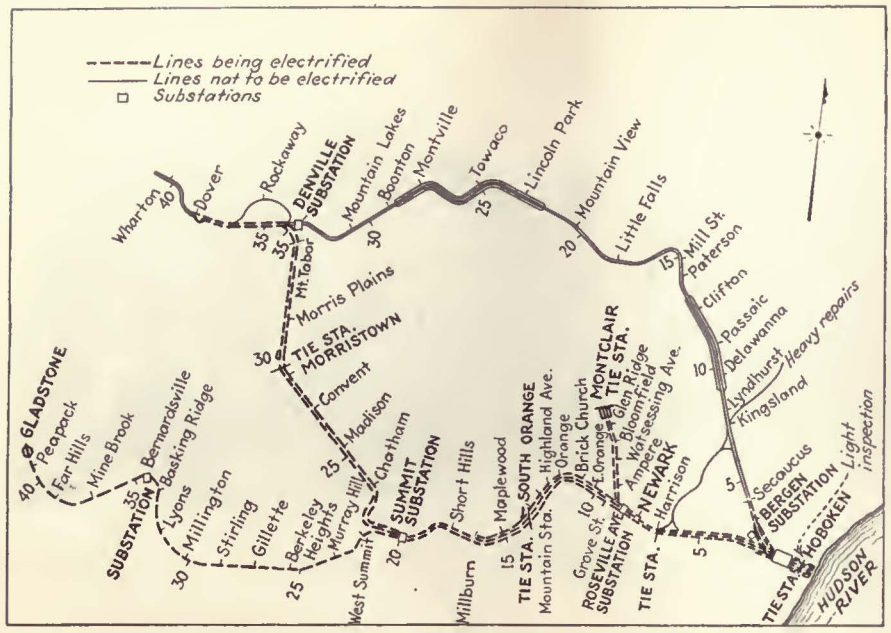
The engineering work is being done by Jackson & Moreland, engineers of Boston, Mass., under the direction of G. J. Ray, chief engineer D. L. & W. Railroad.

The immediate electrification will be confined to the suburban trains within the zone mentioned above. These will be operated with multiple-unit cars, arranged in permanent groups of two, a motor and a trailer, which can be coupled to form trains of two, four, six, eight, ten, or twelve cars. Certain heavy freight trains will also be handled between Secaucus and Hoboken freight yards by electric power.

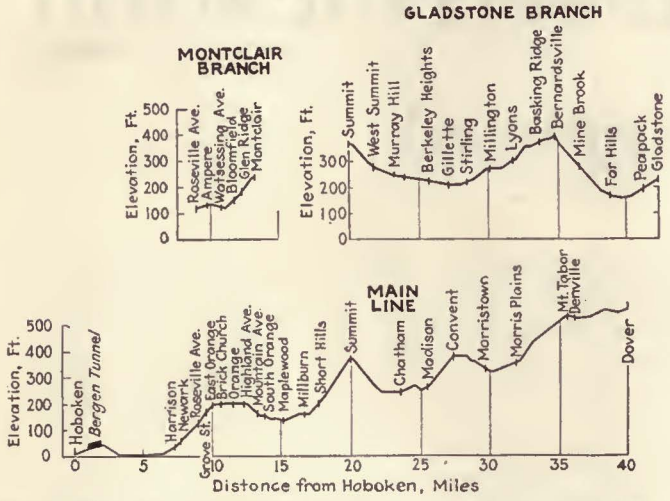
All of the 141 motor cars required for the service will be purchased new. They will be 71 ft. long over bumpers. The trailers with which they will be coupled to form the two-car units are at present in steam service in the suburban district. Sixty, including ten combination cars, are of the so-called low-roof type. They are practically identical in general design and appearance with the motor cars to be ordered. The remainder are of the high-roof type, and include 71 coaches, five combination smoker-baggage cars and five club cars. These cars are all of modern, all-steel construction. The motor cars will weigh 148,000 lb. complete with electrical equipment, and the trailers 113,000 lb., making the weight of a complete unit 261,000 lb., excluding passengers. Each motor car seats 84, and the trailer coaches seat 78 or 82, making a total of 162 or 166 for the unit.

Each unit will be semi-permanently joined with MCB type couplers. All operating electrical equipment will be carried on the motor car, and current for the lights and heaters on the trailers will be carried through jumpers between the ends of the cars. Connections between units will carry the control circuits only, and will be made through jumpers. Each two-car unit will have a motorman's control station at each outside end only. Connection with the contact system will be made through two pantographs which are mounted on the motor car.

Each motor car will be equipped with four motors having a one-hour rating of 230 hp. at 1,500 volts. Pairs of motors will be connected permanently in series, and the pairs will be handled with series-parallel control. A feature of the equipment is that the motors will



This map shows the Lackawanna electrification. Figures are miles from Hoboken. Power will be transformed to 3,000 volts d.c. in five rectifier substations



The profile is irregular, there being a rise of more than 500 ft. from the Hoboken terminal to Dover on the main line

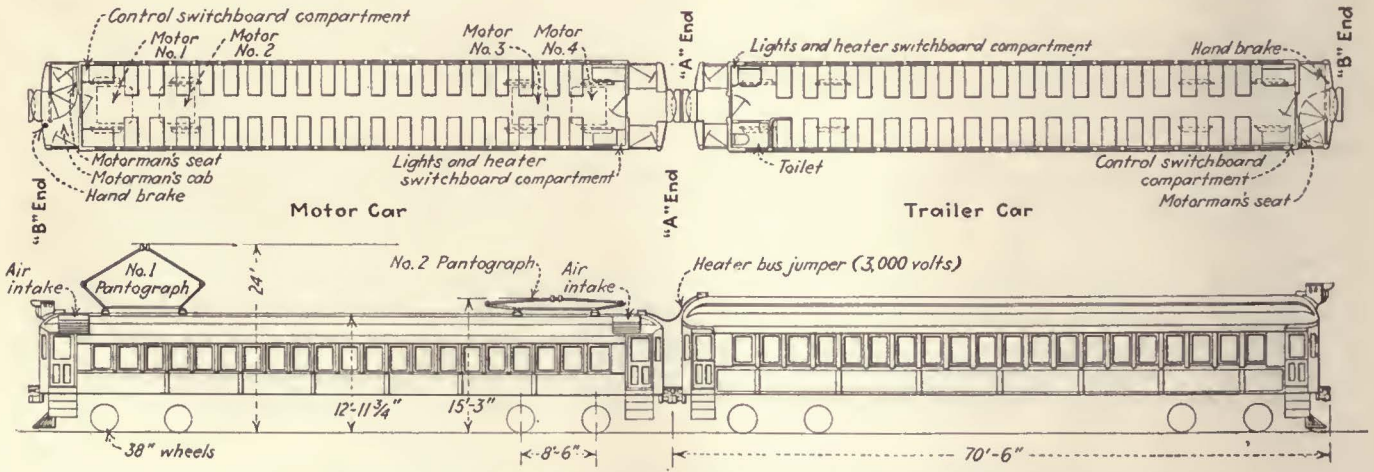
be self-ventilated, the cooling air being taken from the roof of the car at either end, and led to the motors through suitable ducts.

The motor control will be of the multiple-unit, electro-pneumatic type, the magnet valves being actuated with storage battery current. Acceleration will be automatic, although an optional hand control of acceleration is possible. The automatic acceleration has been designed for a rate of 1.5 m.p.h.p.s. with a six-car train. Braking will be at the rate of 1.75 m.p.h.p.s.

Current for the control and for the car lighting will be taken from an auxiliary circuit supplied by a generator forming part of the dynamotor, with a storage battery in parallel, the battery also being charged from this generator. The dynamotor has two 1,500-volt windings with commutators in series. It supplies power from a tap at the mid-point for the 1,500-volt air compressor. The separate generator armature on the same shaft supplies 40 to 50 volts for the control, lighting and battery charging circuits.

The heating for all the cars will be by 3,000-volt current taken from the line. There will be 40 heaters in each car, each with two elements. These heater elements will be divided into two circuits, each circuit being connected across the 3,000 volts. The heat control will be thermostatic, the two circuits being connected and disconnected automatically as needed to maintain the desired temperature by means of auxiliary contactors.

The contact lines will be of the catenary type. For the two and three-track sections the wires will be supported on steel bridges. The vertical members will be steel beams of H section, carrying single cross-members. A few four-track sections will be supported with lattice girder bridges. On the Gladstone branch, which is single track, the overhead will be supported from brackets attached to wood poles. Typical construction is shown in the drawings reproduced. The normal spacing of the catenary structures is 300 ft., but this is varied to some extent to meet conditions, as at stations and on curves. Each of the bridges will be supported by concrete footings. These are being placed at the present time. On the meadows, where the ground is little if any above



Trains will be made up of units, each consisting of a motor car and a trailer semi-permanently coupled. The complete unit weighs 261,000 lb. and seats 162 or 166 passengers

TABLE I—LOCATION AND RATING OF SUBSTATIONS, LACKAWANNA RAILROAD ELECTRIFICATION

Substation	Rectifiers: Number of Units	Rectifiers: Capacity of Each, Kilowatts	Number of Transformers	Source of Supply: Volts	Source of Supply: Cycles	Source of Supply: Company
Bergen	3	3,000	3	13,200	60	Public Service Electric & Gas Company
Newark	4	3,000	4	26,400	60	Public Service Electric & Gas Company
Summit	2	3,000 (2 tanks)	2	66,000	60	Jersey Central Power & Light Company
Denville	2	3,000 (2 tanks)	2	33,000	60	New Jersey Power & Light Company
Bernardsville	2	2,000	2	33,000	60	New Jersey Power & Light Company

tidewater, it has been found necessary to sink piles in order to get a suitable foundation for the concrete footings.

The contact line on the main portion of the system will consist of two contact wires. These and the main and auxiliary messenger cables will be in parallel, with a total equivalent section of copper of 800,000 circ.mil. There will be two No. 0000 trolley wires throughout on the main line.

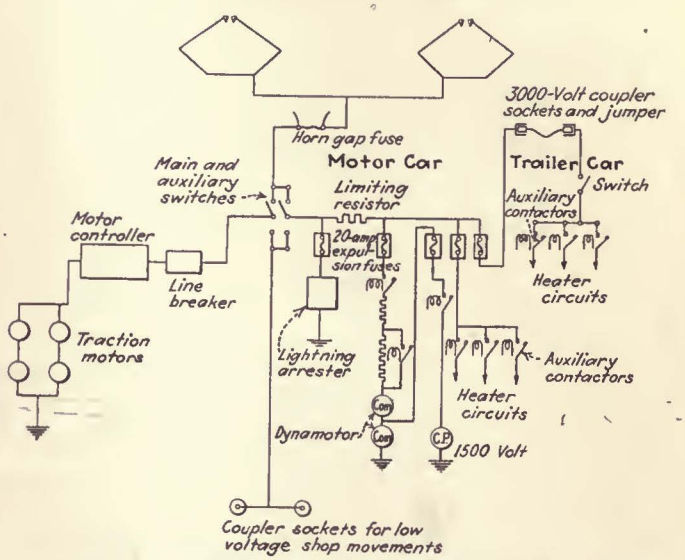
Normally the overhead system will all be tied in together through the substations and tie stations, but automatic switches will be provided that will isolate any section in which trouble occurs.

Power for operation of the system will come from three sources. The Public Service Electric & Gas Company will supply the substations at the west end of the Bergen Tunnel, near the Hoboken terminal, and at Newark, the Jersey Central Power & Light Company the one at Summit, and the New Jersey Power & Light Company the stations at Denville and Bernardsville. Tie stations will connect the overhead conductors for the several tracks together at Hoboken, Harrison, South Orange, Montclair Morristown and Dover.

The power will be converted from 60 cycles alternating current to 3,000 volts direct current in five substations. The locations are shown on the map and the ratings and equipment are given in Table I. Mercury arc rectifiers will be used throughout for conversion. Each rectifier tank will deliver power at 3,000 volts. Three sizes are specified, 3,000-kw. single-tank units being used in the Bergen and Newark substations, 3,000-kw. (two-tank) units in the Summit and Denville substations, and 2,000-kw. units in the Bernardsville station. The Bernardsville station will be equipped for automatic operation.

The main line from Hoboken to Dover has many heavy grades, as may be seen from the condensed profile. There is a rise of more than 500 ft. from Hoboken to the junction with the Boonton branch at Denville. This has necessitated relatively heavy motive power for steam service, particularly on the long run to Dover. With electric power it will be possible to make certain reductions in the running time.

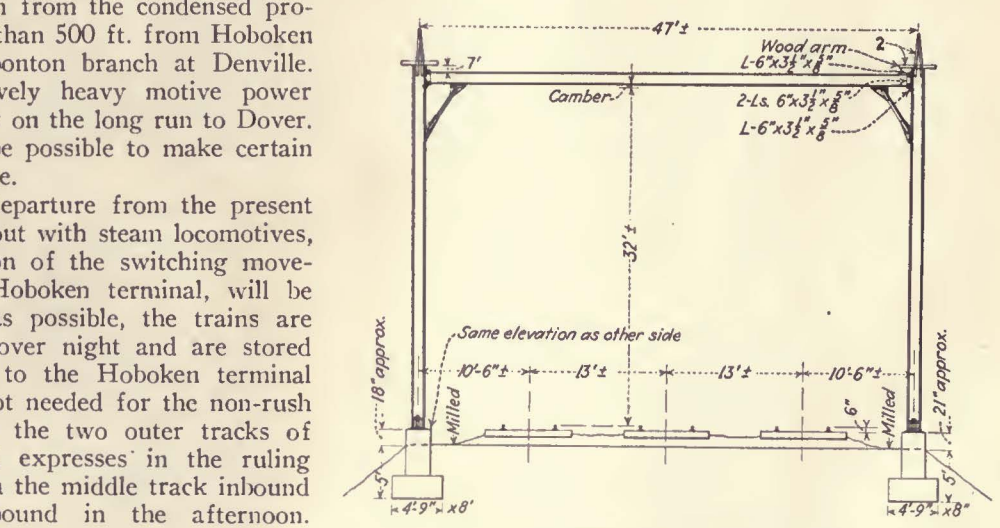
There will be no radical departure from the present plan of operation as carried out with steam locomotives, except that the major portion of the switching movements, particularly at the Hoboken terminal, will be done away with. So far as possible, the trains are kept at the outer terminals over night and are stored in the coach yard adjacent to the Hoboken terminal during the day if they are not needed for the non-rush service. Locals are run on the two outer tracks of the three-track portion, and expresses in the ruling direction of traffic are run on the middle track inbound in the morning and outbound in the afternoon.

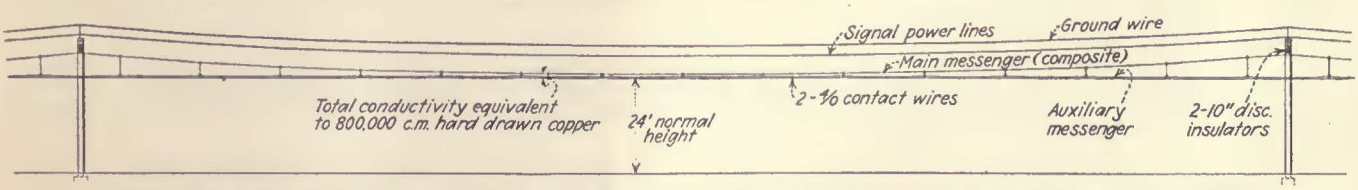


Connections of the major electrical equipment are shown in the schematic car wiring diagram

A shed for light inspection will be provided at the Hoboken terminal. Heavy repairs will be made at Kingsland, about 7 miles across the meadows on the Boonton division. This is the main repair shop for the eastern portion of the railroad, so that the added facilities will be kept to a minimum.

Electrification of the Boonton division is not contemplated at present. The greater portion of the business on this line is freight. By far the larger part of the commuting business, as well as most of the through trains, go out over the division which is being electrified. The through trains will be hauled by steam locomotives for the present.





Catenary suspension of the contact line will be used throughout. Above is a typical three-track supporting bridge

Gross and Net Earnings Are Holding Up

REPORTS of operation of 27 electric railways in the United States and Canada now available show that the revenues are holding steady on the properties included. Out of 23 reports for which comparable monthly figures are given, fifteen companies show greater gross receipts for 1929 than for the corresponding month in 1928. Fifteen of the companies show a reduction in operating expenses for the current year, and eighteen show an increase in gross income after taxes. The disposition of gross income is given for only seventeen of the companies in comparison with last year. Eleven of these show a greater amount available for dividends or surplus.

The best showing is made by the Canadian properties. All the six listed show more revenue this year than last, and every one of them shows greater net. This relatively better showing of the Canadian properties has been commented on previously in this paper. Evidently the causes for it are still in evidence.

The report of the Boston Elevated Railway for the twelve months ended June 30, which is included along with the monthly statement for May, shows a reduction in gross and net revenue, even though operating expenses were lower than for any year since that ending June 30, 1923. The decline in gross, according to a statement from Edward Dana, is continuing and increasing depression in summer riding, and the increase in automobile riding, particularly during the open winter last year. It is pointed out that in spite of the decline in total passenger revenues there has been a substantial increase in weekday traffic for the eight months of the year from October to May, inclusive. Rental charges on rapid transit lines increased by $291,116 this year as compared to last year.

Table I—Monthly Reports of Electric Railway Companies

		Operating Revenue $	Operating Expenses $	Taxes $	Gross Income $	Net Income $
Market Street Railway, San Francisco, Cal.						
June,	1929	779,474	658,763*a*	.....	120,711*b*	61,314*f*
June,	1928	804,151	683,428*a*	.....	120,723*b*	58,356*f*
12 mo.end.June,	1929	9,585,383	8,205,287*a*	.....	1,380,096*b*	649,693*f*
12 mo.end.June,	1928	9,858,135	8,342,756*a*	.....	1,515,379*b*	749,252*f*
Capital Traction Company, Washington, D. C.						
May,	1929	389,304	263,059	32,076	94,727	64,814
May,	1928	386,038	265,386	26,071	95,985	67,728
5 mo.end.May,	1929	.....	.....	.....	.....	281,200
5 mo.end.May,	1928	.....	.....	.....	.....	309,999
Jacksonville Traction Co., Jacksonville, Fla.						
May,	1929	98,918	77,774	9,215	11,349*b*	.....
May,	1928	104,433	81,625	9,286	12,863*b*	.....
12 mo.end.May,	1929	1,177,796	951,547	106,664	113,245*b*	47,682
12 mo.end.May,	1928	1,268,975	1,038,812	107,796	115,072*b*	50,741
Chicago Surface Lines, Chicago, Ill.						
June,	1929	5,118,799	4,015,900*a*	.....	1,102,899	848,376*e*
June,	1928	5,090,269	3,989,114*a*	.....	1,101,155	846,078*e*
United Railways & Electric Co., Baltimore, Md.						
June,	1929	1,368,136	940,037	133,435	313,638	33,710
June,	1928	1,354,102	930,009	128,708	310,342	30,009
6 mo.end.June,	1929	8,390,353	5,766,486	819,139	1,893,889	195,687
6 mo.end.June,	1928	8,224,067	5,574,873	789,127	1,933,340	229,674
Boston Elevated Railway, Boston, Mass.						
May,	1929	2,978,446	1,990,084	147,965	844,765	148,725
May,	1928	3,013,663	2,095,826	158,055	768,815	93,651
12 mo.end.June,	1929	34,223,172	24,473,329	1,695,086	8,144,390	*180,153*
12 mo.end.June,	1928	34,909,542	24,083,391	1,793,128	8,133,413	82,812
Eastern Massachusetts Street Railway, Boston, Mass.						
May,	1929	720,540	460,195	31,258	246,558	80,661
May,	1928	731,243	514,013	18,556	215,760	76,045
5 Mo.end.May,	1929	3,752,014	2,265,644	168,923	1,407,170	468,551
5 mo.end.May,	1928	3,919,918	2,392,562	152,425	1,469,929	491,005
Detroit Municipal Railway, Detroit, Mich.						
June,	1929	2,193,665	1,704,344	62,422	437,112	296,797
June,	1928	1,998,277	1,567,295	66,965	380,000	232,240
12 mo.end.June,	1929	26,329,072	20,888,667	754,745	4,872,689	3,130,286
12 mo.end.June,	1928	23,587,107	18,286,177	784,161	4,758,648	2,860,498
Twin City Rapid Transit Company, Minneapolis, Minn.						
3 mo.end.June,	1929	3,249,703	2,420,058	.....	.....	223,887
3 mo.end.June,	1928	3,167,779	2,438,194	.....	.....	149,111
6 mo.end.June,	1929	7,013,530	5,086,338	.....	.....	686,923
6 mo.end.June,	1928	6,876,251	5,104,546	.....	.....	573,672
Kansas City Public Service Co., Kansas City, Mo.						
June,	1929	713,507	545,324	41,675	126,506	41,959
6 mo.end.June,	1929	4,518,265	3,387,791	250,050	880,423	405,261
Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.						
May,	1929	84,831	57,674	7,840	23,075	*9,974*
May,	1928	90,121	61,469	7,840	33,908	1,993
5 mo.end.May,	1929	430,635	308,611	39,200	95,531	*64,262*
5 mo.end.May,	1928	469,683	325,102	39,200	129,086	*28,984*
Brooklyn-Manhattan Transit System, New York, N. Y.						
June,	1929	4,167,999	2,741,014	213,036	1,346,674	603,523
June,	1928	4,055,296	2,603,516	216,075	1,322,521	660,890
12 mo.end.June,	1929	48,586,548	31,256,533	3,304,036	15,073,622	6,518,372
12 mo.end.June,	1928	47,466,603	30,572,658	3,367,443	13,565,561	6,599,211
Hudson & Manhattan Railroad, New York, N. Y.						
June,	1929	1,006,646	508,250	.....	498,396*b*	162,265
June,	1928	1,018,838	529,074	.....	489,764*b*	154,549
6 mo.end.June,	1929	6,286,633	3,161,902	.....	3,124,731*b*	1,108,429
6 mo.end.June,	1928	6,269,864	3,195,448	.....	3,074,416*b*	1,061,171
New York, Westchester & Boston Railway, New York, N. Y.						
May,	1929	223,109	121,623	23,974	78,409	*137,370*
May,	1928	207,340	132,681	17,813	58,467	*139,364*
5 mo.end.May,	1929	990,151	627,037	105,629	261,116	*797,605*
5 mo.end.May,	1928	936,536	619,369	95,319	229,005	*764,506*
Third Avenue Railway System, New York, N. Y.						
May,	1929	1,387,522	1,039,778	88,035	278,698	31,551
May,	1928	1,353,303	1,021,687	95,949	252,799	46,194
11 mo.end.May,	1929	14,276,172	10,969,717	987,798	2,525,944	*281,618*
11 mo.end.May,	1928	14,217,866	10,908,843	1,018,143	2,476,399	*70,870*
Cincinnati Street Railway, Cincinnati, Ohio						
June,	1929	733,164	499,356	59,847	176,052	2,707
Philadelphia & Western Railway, Norristown, Pa.						
June,	1929	68,096	39,153	.....	28,943*d*	13,024
June,	1928	71,222	42,595	.....	28,627*d*	12,702
Philadelphia Rapid Transit Company, Philadelphia, Pa.						
3 mo.end.June,	1929	14,255,943	10,748,208*a*	.....	3,836,208	10,575*c*
6 mo.end.June,	1929	28,441,135	21,546,476*a*	.....	7,536,182	*109,792c*
Dallas Railway & Terminal Company, Dallas, Tex.						
June,	1929	268,829	190,556	.....	72,795	9,240
June,	1928	258,427	192,191	.....	63,555	0
12 mo.end.June,	1929	.....	.....	.....	883,653	120,987
12 mo.end.June,	1928	.....	.....	.....	783,228	20,948
Galveston-Houston Electric Railway, Houston, Tex.						
May,	1929	49,181	29,271	2,565	17,343*b*	.....
May,	1928	54,585	32,251	2,584	19,749*b*	.....
12 mo.end.May,	1929	617,174	347,172	31,665	238,336*b*	32,508
12 mo.end.May,	1928	684,590	399,129	30,415	255,044*b*	12,771
Houston Electric Company, Houston, Tex.						
May,	1929	287,354	173,236	25,530	88,588*b*	.....
May,	1929	282,228	175,409	25,445	81,372*b*	.....
12 mo.end.May,	1929	3,383,455	2,086,639	287,781	346,192*b*	600,635
12 mo.end.May,	1929	3,225,893	1,988,387	286,568	354,295*b*	555,901
Calgary Municipal Railway, Calgary, Alta.						
May,	1929	82,402	54,008	.....	22,134	*1,697*
May,	1928	73,324	45,476	.....	21,634	2,947
5 mo.end.May,	1929	432,217	244,549	.....	156,341	35,971
5 mo.end.May,	1928	386,587	228,550	.....	126,973	32,342
Edmonton Radial Railway, Edmonton, Alta.						
May,	1929	65,923	44,079	.....	19,344	996
May,	1928	61,359	44,718	.....	15,641	*3,102*
5 mo.end.May,	1929	372,146	224,449	.....	107,696	15,956
5 mo.end.May,	1928	348,146	222,418	.....	98,727	5,011
British Columbia Electric Railway, Vancouver, B. C.						
April,	1929	1,201,207	789,071	.....	412,136*b*	.....
April,	1928	1,081,401	710,175	.....	371,226*b*	.....
10 mo.end.Apr.	1929	11,671,509	7,778,484	.....	3,893,025*b*	.....
10 mo.end.Apr.	1928	10,960,445	7,463,104	.....	3,497,341*b*	.....
Cape Breton Electric Company, Sydney, N. S.						
April,	1929	59,033	41,604*a*	.....	17,428	.....
April,	1928	56,057	43,505*a*	.....	15,552	.....
12 mo.end.Apr.,	1929	675,713	521,699*a*	.....	154,013*b*	85,193
12 mo.end.Apr.,	1928	660,758	521,559*a*	.....	139,198*b*	70,764
Regina Municipal Railway, Regina, Sask.						
May,	1929	31,902	21,584	.....	8,402	*1,124*
May,	1928	25,647	18,884	.....	5,095	*3,222*
Saskatoon Municipal Railway, Saskatoon, Sask.						
April,	1929	30,352	20,740	1,198	8,413	55
April,	1928	24,903	16,616	996	7,290	116
4 mo.end.Apr.,	1929	150,534	90,487	5,940	54,104	20,513
4 mo.end.Apr.,	1928	127,185	78,018	5,087	44,079	15,225

a Includes taxes. *b* Net operating revenue. *c* Surplus (deficit) after dividends. *d* Before taxes. *e* Balance for return on investment. *f* Before depreciation and federal taxes.

Conference Method Effective for TRAINING EMPLOYEES

Experience of numerous electric railways shows this kind of educational work to be of great value. Methods vary somewhat on different properties, but the basic principle has been applied successfully in transportation, track, overhead line and shop departments

BELIEVING that the efficiency of the human element in electric railway operation is a factor equally as important as the efficiency of the physical equipment, many companies have recently been devoting special attention to educational work among their employees. In these activities the conference method of training has been playing an increasingly important rôle. Among the companies which have successfully used this method are the Milwaukee Electric Railway & Light Company, the Boston Elevated Railway, the Cleveland Railway, The Kansas City Public Service Company, the Northern Ohio Power & Light Company, the Chicago, North Shore & Milwaukee Railroad, the Louisville Railway and the Capital Traction Company. The underlying principle of the conference method of training is that all those present at the meeting enter into the discussion. In this it differs radically from the older and more familiar method of instruction wherein the instructor does practically all of the talking.

Experience shows that a conference can be conducted successfully only with a comparatively small group of persons who have had a similar background. Under these circumstances all take part in the discussion and contribute something from their own personal experience. Such a group can analyze their jobs so as to better appreciate their responsibilities and discover the best way to develop a smooth-working organization.

The conference method has a wide range of adaptability. It has been used most extensively in the transportation department of the electric railways, but good results have been also obtained in other departments. Among the transportation subjects discussed in conferences are accident prevention and safety work, courtesy, fare collection, relations with the public, methods of training motormen, conductors and bus operators, and proper use of equipment. The general subject of the problems and responsibilities of a foreman or supervisor has been discussed on several properties. At Boston, Louisville, Milwaukee and Kansas City the conference method of training has been extended to foremen in the track, power, rolling stock and shop departments.

The size of the group gathered together for conference training varies somewhat on the different properties, but is necessarily rather small. This method of education is adapted primarily to the training of foremen and supervisors, although it has been extended under special circumstances to include trainmen and bus operators. In general, the attendance of the conference group ranges from about 10 to 25 members.

Undoubtedly the success of the conference method of training depends to a large extent upon the selection of the conference leader. He should be a man of proper personal qualifications and should never be one who is in a supervisory relation to the persons who are conference members. It is absolutely necessary that he know the technique of conference teaching, that he have an objective and know how to reach it. At present there are relatively few qualified conference leaders, but the number is increasing steadily with the growing interest in this type of employee training.

The conference method of training has been adopted enthusiastically by the Cleveland Railway as one phase of its educational program. This company has used the group conference idea for training men to avoid accidents, particularly those trainmen whose number of accidents have been above the average. The groups have been limited to twelve and the conference has been conducted by the supervisor of accident prevention, who has had each group discuss an actual accident in which one member was involved. The men have decided who was responsible, what could have been done to prevent the accident and what general standards of operation should be adopted. In the opinion of C. D. Smith, superintendent of the personnel department, the results obtained have been most gratifying.

During the past two years the conference method has been used on the Chicago, North Shore & Milwaukee Railroad in the conduct of two distinctly separate training activities. These are: First, the improvement of standards of personal service on the part of those employees whose duties bring them into contact with the customers, and, second, the development of improved standards of foremanship among those charged with supervising the work of others. The meetings have been in charge of a trained conference leader who gives his whole time to the organization and discussion of the conference group. Every effort is made to get a full and unrestricted expression of opinion from the em-

ployees making up the group. Care is exercised that they are given the impression that their knowledge and experience are regarded as having value and that the responsibility for the proper solution of the problem under consideration rests with them. Although it is difficult to measure the results of this training method, the management believes that it has been productive of good results.

At Boston the development of the conference method of training has been an outgrowth of earlier methods which were more in the nature of lectures. In the fall of 1924, group meetings were organized in the four principle operating departments of the company, transportation, track shops and power, as well as a group of women employees. It was early realized, however, that these group meetings did not take full advantage of conference possibilities. More recently the practice has been adopted of holding meetings of the true conference type for men of supervisory rank. According to E. A. Kelly, assistant to the superintendent of transportation, the conference plan has been a marked success. It has caused the men to think for themselves and draw conclusions from their own knowledge of the job. They compare individual experiences and in this way are made to feel that their opinions and suggestions are of value and are given consideration by the officials. The conference gives the employee a renewed interest in his work and makes him feel that he is of importance in the organization. Moreover, much real information and many valuable suggestions have come from the men as the result of these conferences.

The Kansas City Public Service Company at present has four foremen clubs, one each in the equipment, way and structures, electrical distribution and bus garage departments. Each club has its own organization, but nevertheless co-operates with the other clubs. To some extent the activities of these clubs follow the conference method. Their objects are threefold: First, to keep the members in touch with the best modern thought and practice on industrial management and related subjects; second, to provide an opportunity for the exchange of ideas and the discussion of departmental problems; third, to promote social intercourse among the foremen. A man is eligible to membership provided the nature of his work is such that he has foremanship responsibilities regardless of whether he has the direction of only two or three men or a greater number. Also eligible are those closely connected with this work, such as engineers, etc. Each unit meets regularly once every two weeks, from September to May inclusive. The meetings are held on company time. Concerning the results obtained, F. G. Buffe, vice-president in charge of operation, states: "We have found that this is by far the best way to create interest in the work and in the affairs of the company, to improve production and service, to reduce costs and to bring about the friendly co-operation and general good will which are so essential to the successful operation of the property."

The conference method of training was adopted by the Northern Ohio Power & Light Company a little more than a year ago. On this property the attendance is not confined to the supervisory officials, but includes the car and bus operators. According to L. G. Tighe, assistant general manager, the men feel a keener interest in their work when they have an opportunity to discuss their problems and to bring out their own ideas in open and informal meetings. The management feels that the men are ordinarily in closer contact with operations than are the officials and supervisors, and are in a position to develop ideas which will greatly benefit service. It is the belief of the company that the adoption of the conference method by all operating companies will increase the efficiency of the men and reflect favorably on the company, both financially and in the development of good will.

On the property of the Capital Traction Company the conference method as a definite educational procedure was first introduced in July, 1928. Since last fall three series of conferences have been held with: (1) A group made up of division superintendents and assistants, who discussed in particular the hiring and training of car and bus men; (2) A group of shop and roadway foremen, who considered such subjects as foreman's cut orders, building morale, personal relations between foreman and other departments. They take a new interest in their men and handle them better. The appreciation of the value of these conferences is evidenced by the fact that each group has suggested additional present day problems which they wish to handle by this method.

To test the value of the conference training method, the Louisville Railway inaugurated the plan soon after the 1926 A.E.R.A. convention. Conferences are held the second Thursday of each month from 7 to 9 o'clock in the evening. Approximately 40 foremen from the transportation, track, shop, power and line departments attend these meetings. Among the many interesting subjects discussed during the 2½ years that these conferences have been in session are: Carelessness on the job; the importance of reporting all accidents and injuries; an energetic, live foreman will be a good example to his men; how the various departments can be of service to each other; how best to impress on the men the fact that they represent the company before the community; service; safety; how to gain the good will of the public; economy; how can the trainman help the mechanical department? how can all departments help the trainman? how can a man of indifferent nature be made into a good workman? a foreman's responsibility; resuscitation and first aid; fundamentals of personal efficiency; etc.

The company believes that by far the most important benefit derived from these conferences is the genuine spirit of co-operation between departments, which has resulted from the understanding of each other's problems. The necessity for cars to be kept moving on an even headway is no longer considered the problem of the transportation department alone, but, on the contrary, each foreman realizes that it is the problem of every man in the organization. G. B. Powell, superintendent of transportation, believes the foreman's conference has been of great value in the education and development of the key man, the foreman, and the company is looking forward to obtaining new ideas and expecting to develop the conferences into even greater usefulness in the future.

"Advertising to Cure Prejudice"

An extremely interesting story of one railway's unusual publicity campaign—to appear in a future issue.

What Happens When Steel Gets Tired

By

D. D. EWING

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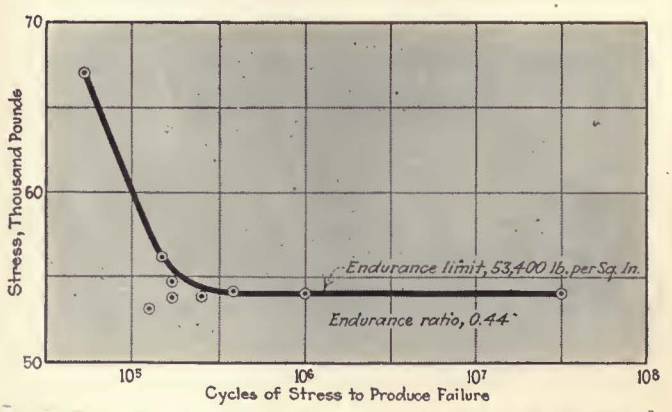


Typical S-N diagram for rail steel. Up to 100,000 cycles the strength of the material decreases rather rapidly

Fatigue of metals is an important factor in failures of track and car construction. This article discusses the causes of the phenomenon and precautions that must be taken in design to minimize the danger. Crystallization is no longer considered the explanation.

IN THESE DAYS when new records of automobile and airplane endurance are being made before the ink used in recording the previous records is scarcely dry, writers in the daily press are fond of remarking about the "tirelessness" of metals and machines. But does metal ever become "fatigued"? If so, what is likely to happen when it is "tired"?

In electric railway operation the materials from which equipment and structures are constructed are often subjected to varying stresses. Car wheels and axles, springs, truck beams, equalizer bars, brake rigging, gears, bolts and studs are all typical elements of equipment which may fail because they become tired. In the track, the rails, spikes, concrete and ties are subject to varying stresses. Trolley wires, span wires, poles and other elements of the overhead system may fail because of fatigue.

What Is Fatigue?

That when animal muscle becomes fatigued it loses strength, is every-day knowledge. Because of the apparent analogy scientists have given the name fatigue to the loss in molecular strength which some metals and other materials suffer under stresses often repeated. That the application of force first in one direction and then in another is more likely to produce failure in a stick or bar than the application of a greater force in one direction only is a principle that was probably known even among the most primitive of men. However, the first recorded work in the way of analyzing the effects of repeated stress seems to be that of a German, Albert, who made some tests on mine hoist chains a hundred years ago.

Wohler, between 1859 and 1870, made a number of investigations which resulted in the formulation of the first really definite notions as to the result of repeated stresses. He found that whereas 800 applications of a stress of 52,800 lb. per square inch would rupture wrought iron, with a stress of 35,000 lb. per square inch 10,140,000 applications were required to produce rupture. From time to time other investigators made contributions to the subject and the theory of the phenomena as held 30 years ago is indicated by the following quotation from a standard text book of that time:

> Rapid oscillations (of stress) cause a change in the molecular structure which impairs the elasticity of the material when such loads are often applied. It is sometimes found that the appearance of a fracture of a bar which has been subject to shocks is of crystalline nature, whereas the same material, if ruptured under a gradually increasing stress would exhibit a tough fibrous structure. Moving loads which produce stresses above the elastic limit cause the wrought iron and steel to become stiff and brittle and hence it is that the working unit stresses should be taken very low.

This theory of fatigue failure came to have wide acceptance. So prevalent is it today that the fracture of a rail, axle, automobile steering knuckle, engine crankshaft or other machine part subject to repeated stresses usually is ascribed to the deadly work of crystallization.

Within the last ten years a great deal of research has been done on fatigue failure, stimulated no doubt by the necessities for new data for use in the design of automobiles, airplanes, steam turbines and other high-speed machinery.

Crystallization Theory Now Rejected

The disclosures of the metallurgical microscope and other developments in the art and science of metallography have led to a complete refutation of the crystallization theory. Under the microscope, wrought iron, steel and other metals are seen to be of granular structure instead of being of smooth and uniform texture. Instead of stresses being uniformly distributed throughout the material, as we are accustomed to think of them, there are actually many irregularities in the stress distribution. The microscope shows that at high-stress concentration points some of the grains of the metal split and slip because there is a non-uniform distribution of stress

Under repeated stresses the bond between the parts of the split grains eventually breaks down and minute cracks result. The metal fails by fatigue when these cracks have grown progressively until the remaining sound metal is insufficient to carry the load and a sudden break results. In the fracture the earlier cracked surface is usually somewhat smooth—made so by the crack alternately opening and closing—while the fresh break is rough and crystalline in appearance.

The ability of a material to withstand fatigue may be expressed in either of two ways: (1) The stress at which a material stands up under a definite number of cycles of force application; (2) the endurance limit or fatigue limit, that is, the maximum stress which the material can withstand with an infinite number of repetitions of the stress producing force. Another term much in use is the endurance ratio, which is the ratio of the endurance limit to the ultimate tensile strength of the material.

How Fatigue Data Are Secured

The usual procedure in fatigue testing is to select a number of small specimens of the material to be tested. These specimens are tested one by one in a special form of testing machine which subjects the specimen under test to rapidly repeated stresses, the stress for each specimen being of different magnitude.

For wrought irons and steels, from 500,000 to 5,000,000 cycles of stress may be required to determine the endurance limit, while for cast iron and cast steel over 10,000,000 cycles usually are required. The results of these tests are plotted in so-called S-N (stress—number of cycles) diagram. The accompanying graph is a typical one for steel rails (see Technologic Paper No. 363, United States Bureau of Standards, "Endurance and Other Properties of Rail Steel"). It will be noted that up to 100,000 cycles the strength of the material decreases rather rapidly, while above 500,000 cycles the strength is constant at 53,400 lb.

The reference just indicated sets forth the results of a number of tests on rail steel. The tests were made on specimens cut from the A and B rails of the middle ingots from eleven heats of open-hearth steel. The carbon content of these rails ranged from 0.62 to 0.75 per cent and the manganese content from 0.68 to 0.813 per cent. The data in Table I from these tests are typical of what may be expected from endurance tests on rail steel.

Rails and Car Axles Suffer Fatigue

Steel rails suffer from the repeated stresses set up by the passage of rolling stock over the track. The bearing surface of the rail-head is subject to particularly heavy loading and fatigue doubtless plays a part in such common head failures as surface pitting, transverse cracks, detrusion of the head metal and surface corrugation, as well as in some of the failures of the rail as a whole.

Prof. H. F. Moore, who has had charge of the extensive fatigue investigations being carried on at the University of Illinois during the last ten years, gives the data shown in Table II on car-axle steels (Bulletin No. 165 of the Engineering Experiment Station, University of Illinois).

In these tests the specimens were in a general way similar in shape to a car axle and therefore had somewhat sharp fillets. Sharp fillets produce stress concentrations, and standard fatigue test specimens are designed to avoid such concentrations. Standard specimens cut from the axle of Test No. 3 gave an endurance limit of 35,000 lb. per square inch and an endurance ratio of 0.38. These figures are 46 per cent higher than those in Table II and show the marked effect of specimen shape on the test results.

From these data may be drawn the conclusion—substantiated by the observations of many other experimenters—that commercial forms are likely to have a lower endurance limit than standard test specimens. Standard endurance limit data, then, represent maximum values. For safety the working stresses should be very much lower than the values of endurance limit as determined on standard specimens.

The first thought of the designer of structures or machine parts is usually to make the design with a certain factor of safety based on the ultimate strength of the material. It appears wiser to use the endurance limit as a basis for the safety factor whenever dynamic loadings must be given consideration.

Endurance Data for Other Steels

Other typical data collected from several sources for plain and quenched carbon steels and for alloy steels are set forth in Tables III, IV and V. Data for cast steels, which are much used in rolling stock parts and as such are usually subjected to dynamic loads, are given in Table VI.

The most common fatigue failure in machines and structures is that from repeated flexure and all the above data were made on specimens subject to reversed flexural stresses.

In some machine parts and structures, the stresses are not completely reversed during a cycle of action but range between a maximum and a minimum. For such incomplete reversal the endurance limit is lighter. Moore and Kommers, in their textbook, "Fatigue of Materials," recommended the following empirical formula:

TABLE I—ENDURANCE DATA ON RAIL STEELS FROM THE MIDDLE INGOTS OF ELEVEN HEATS

Heat Number	Rail	Strength in Pounds per Square Inch: Ultimate Tensile Strength	Endurance Limit	Endurance Ratio
1	A	120,400	47,800	0.40
1	B	119,900	50,400	0.42
3	A	129,750	55,000	0.42
3	B	131,880	54,200	0.40
10	A	132,400	46,200	0.35
10	B	125,650	47,800	0.38
19	A	134,750	59,200	0.44
20	A	115,750	53,600	0.46
21	B	121,500	53,800	0.44

TABLE II—ENDURANCE DATA ON TYPICAL SAMPLES OF CAR AXLE STEELS

Test Number	Chemical Content: Carbon	Chemical Content: Manganese	Strength in Pounds per Square Inch: Proportional Elastic Limit	Strength in Pounds per Square Inch: Ultimate Tensile Strength	Strength in Pounds per Square Inch: Endurance Limit	*Endurance Ratio
1	0.45	0.49	57,000	92,000	27,000	0.29
2	0.47	0.66	59,500	100,500	28,000	0.28
3	0.46	0.40	40,800	91,700	24,000	0.26
4	0.62	0.43	53,500	105,100	26,000	0.25

TABLE III—TYPICAL ENDURANCE DATA ON QUENCHED PLAIN CARBON STEELS

Per Cent Carbon in Material	Strength in Pounds per Square Inch: Proportional Elastic Limit	Ultimate Strength	Endurance Limit	Endurance Ratio*	Authority
0.24	47,500	67,500	29,500	0.44	McAdam
0.38	60,000	91,500	33,500	0.37	McAdam
Sorbitic 0.37	80,000	102,600	57,000	0.56	Moore and Kommers
0.49	72,000	126,500	65,000	0.51	Moore and Jasper
1.02	109,000	200,400	105,000	0.51	Moore and Jasper

*Calculated by the author.

TABLE IV—TYPICAL ENDURANCE DATA FOR UNQUENCHED PLAIN CARBON STEEL

Per Cent Carbon in Material	Strength in Pounds per Square Inch — Proportional Elastic Limit	Ultimate Tensile Strength	Endurance Limit	Endurance Ratio*	Authority
0.14	33,500	62,700	30,900	0.49	Lea
0.21	39,900	70,700	33,400	0.47	McAdam
0.32	37,400	65,700	31,300	0.48	Rogers

*Calculated by the author.

TABLE V—ENDURANCE DATA FOR A FEW ALLOY STEELS

Material	Strength in Pounds per Square Inch — Proportional Elastic Limit	Ultimate Strength	Endurance Limit	Endurance Ratio*	Authority
Unquenched nickel steel...	60,800	101,600	54,000	0.53	Moore and Jasper
Unquenched nickel steel.....	50,500	103,900	49,500	0.48	McAdam
Chrome-nickel steel, unquenched.....	55,500	117,800	50,000	0.42	McAdam
Nickel-steel, quenched.....	139,000	154,200	74,000	0.48	McAdam
Chrome-nickel steel, quenched	129,500	164,500	84,500	0.51	McAdam
Chrome-vanadium steel, quenched.....	129,500	164,400	92,000	0.56	McAdam

*Calculated by the author.

TABLE VI—TYPICAL ENDURANCE DATA FOR CAST STEELS

Material — Per Cent Carbon	Per Cent Manganese	Condition	Strength in Pounds per Square Inch — Proportional Elastic Limit	Ultimate Strength	Endurance Limit	Endurance Ratio*	Authority
0.352	1.71	Untreated	39,000	80,800	32,000	0.40	Moore
		Heat-treated	42,400	108,900	45,000	0.41	
0.25	0.68	Untreated	23,600	67,200	27,000	0.40	Moore
		Heat-treated	42,800	76,600	35,000	0.46	
0.18	0.82	Untreated	22,000	60,000	26,000	0.43	Lessells
		Annealed	28,500	63,000	26,500	0.42	
0.30	0.78	Untreated	22,500	80,800	39,000	0.48	Lessells
Vanadium... 0.18		Annealed	32,000	90,000	42,000	0.52	
		Normalized	50,500	89,000	42,000	0.47	

*Calculated by the author.

$$\text{Maximum stress} = S_{max.} = \frac{1.5\,S}{1 - 0.5\,r},$$

where

S = endurance limit for complete reversal;

$S_{max.}$ = maximum stress attained during the cycle;

$S_{min.}$ = minimum stress attained during the cycle (equals $-S_{max.}$ for complete reversal);

$r = \frac{S_{min.}}{S_{max.}}$ (this will be equal to —1 for complete reversal).

When $S_{min.} = 0$, $r = 0$ and $S_{max.} = 1.5\,S$.

When $S_{min.} = -S_{max.}$, $r = -1$ and $S_{max.} = S$.

Thus the maximum stress due to any cause should not exceed 1½ times the endurance limit when the stress varies between zero and a maximum, and should not exceed the endurance limit when the stress reverses during the cycle of action.

Aside from the quantitative data available, the principal facts and conclusions relative to what happens when "steel gets tired" may be summed up as follows:

1. The endurance limit bears a fairly definite relationship to the ultimate strength of the steel. The ratio between these varies from 0.35 to 0.55 for rolled steel and has a mean value of about 0.45. The mean value of the ratio for cast steel is about 0.42.

2. The endurance limit is roughly proportional to the Brinell hardness number—Prof. H. F. Moore suggests that it is equal to 250 times the hardness number for steels below 350 Brinell.

3. Test specimens with nicks, cracks, grooves, sharp fillets, rough surfaces, etc., may show endurance limits 50 per cent lower in value than for standard specimens.

4. The endurance limit is not correlated with the elastic limit or yield point.

5. The endurance limit seems to bear no definite relation to the ductility as measured by per cent, elongation and reduction in area.

6. Chemical composition does not seem to affect fatigue properties greatly except as it affects the ultimate tensile strength.

7. Where localized stresses may exist full-sized shapes have lower endurance properties than the standard test specimens.

8. Stresses above the endurance limit, caused either by a heavy overload applied a few times or a light overload applied many times, reduce the endurance limit.

9. The maximum stress to which a material is subjected should not exceed the endurance limit when the stress is subject to complete reversal, but may be somewhat higher if the stress simply varies from zero to a maximum in one direction.

10. The endurance limit is often considerably below the elastic limit.

11. For ordinary speeds of stress reversal, the endurance limit is independent of the frequency of reversal.

12. Steel which has been subjected to a large number of reversals of a stress below the endurance limit may show a higher endurance limit.

13. Coarse-grained steels and those containing inclusions of foreign matter have lower endurance properties than fine-grained steels.

14. Heat treatment usually improves the endurance properties of steel.

15. The endurance limit is usually higher if periods of rest occur between the loadings.

Trackless Trolley Installed in Japan

RECENTLY two trackless cars were put in service between Shinhanayashiki and Hanayashiki, Japan, by the Hanshin Highspeed Electric Railway, according to the *Far Eastern Review*. This is the first trackless trolley undertaking in Japan. When application was filed in 1925 for permission to operate a trackless car line, there were no regulations to govern its operation. After prolonged consideration by the local authorities, however, it was decided that regulations governing automobile transportation should be applied to the enterprise and the company obtained the franchise to construct the line.

Shinhanayashiki is a newly opened pleasure resort located near the Hanshin Highspeed Electric Railway connecting Osaka and Kobe, and the trackless trolley line was opened to give service to residents and excursionists visiting the resort. The road on which the cars operate has a width ranging from 7 to 10 meters, the average gradient being 1 in 10 and the maximum gradient 1 in 7. Each car will accommodate 28 passengers and is equipped with two 20-hp. 1,500-r.p.m. direct-current motors. It has four brakes; namely, electric brake, contraction system foot brake, expansion system handbrake and center foot brake. Trolley wire suspension is of the compound catenary system. Steel poles, imbedded in concrete on both sides of the road at an interval of 32 meters, were erected as supports.

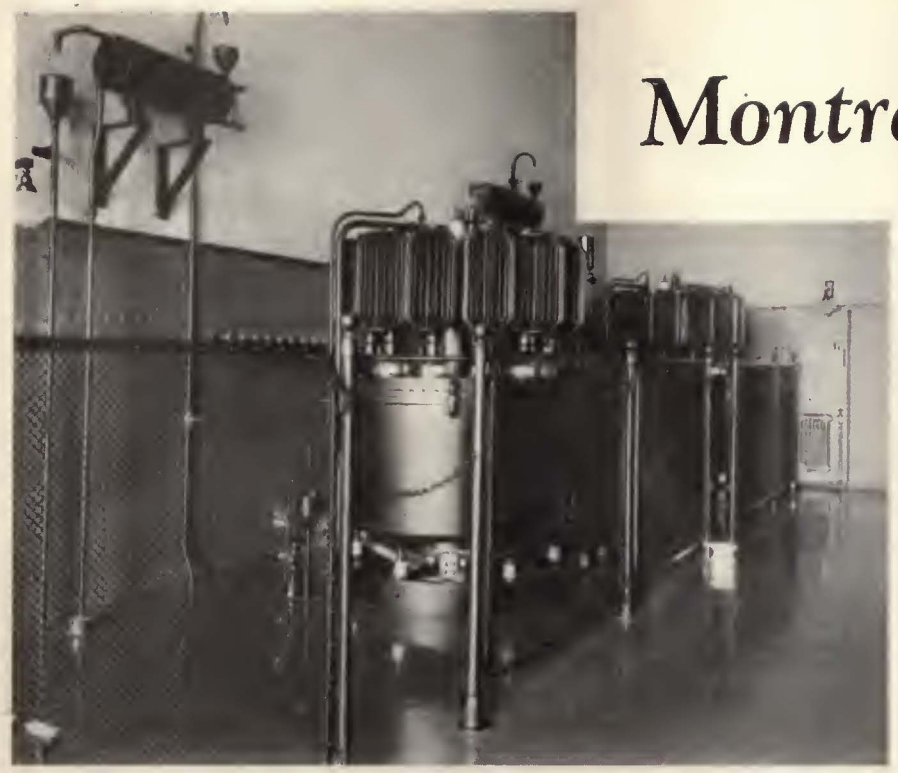
Following the completion of this line, applications for government sanction for other lines have been filed; one in Osaka, two in Fukushima, eight in Ibaraki, one in Ishikawa, one in Yamanashi and one in Aichi.

Electric Operation Profitable in Switzerland

BY THE end of last year 98.5 per cent of the principal lines of the Swiss Federal Railways had been electrified. Results of operation of the Federal Railways for the year 1928 were very satisfactory, the net profit being 17,000,000 francs. Gross earnings increased from 395,500,000 francs in 1927 to 418,000,000 francs in 1928, while gross expenditure rose only slightly and totaled 254,000,000 francs.

Montreal Tramways

Mercury



At present two 1,200-kw. rectifiers are installed in the Rockfield station. Space is provided for two additional units

Results with earlier installation at Verdun prompted the construction of a new station

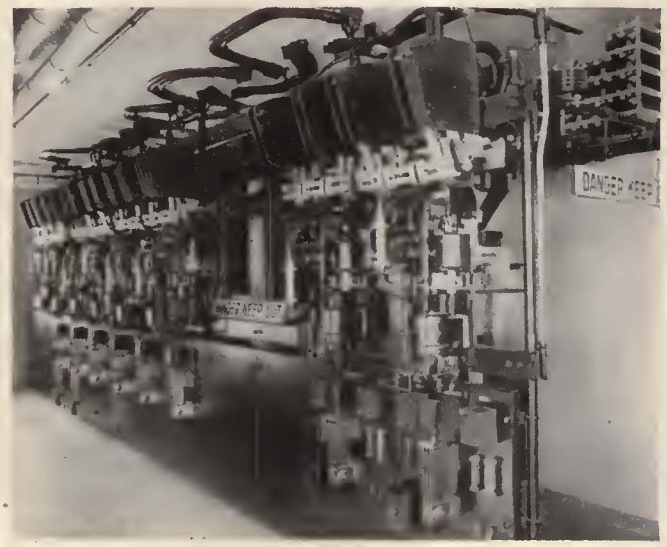
By

M. L. de ANGELIS
Assistant Electrical Engineer
Montreal Tramways, Montreal, Canada

PROGRESS in the design of rectifying equipment has been so great in the past few years that when, after experience of nearly two years with the Verdun substation, the Montreal Tramways decided to install a second automatic substation using rectifiers it was found possible to make a considerable saving in size and arrangement of the units. The earlier installation was the subject of an article in this paper for April 30, 1927, page 766. Originally two rectifier units, each consisting of two 600-kw. cylinders, were included. Later a third unit was installed, bringing the capacity of the Verdun station up to its designed maximum of 3,600 kw. The dimensions of the building were approximately 37 ft. 6 in. x 79 ft. 6 in. x 34 ft. high, or 28.2 cu.ft. per kilowatt installed capacity.

Before the new Rockfield station, which is located in the suburban town of Ville St. Pierre, approximately two miles west of the Montreal city limits, was designed, the progress in mercury arc rectifiers had been so great that the Brown-Boveri Electric Company, which through Griswold & Company, Ltd., of Montreal, furnished the equipment for both installations, was able to supply rectifiers delivering 1,200 kw. from a single cylinder of a size only slightly larger than that of the 600-kw. cylinders at Verdun. Switching and control apparatus have likewise been refined. It was found possible to construct a building 78 ft. 4 in. x 36 ft. 3 in. x 30 ft. high to house all equipment for four 1,200-kw. units, or a volume of 17.7 cu.ft. per kilowatt of ultimate capacity. At present only two units are installed.

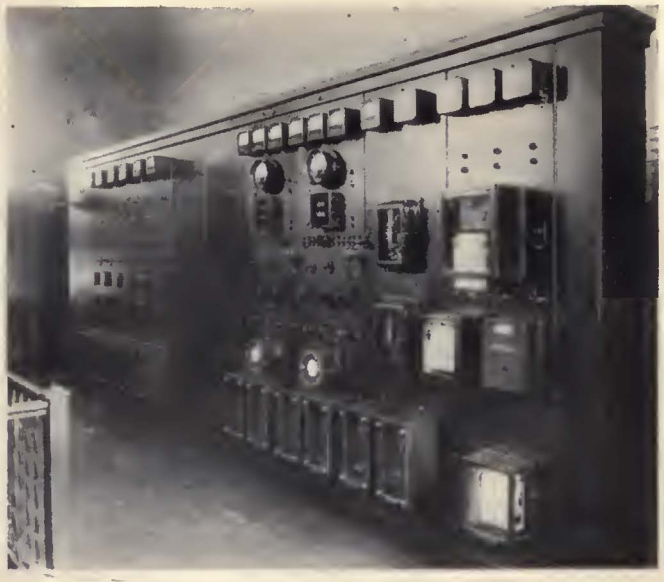
The substation is built of brick with a concrete basement, carefully waterproofed. The main rectifier room is finished in red brick, with concrete floor and roof. The high-tension oil circuit breaker cells and bus structure are along one side of the main room, while the rectifier units are on the opposite side. The circuit breaker cells are built of concrete, and are enclosed at the front by fireproof cell doors. An I-beam supported from the roof immediately over the rectifiers carries a 5-ton chain block for use in dismantling them. The floor of the transformer compartment rests directly on the ground. As the rectifiers are light in weight, no special foundations were needed.



The direct-current feeder switchboard is on the floor directly below the a.c. control board

The basement has a ceiling height of 9 ft. It contains the main room in which are placed the auxiliary devices and the reactors, a furnace room and a toilet. To ventilate the basement there is one large

Extends Use of Arc Rectifiers



The control switchboard handles all the alternating circuits of the entering lines and the input to the rectifiers. The vacant panels are for two additional rectifiers

opening in the wall, which is equipped with shutters and screens. Flues are provided to exhaust the hot air from the recoolers. The building is fireproof throughout.

Energy at present is supplied by one 12,000-volt three-phase, 60-cycle aerial feeder, but switching equipment is available for an additional one. The oil circuit breakers on these feeders are not of the self-closing type, but must be closed by suitable control switches on the substation switchboard.

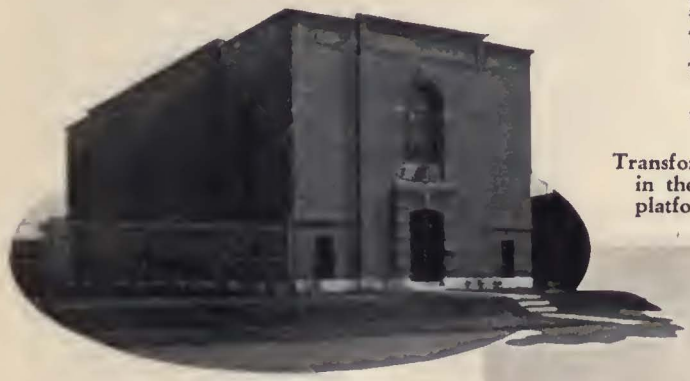
Each rectifier unit consists of one 2,000-amp., 600-volt cylinder fed from a three-phase double-six-phase 12,000/490-volt transformer of the oil-insulated, self-cooled type for outdoor installation, an ignition-excitation set and the necessary vacuum pumps. The rectifier unit weighs 6,100 lb. and the complete transformer 21,200 lb. For feeding the trolley lines there are six 2,000-amp. feeders, with a blank panel for two future feeders.

The rectifiers are cooled by a closed water circulating system, with a radiator-type cooler. Circulation is by centrifugal pumps and blower fans are used to force air through the radiator. The air is taken in from the basement and is discharged through flues from the building. The high-vacuum pumps are cooled with city water, but their consumption is small.

The transformer cells are at the side of the building nearest the rectifiers and are separated from the interior by a fireproof wall. They are roofed over, but the fronts are left open for removal and for ventilation. They are protected with heavy wire screens and may be closed entirely by Kinnear rolling steel doors. Louvers in the walls above the doors, and ventilators in the roof provide for additional ventilation. A feature of the transformer installation is that each transformer is mounted on a truck which runs on a track at the level of the deck of a flat car which may be run on a siding alongside the building.

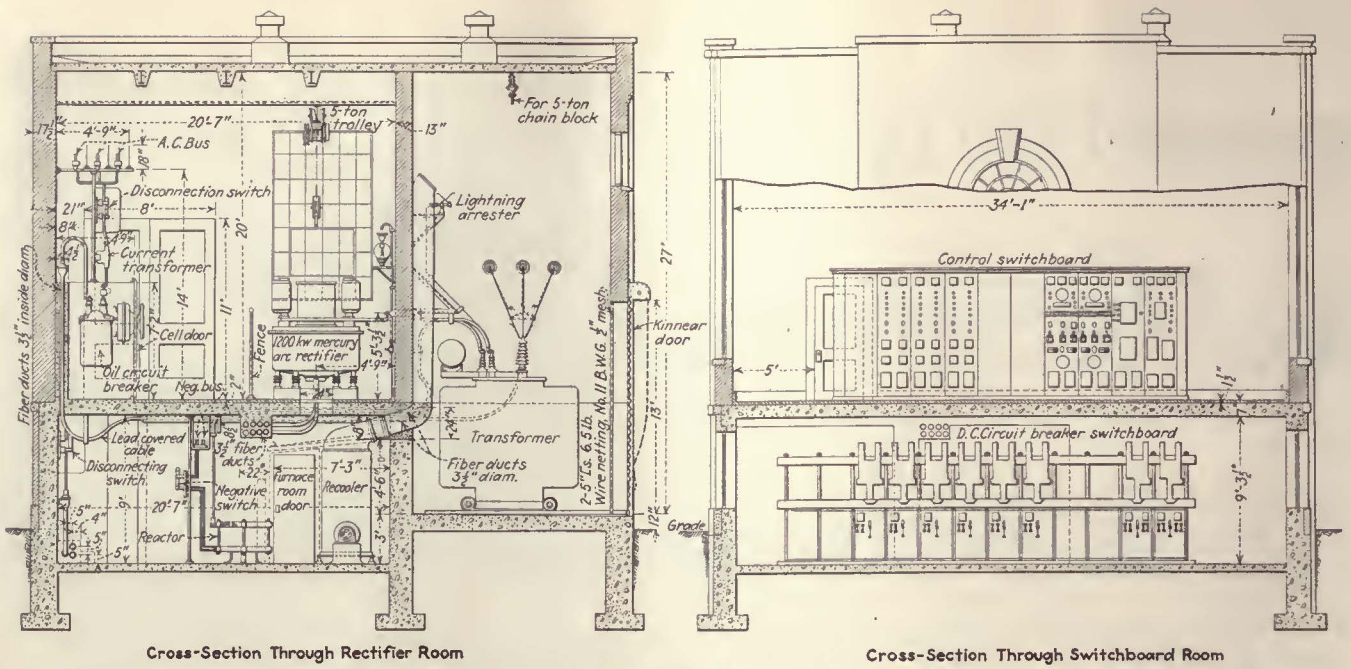
OPERATING STATISTICS OF ROCKFIELD MERCURY ARC RECTIFIER SUBSTATION, MONTREAL TRAMWAYS, JAN 5 UP TO JUNE 1, 1929

	Unit No. 1	Unit No. 2	Total or Average
Hours of operation	1,548.36	1,598.26	3,146.62
Output in d.c. kilowatt-hours	597,870	594,960	1,192,830
Input in a.c. kilowatt-hours	.....	.....	1,285,480
Average efficiency including all auxiliaries, per cent	.....	.....	92.5
Maximum d.c. load on station, kw	.....	.....	1,210
Water used for cooling high-vacuum pumps, gal.	30,960	31,960	62,920
Time during which units were not available for service, hours	23	0	.....
Time during which units were not available, per cent of total	0.66	0	.....



The Rockfield substation is located in a rapidly-developing section of the city, adjacent to the Lachine canal

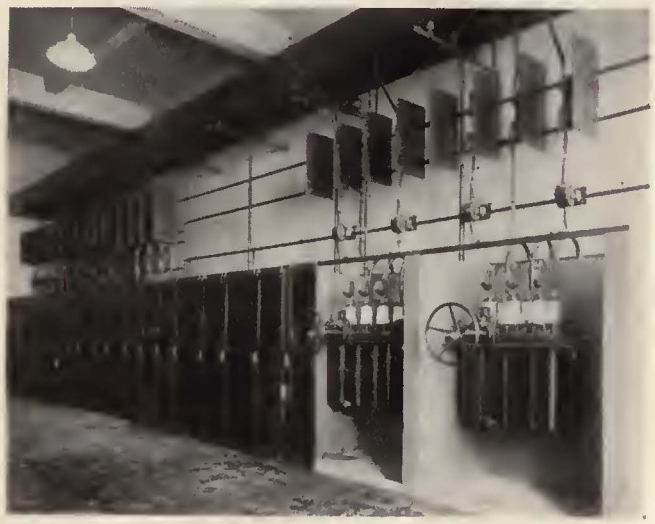
Transformers are housed in individual fireproof compartments, with tracks in the floor at the height above the railroad siding of a freight car platform. Kinnear steel doors protect them from the weather



Cross-Section Through Rectifier Room

Cross-Section Through Switchboard Room

Sections through the main rectifier room and basement and through the switchboard room. The a.c. control switchboard is on the main floor and the d.c. feeder board is beneath at the basement level

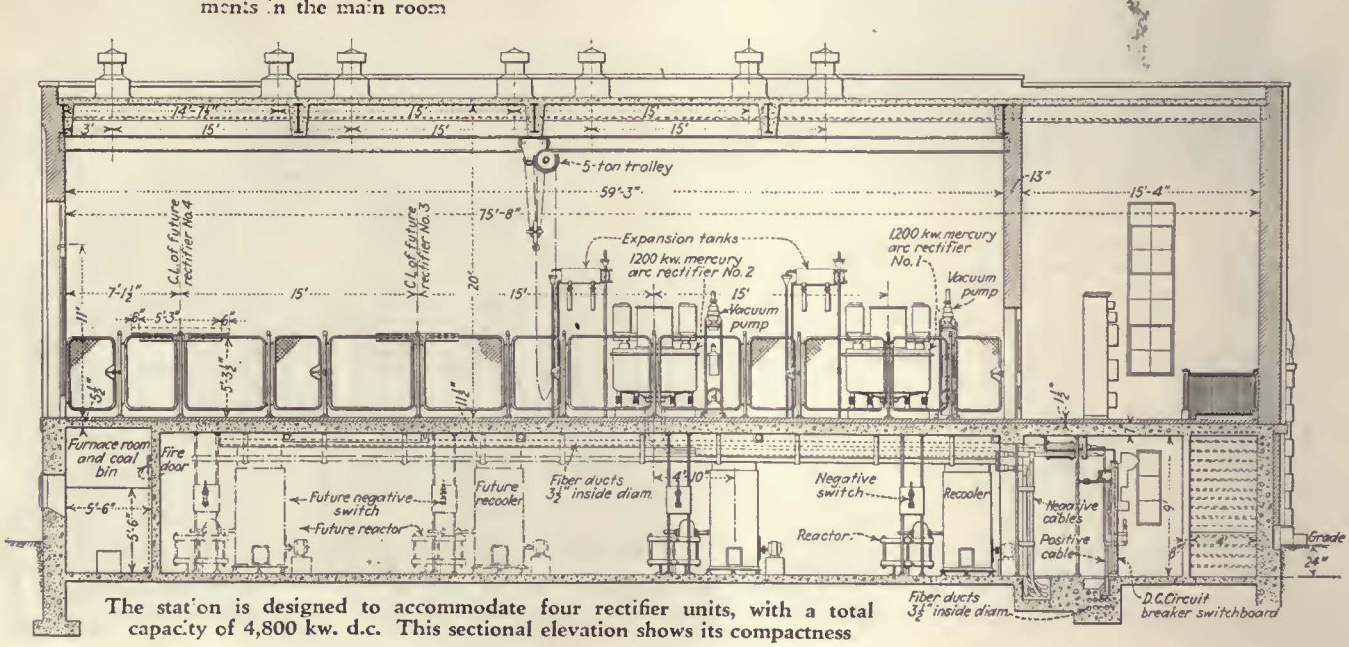


The high-tension oil breakers are housed in concrete compartments in the main room

An innovation in the Rockfield station is that the main control switchboard is in a separate room in the front of the building. It contains the operating switches and automatic control for the entire station, except for the direct-current lines. The feeder board is in a separate room in the basement directly beneath the main control board. The wiring between the two is thus made short and direct.

The equipment is so designed that the station is entirely automatic. It will start either at a predetermined value of 540 volts d.c. on the trolley, by clock or remote control. The sequence consists in closing the high-tension rectifier circuit breaker, starting the vacuum pumps, the ignition and the excitation anodes, and closing the d.c. rectifier breaker on the 600-volt bus. It can be disconnected automatically either at a predetermined low value of about 10 per cent of full load, by clock or by remote control.

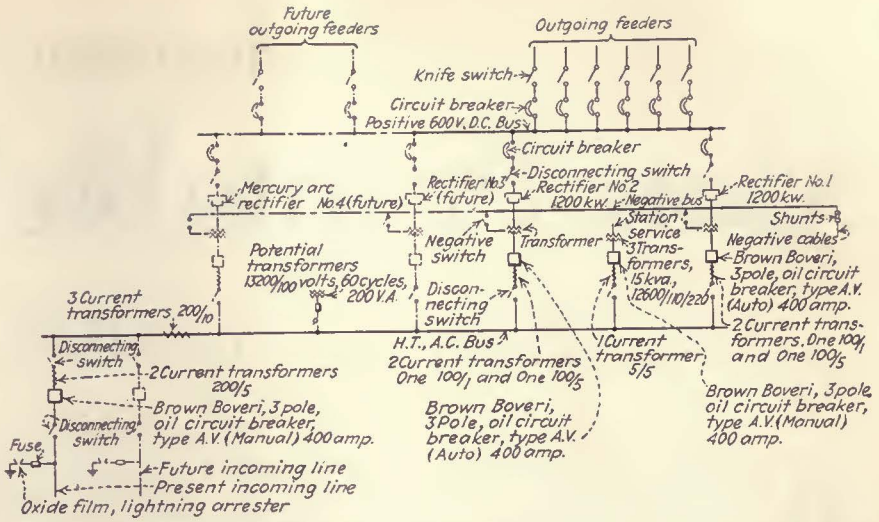
The rectifiers are protected against overload, arc-



The station is designed to accommodate four rectifier units, with a total capacity of 4,800 kw. d.c. This sectional elevation shows its compactness

backs, overheating of anodes, failure of vacuum and of cooling water. In the event of an overload or a short circuit the breakers will reclose after each tripping for three times at predetermined time intervals. After this, if abnormal conditions still prevail, the unit or units are locked out. The circuit breaker also will trip and be locked out by excessive heating of the rectifier, by failure of cooling water, by reversed phase or single-phase conditions, or by excessive low vacuum. The plant will not restart until the inspector has reset the lockout switch.

The mercury condensation high-vacuum pumps always are in operation when the rectifiers are in service, but the rotary or roughing pumps operate only according to the degree of vacuum in the rectifier cylinder.

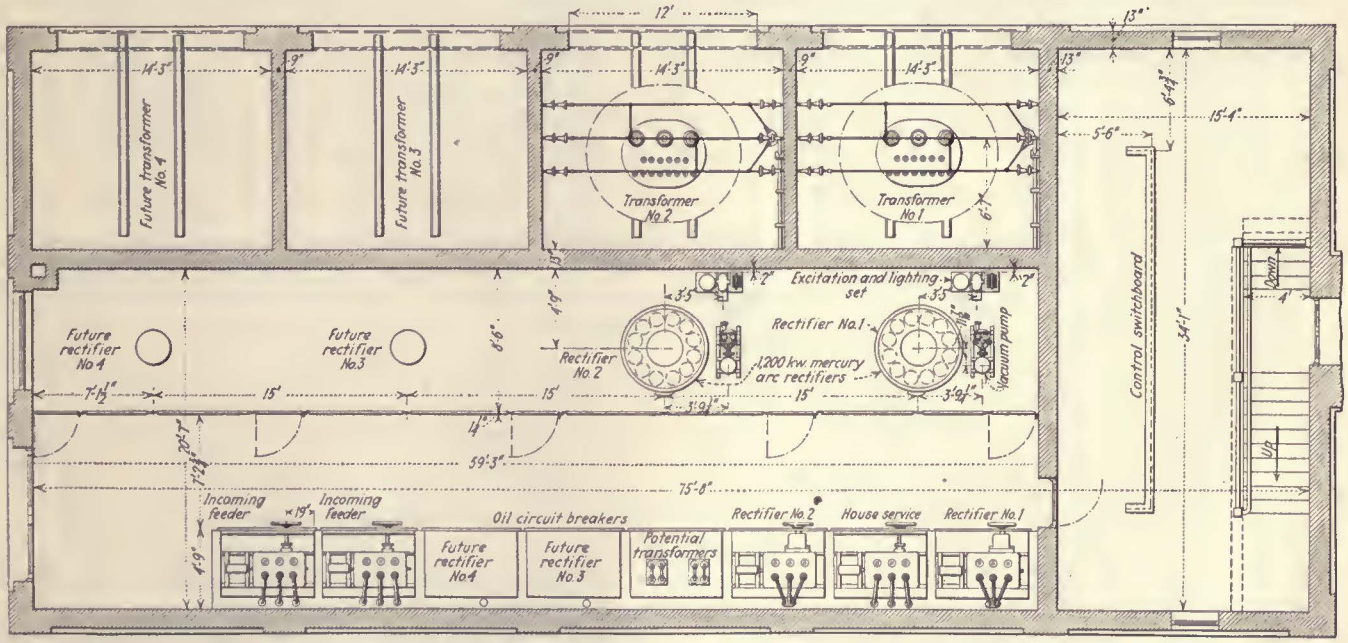


This one-line schematic diagram shows the connections of the two rectifiers installed and the provisions for the two future units. Every effort has been made to keep the equipment simple and reliable

The d.c. feeder breakers are independent of the rectifiers and normally are closed. If tripped by overload or short circuit, they reclose automatically three times at predetermined time intervals. If tripped after the last reclosure they are locked out and must be reset by the inspector.

The station feeds the Lachine and Montreal West divisions of the Montreal Tramways. The building was begun in the spring of 1928 and completed in the fall of the same year. The equipment was then installed and was placed in service on Jan. 5 of this year and has been in service continuously since then, being in operation for 3,146.62 hours out of a total of 3,504 hours of elapsed time. One rectifier has been available for service throughout this period, and the other was out of service 23 hours, or 0.66 per cent of the total time. Because of the present distribution system the station cannot be loaded more heavily, but contemplated changes will in the very near future allot more load to the equipment. Operating statistics are given in the accompanying table.

In the basement are located the recooler, the reactors, the negative bus and the house transformers. The reactors shown in the foreground are to eliminate telephone interference



Plan of the Rockfield substation of the Montreal Tramways. The transformers are in separate compartments, with fire walls between each other and the main operating room. The switchboards are in a separate section at the front of the building by a fire wall

Promotion of

More Profitable Business

Outstanding Topic at C.E.R.A. Convention

MEMBERS and guests of the Central Electric Railway Association assembled at the Golfmore Hotel, Grand Beach, Mich., on June 27 and 28 for a convention, which was one of the most interesting and profitable meetings ever held by the association. The sessions were all well attended, and much interest was shown in all the papers presented. The outstanding feature of the two-day program was a symposium on the promotion of more profitable business, sponsored by D. R. Thomas, president of the Electric Railways Freight Company. Papers on the fundamental problems of the industry and subjects of special interest gave the program excellent balance. The sessions were presided over by President L. M. Brown, vice-president Interstate Public Service Company, Indianapolis, Ind.

The symposium arranged by Mr. Thomas was participated in by seven speakers, who developed the subjects of urban railway business, freight business, truck and trailer interurban operation, express service and advertising. The first paper of the group, on "Promotion of More Profitable Urban Railway Business," was presented by R. N. Graham, manager of railways Penn-Ohio System, Youngstown, Ohio. Mr. Graham pointed out the various factors that have been responsible for the large increase in revenue on his system, emphasizing particularly the results of instituting the weekly pass. He stated that the most logical way to build up more business was to encourage riding in the off-peak hours, when the cars usually carry light loads, by offering the public this service at a more attractive rate. Mr. Graham pointed out the effectiveness of the weekly pass in building up this off-peak riding and how it was proving a time saver to both the patrons boarding the cars and the operators. He also asserted that the pass was serving as a good-will builder for his company.

"The promotion of a more profitable freight business for the electric railway means the promotion of a more profitable service for the customer. Business means service, and unless service is rendered there will be no business—and by service is meant actual performance and not clever conversation." Developing this thought, Frank W. Gerlach, assistant to the president Electric Railways Freight Company, Cleveland, Ohio, pointed out that it is necessary for the electric railways to render the service required by the public in a more satisfactory manner than can be rendered by any other carrier. According to Mr. Gerlach, to meet fully the freight transportation requirements of the public and to promote business in the greatest degree, the electric railways must do one or more of the following things, dependent upon the local conditions affecting the operation of each company:

1. Co-ordinate rail and truck operation, so as to serve off-line points, these truck lines to be used as feeders for the electric railway lines.
2. Provide the shippers and consignees with pick-up and delivery service.
3. Render container service to attract the higher class commodities now carried by truck companies.
4. Encourage the development of carload forwarding companies that will specialize in handling business over the electric railway lines.
5. Take advantage of profitable opportunities to co-ordinate electric railway facilities with those of steam railroad, water navigation and airway companies.
6. Operate freight trains on limited passenger train schedules.
7. Fix the departure of trains at hours most suitable to the shipper, and maintain a force at terminals to meet requirements of the shipper and consignee.
8. Develop the initiative and promotional ingenuity of the sales organization and station agents.
9. Utilize the purchasing power of the company.
10. Improve the appearance of electric railway freight equipment.

Development of an extensive truck and trailer operation in southern Michigan, as well as between Flint, Saginaw and Bay City, by the Southern Michigan Transportation Company, was described by G. W. Quackenbush, traffic manager Michigan Railroad, Grand Rapids, Mich. Mr. Quackenbush could not give a comprehensive report as to the operating efficiency of the system nor figures as to the value of traffic handled, since the new service was instituted only recently, but he did give a clear picture of the character of service offered and the extent of the company's system.

Revenue Possibilities in Express Service

Real express service on electric railways was the subject of a paper by F. W. Brown, general manager Electric Package Agency, Cleveland, Ohio. Mr. Brown explained the character of the service which his company offers and pointed out that real express service is a distinct field, entirely separate from and non-competitive with any other class of service offered by electric railways. He showed that the service could be instituted practically on almost any interurban system and outlined the many advantages of such an express service. An abstract of the paper accompanies this report.

"It is axiomatic," stated W. S. Rodger, traffic manager Eastern Michigan Railways, Detroit, Mich., speaking on the subject of public demands on our transportation system, "that our patrons are demanding speed, safety and comfort from transportation companies in a constantly increasing manner. The demands made upon us for improvements," he continued, "may be the result of our competitors stepping faster than we do and inaugurating methods, which we have silently realized were desirable, but which were withheld from adoption until we were forced to do so, because of inertia or lack of

capital. It is also true that competitors have been stirred to action by our efforts. The continued advancement that is being made in our industry is the result of development by all who are engaged in it, and it is up to us to keep at the head of the parade of progress if we expect to succeed and get our share of the constantly increasing volume of traffic which is offered for handling by some means or other. We cannot afford to sit idly by and let the private automobile handle the passengers or the highway truck handle the freight."

The final speaker of the symposium on the promotion of more profitable business was Labert St. Clair, di-

Real Express Service Offers Revenue Possibilities

By F. W. Brown
General Manager Electric Package Agency
Cleveland, Ohio

ELECTRIC railways, keen for new sources of revenue, will find in express service a source entirely undeveloped and with very promising possibilities. With proper encouragement and development it can be made into a profitable activity, not competitive with any other class of service but bringing new shippers into the fold and creating entirely new revenue.

Express service must not be confused with fast freight. It is a different class of service, to serve a different class of shipper. It's the terminal service on shipments and other special features that distinguish it from freight service. The two services do not conflict in any way, and the demand for one is not satisfied when supplied with the other. The public has more in mind when demanding express service than rapid movement between two points. It may have in mind the free pick-up or delivery at point of origin or destination, or that such pick-up would be made long after freight houses are closed, or delivery at destination for an early market, also long before freight shipments would be available. Again, it may desire that the invoice price of the shipment be collected before the consignee can get possession, it might carry an unusual value making insurance desirable or the shipment may be routed over a transfer point, in which case there is often 24 hours quicker service by express than by freight. These are some of the features that the public quite likely has in mind when demanding express service.

The pick-up service at point of origin gets to the small shipper who does not maintain his own truck. It is usually cheaper to call for the express company than to hire a truck to take the goods to the freight house. It also furnishes service without regard to the closing regulations of freight houses.

Delivery service at destination is another feature which the freight department cannot supply at the rate charged for freight transportation. Delivery at 4 a.m. on the market, often with C.O.D. collection to be made, department store purchases of the previous night that must be at the door when the store is opened the next morning, and delivery of individual packages are examples of service that would be impossible by freight.

The classification provided by the express companies permits of the handling of shipments without the same rigid requirements as to containers and packing insisted upon by freight. Trunks and suitcases are handled under a seal, household goods without the necessity of crating and boxing as when sent by freight, and the higher rate secured for the service is based on those conditions.

A great many C.O.D. shipments are handled where the collections are small, and other times when they run into a large amount, but with the rapid movement of shipments by electric freight it is impossible to get an order bill of lading through the bank as soon as the shipment reaches destination. Therefore the handling of C.O.D. shipments by express allows the shipper to get his merchandise to the consignee and collection of the charges at the same time. It also provides an additional source of revenue in the return of money to the shipper.

Ordinary express rates are based on a valuation of $50, and if the shipment carries a greater value an additional charge is made. Therefore, it is possible for a shipper to place the true value on his shipment, pay the necessary fee and have the merchandise insured.

Express rates are usually of two classes, first and second, the first class rate being approximately three times that of first class freight and the second class rate about 25 per cent less than first class. Food products generally fall into the second class.

Express service as described is offered on the electric railways operating into Cleveland and on some of their connecting lines by the Electric Package Agency, which started its service at Cleveland more than 25 years ago, long before freight service was provided on these lines. When regular freight service was instituted the Electric Package Agency continued to serve as an express carrier only. It now provides almost identically the same service on the electric lines over which it operates as the American Railway Express provides on steam railroads.

Complete merchandise express service is provided by the Electric Package Agency over the lines of the Lake Shore Electric Railway; the Cleveland, Southwestern Railway & Light Company; the Northern Ohio Power & Light Company; the Pennsylvania-Ohio System; the Stark Electric Railroad, and to Detroit over the Eastern Michigan lines. It is an entirely separate organization, the directors being the managers of certain of the lines over which it operates, but its management, accounting, supervising and soliciting are entirely separate.

Under the contract with the railways every phase of the service except the actual transportation between point of origin and destination and the station service at such points is performed by the Electric Package Agency. This includes responsibility for shipments between shipper's door and warehouse at point of origin and after received from the railway at destination, supervising, soliciting, advertising, auditing and costs of necessary supplies. The railway receives a shipment from a driver at a point of origin, bills it on an Electric Package waybill and delivers it to a driver at the destination, who collects charges and returns same to the agent. Thus the service performed by the railway is less than for interline or local freight shipments, as no accounting, except that of the local agent, is required, nor is warehouse storage space needed. The average rate received by

Trucks used by the Electric Package Agency for the collection and delivery of express shipments in Cleveland

the railway for this service is 1½ times first-class freight rate on local shipments and above first-class freight rate on interline shipments. Each railway is furnished a settlement report by the 15th of each succeeding month, together with a check for its proportion of earnings.

The advantages of express service may be summed up as follows: The rates charged are the same as those of the old line express company, which are about three times first-class freight rates and, after deducting the cost of the extra terminal service, leaves to carriers a rate per 100 lb. above first-class freight rate, about double the average per 100-lb. rate received for freight shipments. The service adds new business at this high rate which cannot be secured unless you supply all of the features of this class of service, and which the shipper is paying for but finds is essential. It does not conflict with any other class of business you are now handling, either "dispatch freight" or regular freight with free truck service for large shipments. It does not add greatly to operating costs, and in many cases adds nothing at all. It adds a new shipper to your line, who brings the business to your warehouse and takes it away promptly, thus not congesting your terminal, and it pays you liberally and well for your service.

rector of advertising American Electric Railway Association. Mr. St. Clair confined his remarks to the securing of newspaper publicity, advertising that does not cost. He stated that the public is interested in stocks and business at the present time, and that newspapers are anxious to receive public utility news. Have a reporter call if you have something of interest for the newspaper, was the advice of Mr. St. Clair. He urged that all contributions be made brief and suggested as likely material, speeches, live pictures and editorial thoughts.

Likening the flat and cut rate taxicab operations in the country to a virulent disease with the unhealthy ability to spread throughout the country with disastrous results, H. A. Inness Brown, editor of *Taxi Weekly*, urged that the electric railways co-operate with the legitimate metered taxicab companies in battling this evil. Mr. Brown indicated that the present expansion of cut rate taxicab operation is similar to the jitney peril, which so seriously injured the electric railways several years ago, before being forced out of business. Mr. Brown's paper appears in abstract below.

"One of the foremost problems facing the street railway industry is the formulation of its policy with regard

Flat and Cut-Rate Taxicabs a Serious Menace

By H. A. Inness Brown
Editor "Taxi Weekly"

FLAT and cut-rate taxicab operations, in spite of being basically unsound, constantly demonstrate the unhealthy ability of a virulent disease to spread throughout the transportation system of this country. There is nothing really new about this disease. The railways had an attack of it just about fifteen years ago. At that time it was called the "jitney peril."

The street car companies, being unprotected by proper legislation, were seriously injured by these jitneys, some of them being actually forced out of operation. Gradually, however, by drawing public attention to the menace, and by obtaining proper laws against such unfair competition, the jitneys were forced to discontinue. But before such legislation could be obtained hundreds of thousands of dollars had been lost by the street car companies as well as by the jitney operator.

Meanwhile the taxicab business developed. Companies built up good service and a following by furnishing comfortable, standardized cabs with capable, polite drivers. They created the measured mile so that the passenger might pay at a reasonable rate for the actual transportation used. The tendency was to complete personal service with better taxicabs and better drivers.

From 1914 to 1928 the legitimate cab companies prospered. They attracted capital. They made friends. It looked as if nothing could wreck or hurt the business. But in the business itself there were growing up a number of men who knew nothing about costs but who saw an opportunity to "put over something" on the old-time taxicab operator. The taxicab business was suddenly subjected to a similar disease as that which attacked the street railway companies in 1913. Here's how it occurred:

In the spring of 1927 a cab driver in the city of Rochester, N. Y., who had been discharged by his employer, conceived the idea of establishing a cab company which would operate upon rates of fare much lower than those in existence. He received credit from pleasure car dealers, from the tire companies and from the gasoline and oil people. He brought his cabs out at a cut rate of 25 cents and obtained a great volume of business immediately—some of which came from former taxicab patrons of the legitimate taxicab company and some of which came from the street railway company.

All of this business, however, was obtained at a loss and the company was finally abandoned and its promoter had to go elsewhere. Either through his own efforts or through some of his friends, he established, however, other cab operations in Syracuse and Utica. The idea began to spread. Money, taxicab drivers were told, could be made by operating at cut rates. Almost immediately cut-rate operations started in various parts of the country, most of them being financed by pleasure car dealers.

While this Rochester operator did not make money for himself he had caused great losses to the legitimate cab business in the various cities where he had started operations, often forcing the legitimate cab company to reduce its prices so that it in turn competed with the street car companies for riders. For a brief time, it looked as if this new sort of flat-rate operation was profitable. The cars were new and they needed little attention. Soon, however, depreciation began to get in its work—and the cab companies, including those started by the original promoter, began to look for a way back to higher rates and measured miles.

A good example of the outcome of this type of operation is afforded in Columbus, Ohio, where, after a comparatively short period, three companies went bankrupt and Cy Hill, the driver who introduced the flat-rate cabs, left town. His company was overwhelmed in debt, his drivers unpaid, judgments unsatisfied and his cabs worn out. The legitimate cab companies lost money by the invasion and the electric railway suffered a severe reduction in revenue during the period.

But the picture of Columbus might well be the picture of any reasonably large town in America. More than 100 cab companies, which attempted flat rates in the last year, are now in the process of reorganization or liquidation.

It is unfortunate that these failures are not solving the problem of cut rates. Promotions of cut-rate cabs are still going through the country. These promotions are based on the product of one of the largest cheap car manufacturers in America. The method is to offer the cabs for sale to the legitimate cab company. If this company cannot buy them, because they are unsuitable to cab operation, the automobile company's representatives then offer them to the drivers or form a company to operate them at a rate below the standard. The result is a taxicab operation below costs—a taxicab operation that offers a ride at street car prices—a taxicab operation that makes no money but makes everyone in the transportation business lose money.

This problem may seem to be only a taxicab problem. But is it really limited to taxicabs? Has it any effect on the revenue of the street railway company? I believe it has a devastating effect. In Seattle, for instance, the electric railway there reported a loss of $800 a day, due to flat-rate operation. In Columbus a 25 per cent reduction in the number of street car riders occurred during the height of the flat-rate war at a cost of about $20,000 a month to the railway. In Providence the railway said that unless something was done to give them protection from flat-rate taxicab operators that they would be forced to abandon their franchises. In Worcester a similar condition existed, while in at least five other cities of reasonable size, including Richmond, flat-rate operation caused a loss of from $250 to $2,000 a day to regular street car lines.

138 Cities Have Cut-Rate Cabs

Cut rate operations, running at rates per person below the fare on the electric railway lines, have been established in Dayton, Columbus, Akron, Cleveland, Providence, Boston, Baltimore, Rochester, Richmond, Charleston, S. C., San Francisco, Seattle, San Diego, Cincinnati, Louisville, Detroit and 122 smaller cities.

In the West there is one cab company, operating at an extremely low rate, that is planning operations throughout the West and Middle West at rates below the cost of operation. This company's plans, as announced to the public, included the establishment of cut-rate cab companies in small cities as well as larger centers. They state frankly that their form of operation, which gives only transportation to the passenger, without any frills, is likely to cause the legitimate cab company great loss in business. They are after volume—the greatest number of riders at the cheapest possible price. This is vital news. It means that something must be done to prevent a new crop of cut-rate cabs.

The only real solution possible is protective legislation. And such legislation, if it is going to be really protective, must be sought by the electric railways as well as the taxicab companies. The cut rate business hurts the railways as much as it hurts the taxicab man. The taxicab company can meet the competition by cutting rates, but the railways must keep the same rates and fight the competition by the best possible service. If they are going to have the competition of the converted pleasure car or jitney lines, they must find some means of fighting it.

In the wake of flat-rate operations follow bankruptcy petitions, greatly increased traffic hazards, violations of municipal and state laws, demoralization of the transit lines, and an increased volume of rides at a loss. These are facts that force the thinking men in the taxicab business and in the electric railway business to realize that something must be done.

to bus operation." With this statement, Thomas Fitzgerald, vice-president Pittsburgh Railways, Pittsburgh, Pa., launched a discussion on the fundamental principles involved in determining the bus policies of an electric railway. "The adoption of a hard and fast policy," Mr. Fitzgerald continued, "is believed to be impracticable, if not impossible. If we grant that the success of policies of public utilities in a large measure are dependent upon meeting and satisfying public opinion, it is self-evident that the bus policy of an electric railway must be adapted and adaptable to changing public opinion. Such a policy should be sufficiently flexible to meet the changing conditions not only in the field of bus operations as they develop, but in the field of electric railway operations as well."

In reviewing the elements which have contributed to the problem of determining the proper bus policy, Mr. Fitzgerald first pointed to the development of automotive vehicles and their effect. He held that it would be unwise to assume that the time has come to determine upon a definite policy toward the bus, in view of the continued expansion of the automotive industry. He warned that if railways continued to offer street car service, which is generally very little different from that offered to a former generation, and if at the same time, bus facilities and service are developed rapidly along modern lines, the effect on the public attitude must be unfavorable to the railway and favorable to the bus.

Mr. Fitzgerald named economy, through which more frequent car service may be provided, speed, reliability of service, greater comfort and elimination of noise as necessary elements in improving the railway service. He stressed the fact that public attitude toward electric railway management, over a long period of time, is based upon the efficiency with which the service is rendered. "This efficiency," he stated, "is directly dependent upon the financial strength of the electric railway, and the management, therefore, must preserve the financial and physical condition of their facilities to obtain success. From this viewpoint, the indicated policy toward the bus operation is that of employing the bus only when the results contribute to the economic well-being of the railway and bus facilities combined." Mr. Fitzgerald listed the fields in which the bus has been demonstrated to be effective and other developments that hold promise.

John R. Blackhall, general manager Chicago, North Shore & Milwaukee Railroad, Highwood, Ill., speaking on the subject of improved interurban operation, named as the three main factors to consider in the operation of an interurban railroad the public, the employees and the investors. "If these three factors," he stated, "are constantly kept in mind by the management, operation will be reasonably successful, unless there is something basically wrong in the rates or financial structure of the organization and the location of the property." It is Mr. Blackhall's opinion that convenience of service is the strongest selling point the interurban railroad can put forward when bidding for the patronage of the public. He defined convenient service as transporting people from where they are to where they wish to go, with safety and comfort, in the shortest possible space of time—but above all, at the time they wish to go. He stressed the importance of making a thorough study of the traveling habits and requirements of the people in the communities served and scheduling trains to meet their requirements in the best possible manner. "The next important thing," he said, "is to see that the trains make the time shown on the time-table."

Expanding on the second factor, employees, Mr. Blackhall stated emphatically that it is impossible for the management of a company to give the public satisfactory service without the active co-operation of the employees. He told of the training given North Shore employees in the handling of customers, and stressed particularly the developing of interest in this work by continuing the training after the preliminary work. Mr. Blackhall told also of the training given North Shore employees in selling rides. He emphasized the point that employees cannot be expected to sell the service without the necessary training to equip them for that work.

"Make your product purchasable without petty irritation and through a price plan that automatically incites voluntary use of your service" was the advice of Walter Jackson, consultant on fares and motor buses, Mt. Vernon, N. Y., for winning and holding customers. Mr. Jackson referred to "habit-creating" fares as essential, along with improved equipment and service, in attracting patrons, and cited the merits of the weekly pass that make it an effective ride promoter.

Three Bus Sizes Meet Most Needs

In answering the question, "What size bus is best suited for city transportation?" Del A. Smith, general manager Department of Street Railways, Detroit, Mich., divided all regular bus lines into three general classifications and gave the type of bus considered best for each class of service as follows:

1. For light, feeder and shuttle service, as well as short extensions into thinly populated territory and outlying districts, the small 21-passenger bus is satisfactory because it makes possible the maximum frequency of service at the minimum cost per mile, providing no extreme peaks are encountered.
2. On secondary or medium lines which have a considerable volume of traffic with a fairly heavy peak load, the 29-passenger bus is desirable and economical because of the greater passenger appeal afforded without seriously lengthening the headway.
3. For main trunk lines and lines where the population is pyramiding or wherever extreme peak loads are encountered, the single-deck street car type bus seating 40 passengers is justified, because it has been proved that the operating cost per mile is but 50 per cent more than for the 21-passenger bus and about 25 per cent more than for the 29-passenger type, giving twice the seating capacity and room for four times as many standees as the 21-passenger unit. In short, the 40-passenger single-deck bus is preferable in service approaching mass transportation.

Mr. Smith also referred to special classes of service, such as de luxe express operation and the use of small capacity buses to replace jitneys. The paper was presented by Homer E. Libby.

The requirements of modern automatic control, as listed by B. O. Austin, control engineer Westinghouse Electric & Manufacturing Company, in his paper, are variable tractive effort, quick response to any change in the controller handle position, smooth and rapid acceleration, effective notching, ability to stop and hold the control at any point, adaptability to foot and hand operation, non-interference with safety devices, simplicity and reliability. Mr. Austin named the fundamental advantages of automatic control as variable automatic accelerating rates, maximum operating efficiency, foot control and low operating cost. Mr. Austin's paper was discussed by W. A. Clough, railway and bus equipment engineer, General Electric Company.

A golf tournament on the afternoon of the first day was the high spot of the entertainment program. At the banquet held the same evening, the entertainment was furnished by the South Shore Chorus, "Mary and Jim," popular radio artists, and a première danseuse from Chicago. Following the banquet a dance was held.

Interior of new Detroit car

Speedy Light-Weight Car Built at Detroit

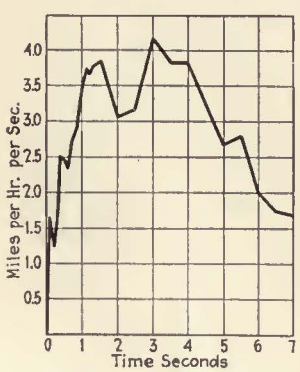
Design of experimental vehicle includes extensive use of aluminum. Four high-speed 50-hp. motors are mounted on Timken trucks

LIGHT WEIGHT, rapid acceleration, and high free-running speed are features of an experimental car recently built by the Department of Street Railways, Detroit. Factors which have contributed to keeping down the weight are: Light-weight motors and trucks, reduced amount of steel framing in car body, absence of heavy brake rigging, use of aluminum as the material for the trolley pole, bumpers, door engines, air compressor and piping.

	New Car, Pounds	Old Car, Pounds
Car body weight	19,400	21,320
Trucks	9,280 (incl. gears)	9,940
Motors	3,820	5,240 (incl. gears)
	32,500	36,500 lbs.

In general, the car follows the Peter Witt design now standard on this system. Four Westinghouse 300-volt 60-hp. motors are mounted on Timken model 52 trucks. General Electric 16-point automatic control is used. The following comparison shows where the reductions in weight have been made.

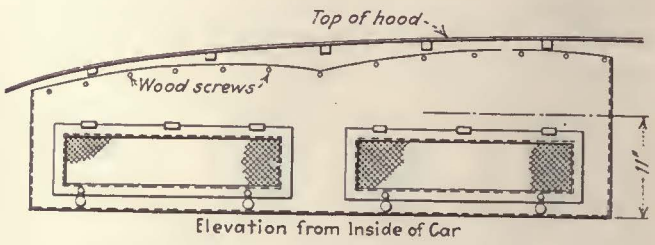
Preliminary tests show this equipment to produce an acceleration rate of 4.18 m.p.h.p.s. in the first three seconds. The acceleration is of such a smooth character as to cause no inconvenience to the passenger, although he cannot fail to notice the speedy action of the car. The numerical value of the rate of acceleration has been determined by the use of a Cambridge recording accelerometer, and a typical acceleration curve is shown in an accompanying illustration.



Rapid acceleration shown by tests of new Detroit car

The braking system is straight air but has the novel feature of using a foot-operated brake valve of the G. E. VB-2 type. This is a balanced air pressure valve and gives an operation akin to that of braking an ordinary automobile. The pedal is spring controlled and may be locked in the application position. The air brake piping is made of dead soft aluminum tubing. The radiating coil for the air brake system is made of a finned type of pipe recently designed by the Peter Smith Heater Company. It possesses the advantage of reduced weight, less internal friction and simplified installation.

The body is of steel construction and uses U-shaped posts and carlines. Wooden post fillers are not used but aluminum post facing of a section shown in an accompanying sketch. The seating arrangement is much the same as previously used except that cross seats have been substituted for longitudinal seats in the forward section. The seats are of an individual type and are deep upholstered with cushioned backs, giving the maximum of seating comfort. The upholstery is Delft blue leather which, with mahogany woodwork, makes a pleasing combination.

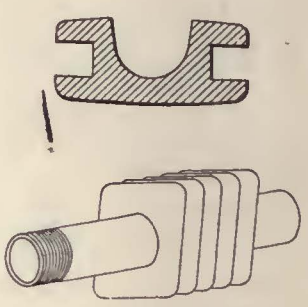


Novel devices included in design

Above: Ventilated cover for door engine allows warm air to circulate around apparatus and prevents freezing in winter.

At right: Cross-section of aluminum window post facing.

Below: Finned pipe radiating coil for braking system.



As a departure from customary practice on this property a single sash was substituted for the usual upper and lower sash, and as the post centers were increased from 29¼ in. to 33½ in. the sash is wider, thus improving the appearance of the car. A wide bottom sash rail was used and into each was fitted an individual ventilator. Forced ventilation is used; following a design developed by the Peter Smith Heater Company. With this system air is admitted to the car through intake ventilators on the roof and exhausted through four grilles distributed in the floor. The exhaust is accomplished by means of a motor-driven exhaust fan suspended under the car floor and connected to the floor grilles by flexible metal tubing.

Reduction of unsprung weight is one of the most important of several noise reduction features that have been included in the design, others are worm gear drive, rubber spring supports, rubber motor supports, rubber mounting of air compressor and trolley base, and sound insulating of the floor with felt. The operation of the car from the noise standpoint has proved highly satisfactory.

A.I.E.E. Discusses

Railway Electrification

At the transportation session during the Swampscott convention the Mexican Railway electrification, contact wire wear and substation design were important topics

PROMINENT on the program of the summer convention of the American Institute of Electrical Engineers, held at Swampscott, Mass., June 24-28, was the subject of transportation. The committee on that subject, headed by W. M. Vandersluis, presented a report showing the progress of electrification of steam railroads during the year. Reference was made to the projects of the Pennsylvania Railroad, the Great Northern Railway, the Cleveland Union Terminal Company, the Reading Company, the Delaware, Lackawanna & Western Railroad, the Boston, Revere Beach & Lynn Railroad and the city of Rochester. These have been mentioned in this paper from time to time. Diesel-electric locomotives, rail cars, supervisory control for substations, mercury arc rectifiers and high-speed circuit breakers are also included among the developments of the year.

Four papers of interest to electric railway engineers were presented. These covered the electrification of the Mexican Railway, contact wire wear on electric railroads, an alternating-current electric railroad substation of the Pennsylvania, and the direct-current substations supplying the Illinois Central. Brief abstracts of these papers follow.

Mexican Railway Electrification Discussed

The paper on this subject, by J. B. Cox of the General Electric Company, gives operating results of the electrification of the Mexican Railway, Ltd., which was the first railway built in Mexico, having been opened to traffic on Jan. 1, 1873. The main line runs between Mexico City and Vera Cruz and is 264 miles long. There are six branch lines which increase the route miles to a total of 482. The most difficult portion of the line consists of 19 miles of 4.7 per cent grade between Encinar and Boca del Monte, where the table-land is reached. In 1921, when the road was returned to its owners following five years of government operation, the property was found to be in unsatisfactory condition, with operating expenses more than doubled, thereby increasing the operating ratio from 0.51 in 1924 to 0.79 in 1920. Higher wages and new working agreements were largely responsible and continued to become more difficult. The mountain division had about reached its maximum capacity with the existing equipment, making it necessary to consider improvements.

A study of the operating costs of this section was made in 1921, from which it was apparent that electrification would relieve the congestion and make it possible to more than double the capacity of the line and at the same time make a yearly saving of $523,000 in operating expense. The electrification was estimated to cost $2,420,000, thus indicating a return of 21 per cent on the gross investment including electric locomotives, in addition to the increased capacity and many other advantages.

Construction work was started in January, 1923, and electric operation between Orizaba and Esperenza was complete in January, 1925. The total cost for the 29-mile section was $2,427,480. Internal disturbances delayed the work several months and reduced the traffic greatly. In March and April, 1928, the traffic became comparable with that of September and October, 1921, for which period the actual traffic records and operating costs with steam had been used as a basis for comparison with the estimated cost of an equal traffic with electric operation.

In the meantime the general results had been so satisfactory that the electrification was extended 35 miles south to Paso del Macho, making a total of 64 miles at a cost of $3,606,937.

The system is operated with 3,000 volts direct current, supplied from a simple catenary system with double No. 0000 trolley wire on the main line and single No. 0000 trolley in yards and passing tracks. There are two 500,000 circ.mil positive feeders and one No. 0000 negative feeder between Orizaba and Boca del Monte. Originally a single substation was installed near Maltrata, being almost in the center of the feeder circuit. This station contains two 3,000-kw., 3,000-volt, three-unit synchronous motor-generator sets for supplying power to the original 29.5-mile electrification. With the extension of the electric zone to Paso del Macho, making the total length of route approximately 64 miles, a second substation was installed at Portrero. This contains two 1,500-kw. units which are similar, except for size, to the original equipment. Both stations are supplied with power purchased from the Puebla Tramway, Light & Power Company at 42,000 volts, 60 cycles.

The initial installation included ten locomotive units suitable for handling both passenger and freight trains. They are of the twin-geared six-motor articulated-truck type, capable of operating at a maximum speed of 40 m.p.h. and provided with equipment for regenerative electric braking. The motors are designed for 1,500 volts per commutator, two being permanently in series.

The Orizaba-Esperenza section has now been in complete operation electrically since January, 1925, and the full records for four years are available. During March and April, 1928, the traffic reached a new maximum

which was in excess of that which was attained with steam. Briefly, the ten electric locomotives handled 36 per cent more tons than were handled by more than double the number of steam locomotives in September and October, 1921, with 8 per cent less trains and 40 per cent less train-hours on the road, and at 50 per cent of the corresponding total cost of steam operation for 26 per cent less tonnage. The saving was $67,102 for the two months, or at the rate of $402,612 per year, which alone represents more than 15 per cent on the total gross cost of electrification. This does not represent the total saving, as labor costs had increased sharply in the meantime. When the costs were adjusted to equal traffic and equal wages, it was shown that the equivalent costs for steam service would be $1,068,000 per annum and the electric costs $404,652. The indicated annual saving is thus $663,348, as compared with an estimate of $523,029.

Securing Flexibility in Contact Line

In his paper on contact wire wear on electric railroads, I. T. Landhy, assistant engineer Illinois Central Railroad, described the contact systems of several electrified roads. Flexibility in the contact plane is important, he held, and it can best be secured by staggering the points of support of the contact wire with respect to the messenger, while at the same time damping out the unwanted harmonic wave ahead of the pantograph by means of as high a tension in the contact wire as it will permit. Pantograph design resolves itself into a judicious composition of the following essentials: (1) Sufficient current-collecting surface; (2) lightweight moving parts; (3) sufficient uniform upward pressure; (4) freedom from friction in the bearings. Intrinsically, he said, lubrication plays an important rôle in reducing wear. On long tangents where the contact wire is in the middle of the pantograph the greater part of the time, the lubricant becomes depleted and wear is increased. On curves where the pantograph is wiped across the contact wire the wear is less, the lubricant from the ends of the pantographs being distributed over the whole surface. A comparison of contact wire measurements shows that there is approximately 30 per cent more wear on tangent track than on curves. The experience of the New Haven has been that, generally, the higher the speed the less the wear of the contact wire. The effect of contact wire wear of current collected is not so well known, but the general impression is that the greater the current the greater the wear.

Substations of the Illinois Central and Pennsylvania Described

J. V. B. Duer, electrical engineer Pennsylvania Railroad, described one of the a.c. outdoor substations supplying 11,000 volts single phase for the Philadelphia-Wilmington electrification. In this station all apparatus is in the open except the control board, which is located in a house designed for the purpose.

The railway substations for the 1,500-volt d.c. electrification of the Illinois Central were described by A. M. Garrett, engineer of substations, Commonwealth Edison Company. These substations, owned and operated by the Commonwealth Edison Company and the Public Service Company of Northern Illinois, receive the 60-cycle energy for conversion to direct current from the 12-kv. transmission system of the former and the 33-kv. system of the latter power company. Approximately 80 per cent of the conversion capacity is in synchronous converters and the remainder in mercury rectifiers. The decision to use rectifiers for a part of the load can be assigned to several reasons, principal among them being that this new type had the natural advantage which a unit with no moving parts has over one with rotating parts and wearable and friction surfaces. Other reasons included high efficiency with fluctuating loads, absence of noise and vibration, low maintenance expense, and the elimination of extensive ventilation facilities.

Discussion of the papers presented was called for en bloc by Chairman N. W. Storer, of the Westinghouse company, who presided. Prof. D. C. Jackson of Jackson & Moreland, Boston, commended Mr. Cox's paper because of the cost data included in it.

General Discussion Shows Interest in Electrification Problems

Sidney Withington, electrical engineer of the New Haven road, said the data presented by Mr. Cox would be more convincing if contrasts were made between the most modern steam locomotive power units and electrical equipment. The economies of superheaters, feed water heaters, etc., should be taken into account in modern comparisons. Referring to Mr. Landhy's paper, he said that it is still a question whether to lubricate the railway trolley wire or the pantograph shoe. It may be necessary to utilize some auxiliary moving part on top of the pantograph in order to cut down vibration. Chromium plated material may be useful in future pantograph design. Observation of trolley wear on the Providence-Fall River, Mass., electric branch indicates increased wear on sections of the line leaving stations, heavy accelerating currents being taken from the wire on these stretches.

C. S. Anderson, American Brass Company, pointed out that from 15 to 20 per cent less wear is being secured with cadmium-copper bronzes than with tin-copper bronzes. The former do not become brittle or "hot short" when overloaded.

Major E. L. Moreland, Boston, raised the point that the use of one vs. two contact shoes on pantographs deserves more thorough study in relation to wear. Several speakers maintained that the use of two shoes insures better contact, but the cost of such practice in terms of increased wear was not definitely acknowledged. Most of the speakers preferred two shoes.

W. B. Potter, consulting engineer General Electric Company, said that the electric locomotive presents the greatest problem in railroad electrification from the cost standpoint, in many cases running between 40 and 50 per cent of the total cost of electrifying. He said further that the mercury arc rectifier will be utilized more widely in the future, perhaps being available for 5,000-volt d.c. service in time. The unidirectional characteristics of its output make it promising in electrochemical applications. The future of railroad electrification is very bright, Mr. Potter declared.

In the closing remarks by the authors, it was brought out that the use of high towers by the Pennsylvania Railroad electrification was predicated by the spacing required for 132-kv. transmission. Mr. Garrett pointed out that a good deal remains to be learned about the operation of mercury arc rectifiers, including study of their interior performance, possible improvements and limitations. Results thus far obtained are good, but the subject is not a closed book.

Transmission and axle overhaul is kept separate from motor rebuilding in New Haven bus shop of the Connecticut Company

DAILY CHECK

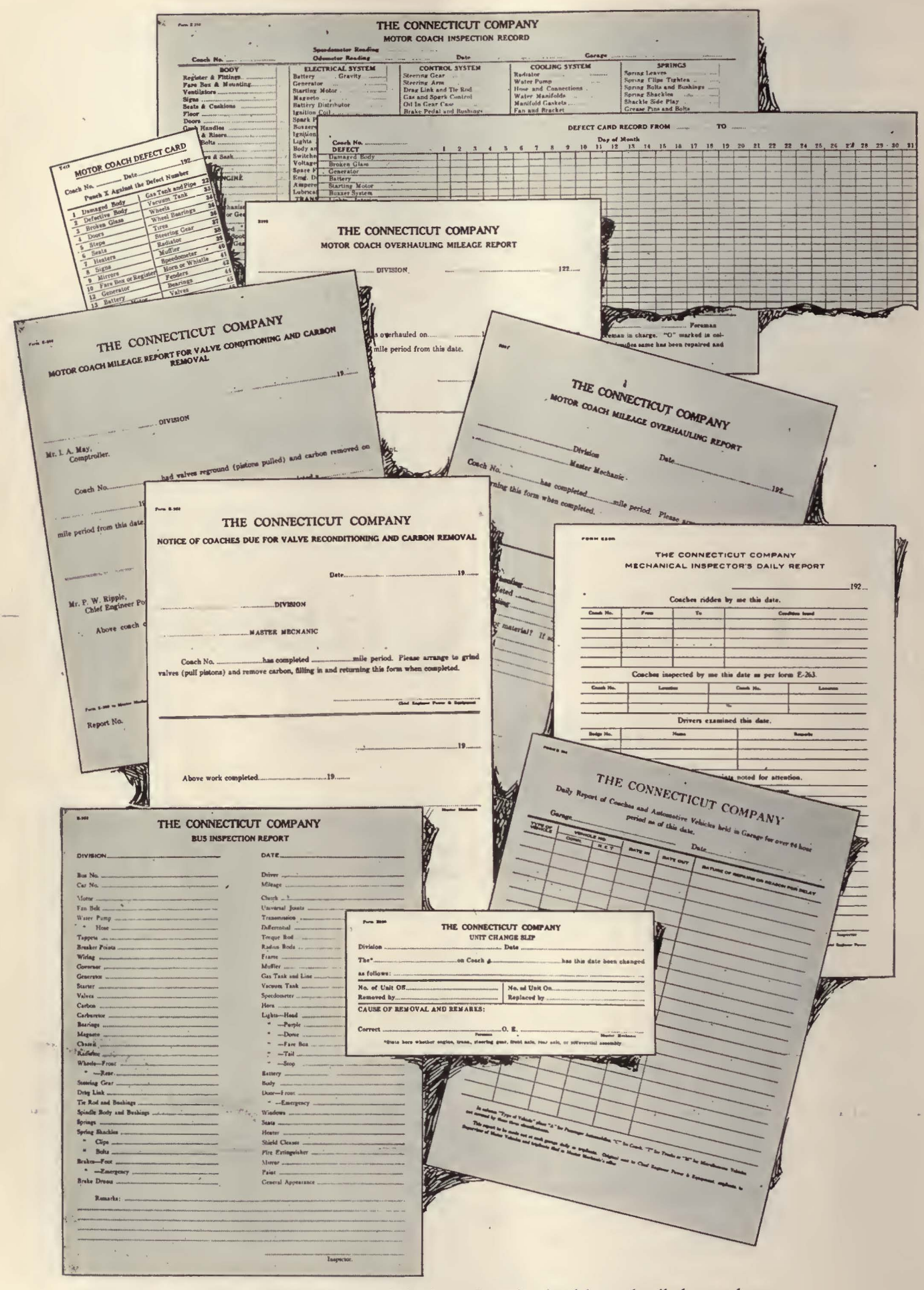
Shows Condition of Bus Fleet

Comprehensive reports keep Connecticut Company officials well posted concerning condition of equipment. Inspection and maintenance work is done at 15 operating garages. All overhauling is done at the New Haven shop on unit replacement basis. Painting not synchronized with overhaul.

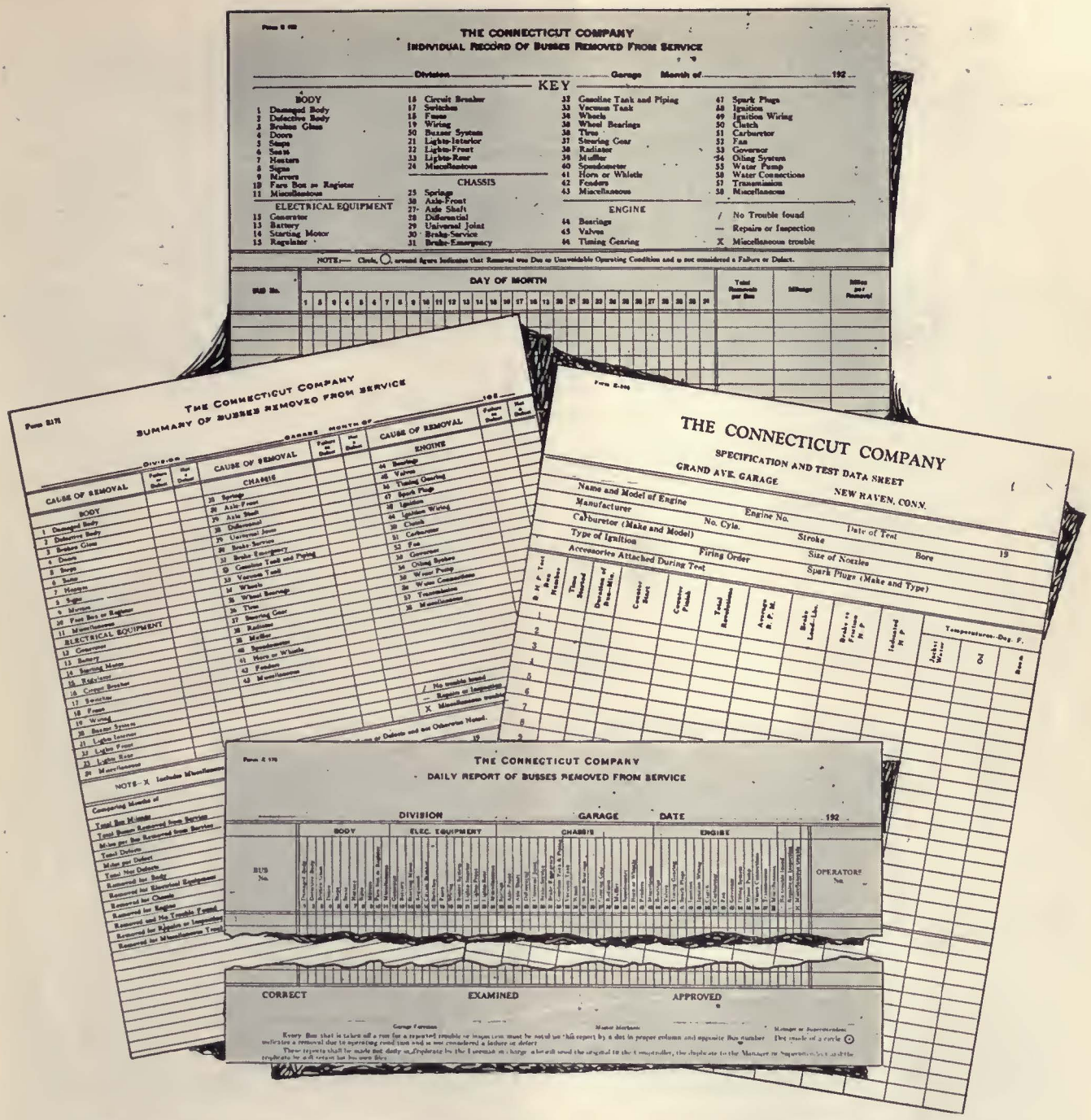
MAINTENANCE of buses operated by the Connecticut Company is based on a mileage system, with the exception of painting, which takes place on an average of once every 12½ months. In order to know exactly when a bus has traveled the required distance for motor overhauling or general unit changes, the comptroller's office keeps accurate records of the distance traveled by each vehicle. When a bus has completed the specified mileage the maintenance department is informed promptly and it is taken out of service.

Experience has convinced the management that it is a good policy to overhaul the various units at predetermined intervals. One of the first requirements in keeping a bus constantly available is that any defect, however small, is brought immediately to the attention of the repair force. To accomplish this, the company has designed a "Motor Coach Defect Card" which is issued to each driver before he starts on his daily run. On this card, the various parts of the bus are listed under fifty-seven headings. Should a defect occur the driver indicates the item by a punch mark on the card, adding any other information which he deems necessary regarding the trouble. At the end of his daily run this card is deposited in a box in the garage. It is collected by a member of the shop force who repairs the item indicated, and, at the same time, notes this fact on a "Motor Coach Inspection Record," which is kept for each bus.

When the bus has traveled 2,000 miles, this record of repairs is used as the basis for inspection. The bus is thoroughly gone over and all defects which have developed since the last 2,000 mile inspection are carefully checked to see that the respective parts are in proper running condition. At every 2,000 mile inspection, this record is compared with the previous one to see if certain defects have recurred. In such instances this is investigated and particular care is taken that the same.



Close check of the condition of the buses is maintained by a detailed record system



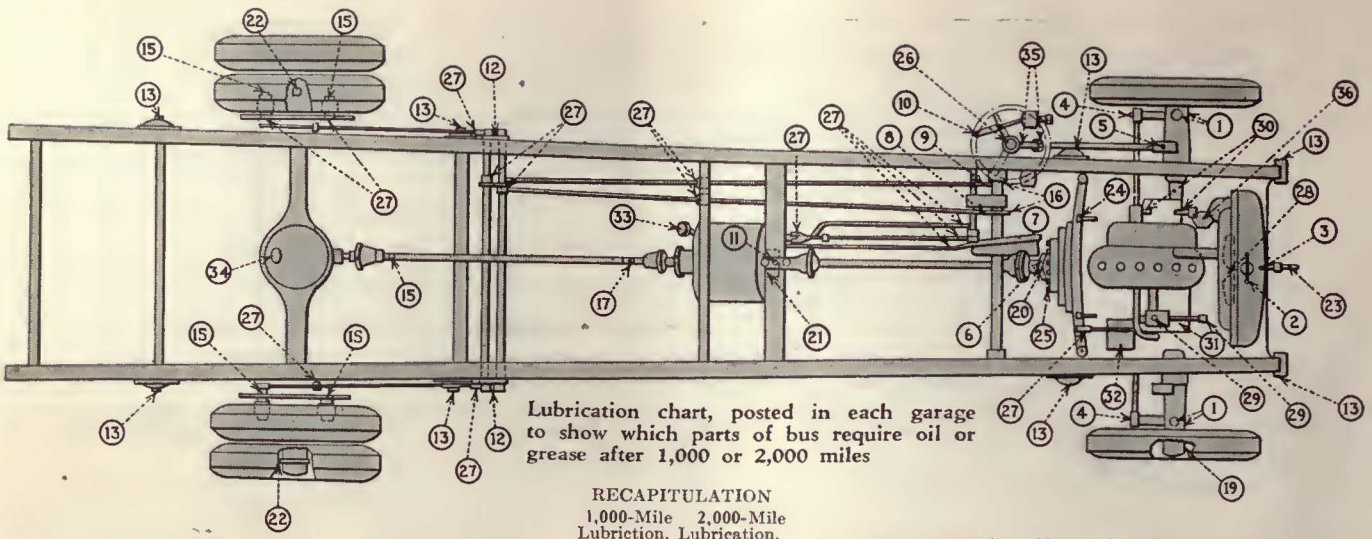
Forms used for recording information on buses removed from service, and a sample specification sheet

defect does not occur again. These records are kept for three years in order to have available at any time the written proof of the durability or weakness of the various parts of the bus.

Besides keeping the coach continually in first-class running condition by repairing all minor defects, the company recognizes the necessity of reconditioning the motor at intervals independent of the general overhaul or unit change, which takes place after every 75,000 miles of operation. Due to the different construction of the sleeve-valve motor and the poppet-valve type, the removal of carbon from these two types of engines takes place at different intervals. Best results are believed to be obtained when the cylinders are cleaned and the valves reground in the poppet-valve motor after every 10,000 miles and cylinders cleaned in sleeve valve engines every 20,000 miles.

When the carbon has been removed and the valves reground, the master mechanic notifies the maintenance department, which advises the office of the comptroller that the bus has been put in service. He also requests to be notified when that bus has traveled another 10,000 or 20,000 miles, depending on the type of motor. The report sent by the maintenance department to the comptroller's office with the information when a particular bus should be brought in for reconditioning of motor is called "Motor Coach Mileage Report for Valve Conditioning and Carbon Removal," and the notice sent by the maintenance department to the master mechanic is called "Notice of Coaches Due for Valve Reconditioning and Carbon Removal."

When a coach has traveled 75,000 miles, it is considered necessary to take it out of service for a complete unit charge, and the auditing department sends the



Lubrication chart, posted in each garage to show which parts of bus require oil or grease after 1,000 or 2,000 miles

"Motor Coach Overhauling Mileage Report" to the maintenance department, advising that a bus has traveled the specified distance. The maintenance department then notifies the master mechanic in whose division the bus operates and instructs him to take this vehicle out of service and send it to the central repair shop in New Haven.

All necessary repairs are made there, while anything which has been brought to the attention of the division repair force at the 2,000 mile inspections is again carefully gone over to insure that recurrence will not take place. All units such as steering gear, motors, front axle, rear axle, transmission and differential are removed from the bus and replaced by reconditioned units from the storeroom. By following this method, the time out of service is reduced to a minimum. When the bus is finally O.K. for service, it is sent back to its division, and the maintenance department informs the comptroller's office of this, to enable them to keep a record and to advise the chief engineer of power and equipment when the bus should again be taken out for a reconditioning of motor or an annual overhaul. The maintenance department keeps a record of any unit change which takes place and a so-called "Unit Change Slip" is filled out by the foreman in whose shop the change takes place, giving all the information required. In this manner, a careful check is obtained on the performance of all units in operation on the entire fleet.

In order to keep fully posted on the efficiency of the various division repair shops, the company has a number of so-called "floating inspectors" who ride the buses and bring any irregularity to the attention of the master mechanic responsible, while a copy of their daily findings is sent to the main office. Besides filling out this so-called "Mechanical Inspectors' Daily Report," they make

RECAPITULATION

1,000-Mile Lubriction, Part No.	2,000-Mile Lubrication, Part No.
1	2
4	3
5	8
6	9
7	10
13	11
17	12
18	15
20	16
29	19
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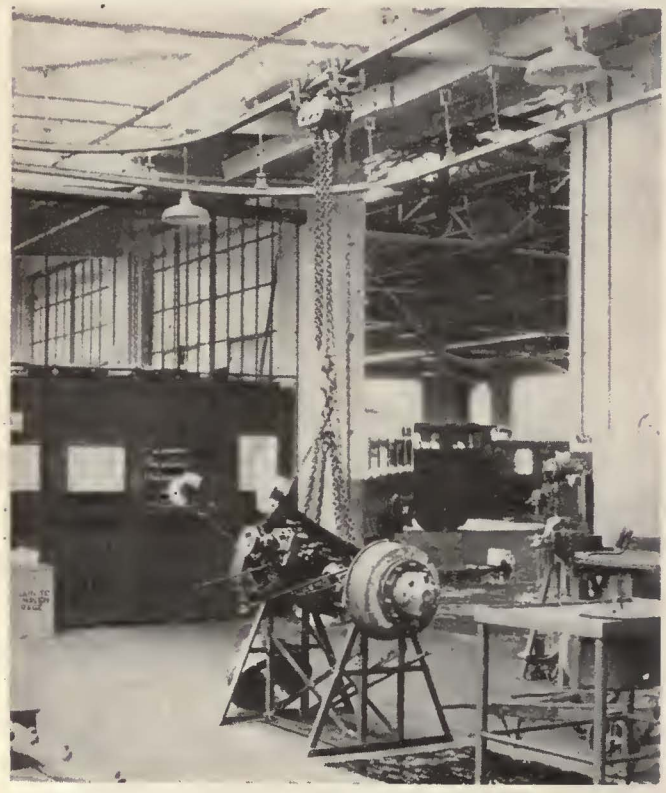
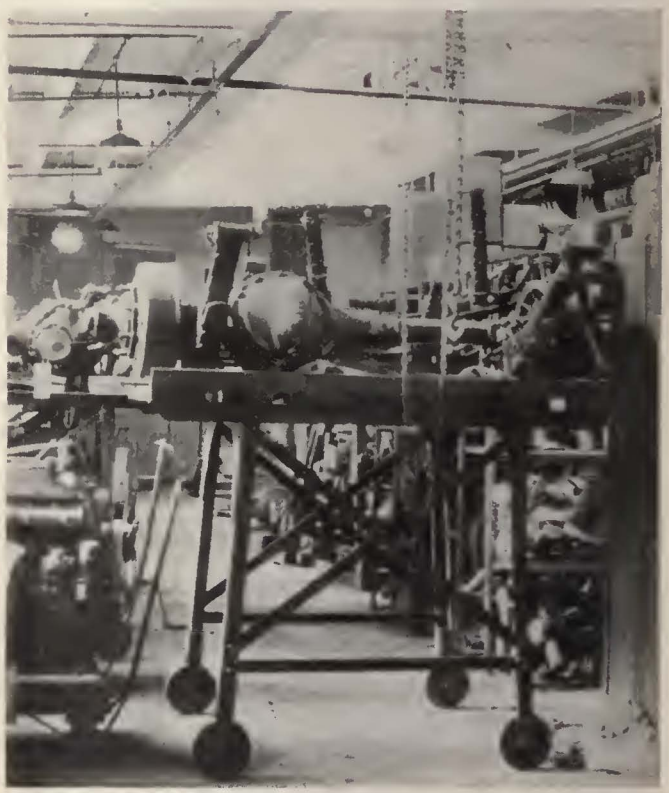


Rear axle completely overhauled and ready to be taken to storeroom



Motor and axle assemblies are stored on specially designed carriages with the motor under the axle

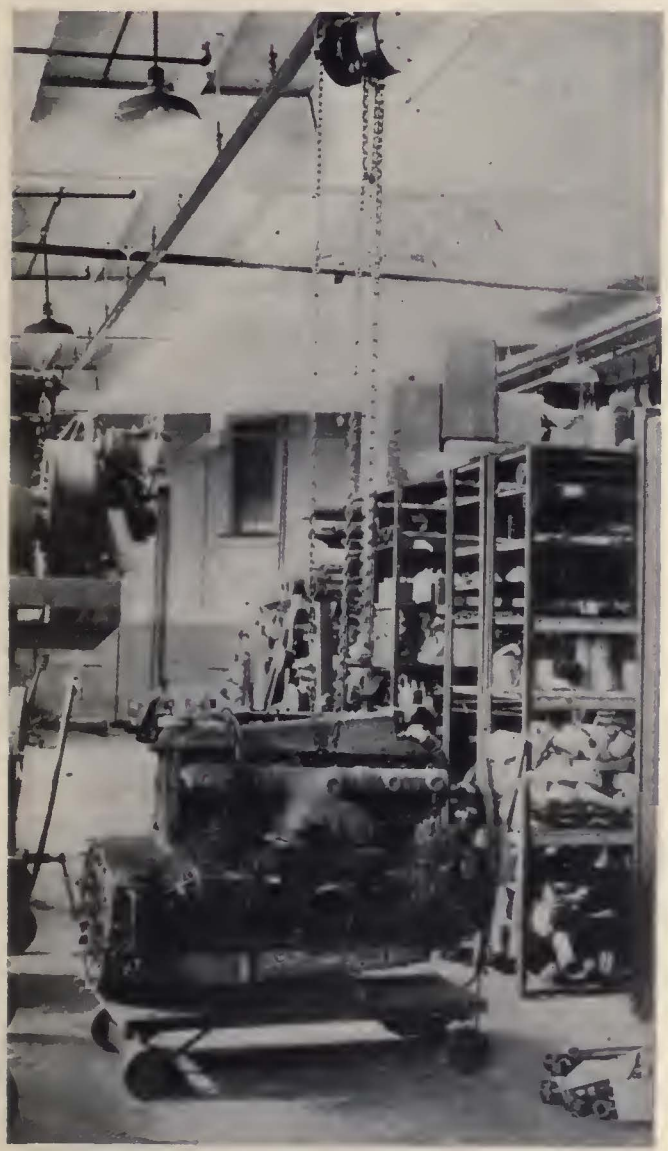
a report on each bus they ride, noting the defects observed and the action taken. Independent of the maintenance department, the chief engineer of power and equipment is informed daily by the transportation department which coaches have been held in the garage for more than 24 hours.

A report is received daily of the total number of buses removed from service and an individual record is kept also of buses removed thus indicating weak points in the upkeep of the rolling stock. A list of all buses removed from service is kept for each month, and the chief engineer can thus determine immediately why the buses are kept out of service and detect any laxity or inefficiency in maintenance work.

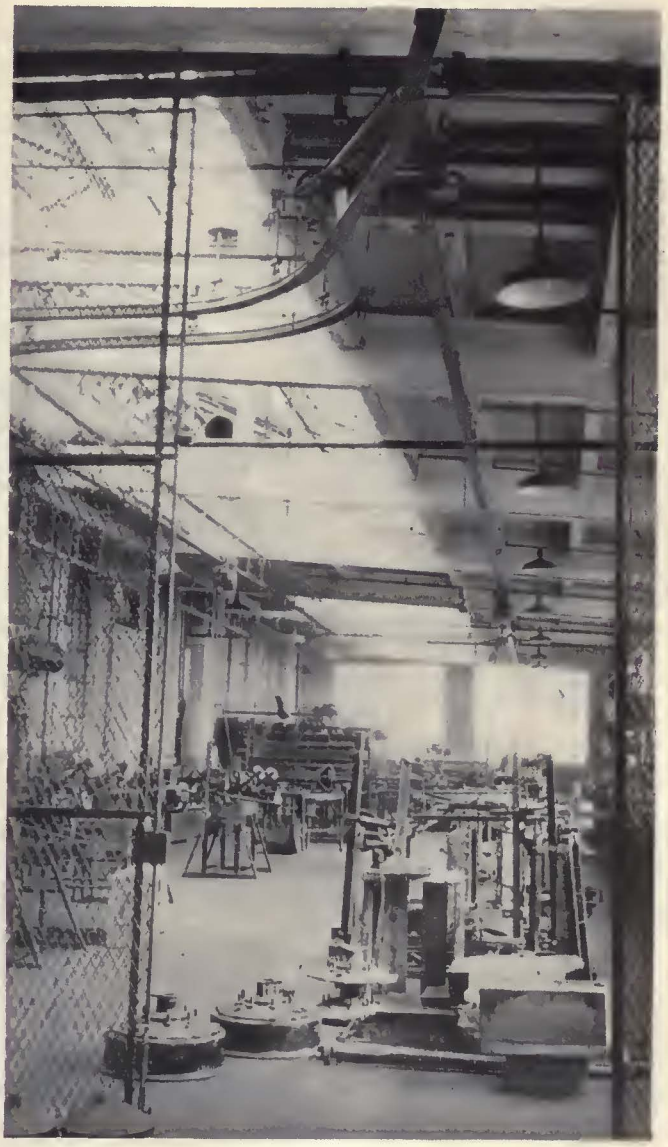
The units changed after the completion of every 75,000 miles are thoroughly overhauled and parts which require repair are replaced by those which have been reconditioned or are new, so that the bus will be available again in the shortest possible time. Replacement units are kept always available in the central repair shop storeroom. These include engines, transmissions, steering gears, front axles, rear axles and differential assemblies. Should an emergency call come in from one of the divisions for a replacement unit prior to the 75,000 mile overhaul, it can be shipped immediately and the damaged unit sent to the repair shop where it is overhauled and put into the storeroom. Before an engine is again O.K.'d for service and placed in the storeroom, a thorough test is made on the dynamometer.

The layout of the shop is such that the least possible time is required for the conveyance of units from the buses to the various places in the shop where the units are to be repaired. A monorail hoist system beginning at the platforms where the buses are overhauled, conveys the units taken out to the repair bays and through a switch system. The unit can be brought either to the left or the right side of the repair shop for repairs .

Painting of the buses is done entirely independent of the central repair shop. In the territory where the buses operate there are in all five paint shops. In New Haven this takes place in the paint shop of the carhouse. A bus is given one to three coats of paint depending on its condition and dried in a specially designed electrically heated shed, described in the April 28, 1928, issue of the ELECTRIC RAILWAY JOURNAL. By this means it is possible to turn out a completely repainted job in three days, thus reducing considerably the time required for this kind of work, which formerly was about six days.



Completely overhauled motor, tested on the dynamometer and ready for installation in a bus



Monorail hoist system takes units from stockroom to the place where repair work is done

Cleveland Railway Wins Company *in* Maintenance

Company prize for year, three of the four departmental certificates of merit, the individual cash prize of $200, and three of the quarterly prizes go to Cleveland. Other awards made to the Cincinnati Street Railway and the San Diego Electric Railway

FAR outdistancing all competitors, the Cleveland Railway was pronounced by the judges to be the winner of the company prize in ELECTRIC RAILWAY JOURNAL'S Maintenance Contest for the year ended July 15, 1929. The prize, a handsome bronze and silver plaque, is presented to the company which has contributed most to the advancement of maintenance practice through participation in this contest. Not only did representatives of the Cleveland Railway win the company trophy, but also a majority of the departmental awards for the year, and the individual cash prize of $200. The interest felt in this contest by all the various departments is shown by the fact that the quarterly prize in the way and structures department was awarded to a Cleveland man at the end of each of the three three-month periods.

In the bus and garage department, two quarterly prizes went to Cleveland, as did two prizes in the electrical and line department. No other company won more than one quarterly prize except the San Diego Electric Railway, which was awarded a prize in the bus and garage department for the first period, and a prize in the rolling stock and shops department for the second period. This company was the winner of the certificate of merit in the rolling stock and shops department. In the other three departments, the certificates of merit went to Cleveland.

After careful consideration of almost 200 articles submitted in the contest, the committee unanimously agreed on the award of the cash prize of $200 to Joseph Croyle, for his article "One Man Tie Nipper," published in the April issue of the JOURNAL. A close competitor for this prize was the article "Efficient Methods Developed for Stringing Trolley Wires" by Angus G. Scott, assistant superintendent of overhead lines of Cleveland, which received honorable mention by the committee. Both of these articles are the result of the experiences of the writers in the maintenance work of the track and overhead line departments, and show clearly the valuable results that can be accomplished by men who do not merely follow routine methods, but try to improve the quality of the work done and to save the company expense.

How Cleveland Won the Company Trophy

WHEN the Maintenance Contest was started this year, the president of the Cleveland Railway, J. H. Alexander, sent out a letter to all department heads calling their attention to the terms of the contest and the desirability of making a special effort to not only win as many individual prizes as possible, but to earn the trophy for the company as well. The interest in the contest was further stimulated by discussion of the subject at meetings of the company's contact club, comprising executives, department heads and junior department heads, which meetings are held at irregular intervals for the purpose of keeping the organization familiar with company policies and at which time speakers discuss subjects of common interest.

That the result has more than justified the effort is well evidenced by the fact that the company was awarded seven prizes out of a possible twelve in the three groups of the contest; that it received three out of a possible four departmental certificates; that it earned the individual cash prize and honorable mention for the entire year's contest and was awarded the company trophy. The result emphasizes the *esprit de corps* which exists in the Cleveland Railway's organization and shows clearly what can be accomplished when an organization works whole-heartedly as a unit behind its executive head.

Prizes Awarded for Third Quarterly Period

PRIZE winners in each of the four departments for the three-month period ended July 15 were selected at the same time. In the department of rolling stock and shops the award was made to E. J. Jonas, superintendent of equipment Cincinnati Street Railway, for his article "Car Body Turn-

Comparison of Number of Articles Submitted by Various Companies

Name of Company	Rolling Stock and Shops	Way and Structures	Electrical and Line	Fuses and Garages	Total
Cleveland Railway	17	16	22	12	67
Virginia Electric & Power Company	11	8	1	8	28
San Diego Electric Railway	13	1	1	4	19
Other companies	56	15	7	3	81
Total submitted in contest	97	40	31	27	195

Prize-Winning Articles in Maintenance Contest

Name of Author and Company	Title of Article	Department	Group Number	Date Published
F. E. Davidson, Cleveland Railway	Double Portable Crossover	Way and structures	I	February 9, 1929
Joseph Croyle, Cleveland Railway	One-Man Tie Nipper	Way and structures	II	April, 1929
A. G. McIntosh, Cleveland Railway	Safety Ground Device for Electric Equipment	Way and structures	III	August, 1929
Leonard S. Rose, Cleveland Railway	Hinged Pit Cover	Bus and garage	II	June, 1929
Leonard S. Rose, Cleveland Railway	Pit Jack for Removing Bus Transmission Units	Bus and garage	III	August, 1929
Angus G. Scott, Cleveland Railway	Pole Brushing Device	Electrical and line	II	June, 1929
Angus G. Scott, Cleveland Railway	Efficient Method Developed for Stringing Trolley Wire	Electrical and line	III	August, 1929
L. H. McAdam, Toronto Transportation Commission	Auxiliary Ground Box for Track Switches	Electrical and line	I	December 15, 1928
Charles Herms, San Diego Electric Railway	Piston Ring Compressor	Bus and garage	I	January 19, 1929
Arthur E. Clegg, San Diego Electric Railway	Method of Adjusting Brush Pressure	Rolling stock and shops	II	April, 1929
Harvey L. Bullock, New York Central Railroad	Automatic Drain Valve	Rolling stock and shops	I	November 17, 1928
E. J. Jonas, Cincinnati Street Railway	Car Body Turnover Truck	Rolling stock and shops	III	August, 1929

Trophy *and Other Awards* Contest

over Truck." A. G. McIntosh, superintendent of track Cleveland Railway, was awarded the prize in the department of way and structures for his article, "Safety Ground Device for Electric Equipment." In the electrical and line department, the prize went to Angus G. Scott for his article, "Efficient Method Developed for Stringing Trolley Wires." Leonard S. Rose was awarded the prize in the bus and garage department for his article, "Pit Jack for Removing Bus Transmission Units." All of these articles are published on the following pages in this issue.

Joseph Croyle (In Oval) Angus G. Scott Leonard S. Rose

A Worthy Trio of the Cleveland Railway

THE individual cash prize of $200 for the best single item submitted in the maintenance contest was awarded to Joseph Croyle, track foreman Cleveland Railway, for his article "One-Man Tie Nippers," published in the April issue, page 550. An article giving a description of Mr. Croyle's career appeared on page 673 of the June issue.

The departmental prize in the third period of the Maintenance Contest for the electrical and line department was awarded to Angus G. Scott, assistant superintendent of overhead lines, for his article entitled "Efficient Method Developed for Stringing Trolley Wire." An article describing the career of Mr. Scott will be found in the June issue, page 673.

In the bus and garage department the prize of the third period of the contest went to Leonard S. Rose, assistant superintendent motor coach department Cleveland Railway, for his article "Pit Jack for Removing Bus Transmission Units." A biography of Mr. Rose will be found on page 673 of the June issue.

Emil John Jonas

BORN in Cincinnati, Mr. Jonas was thrown on his own resources at an early age, and had to provide for his own living as well as his education. The latter was made possible by attending the night classes of the Ohio Mechanics Institute for several years. At an early age he was attracted to transportation, especially in connection with the slow-moving cable cars on which he sold newspapers. After he gained a vast amount of practical experience at Chester Park during a year with the St. Louis Street Railway as chief electrician, he went back to the Cincinnati, Georgetown & Portsmouth Railroad as superintendent of power and roadways at the time of its electrification. During his twenty years of service in various capacities with the interurban lines, much pioneering work was done in developing a demand for domestic and industrial electric service in Clermont and Brown Counties. Seeking a larger field, he joined the ranks of the then Cincinnati Traction Company in 1922.

When operation of this system was taken over in 1925 by the Cincinnati Street Railway, Emil John Jonas was assigned to the position of superintendent in charge of rolling stock and shops. His most notable achievement in this capacity was the designing and equipping of the new Winston car shop, which has been accredited by prominent equipment men as being the last word in shop design.

Emil John Jonas

Andrew G. McIntosh

ARRIVING in this country from Scotland in April, 1913, Andrew McIntosh started immediately to work for the Cleveland Railway as welder and on the maintenance of equipment. From 1917 to 1919 he was foreman in charge of welding and burning for the American Ship Building Company in Cleveland, and from 1919 to 1921 Mr. McIntosh was foreman in charge of electric welding for the American Steel & Wire Company. Returning again in 1921 to the Cleveland Railway he became equipment foreman of the way department. He has charge of all electric and thermit welding, burning, spot welding and grinding; also, the maintenance and operation of equipment, such as concrete mixers, concrete breakers, tampers, plows, rollers, sand-drying and sand-blasting machinery, etc., are under his supervision.

Andrew G. McIntosh

These Items Won Prizes in

Safety Ground Device for Electric Equipment*

By A. G. McIntosh

Superintendent of Track Equipment, Way Department, Cleveland Railway

EXTENSIVE use of electrically-operated equipment on track work of all descriptions emphasizes the need for a safe grounding device. A new type of safety ground has been designed and used successfully

Safety of trackmen is promoted by use of this grounding device

by the Cleveland Railway. It consists of a wrought-iron plate as a contact shoe to which is fastened a ¾-in. fiber top, somewhat larger over all than the iron shoe, for protection from the latter. The handle is made of fiber and all screws are countersunk and the holes filled with sealing pitch. A 12-in. length of lead wire passes through the fiber top and is fastened to the iron contact shoe, terminating in a connecting plug. The wire leading from the machine being operated is equipped with a receptacle into which this connecting plug is inserted, so that the contact shoe may be changed from one machine to another without disconnecting the wire from the machine. This ground can be used on either T or grooved girder rail, and can be made in any machine shop at a very small cost. It can be handled in any kind of weather with perfect safety.

Efficient Method Developed for Stringing Trolley Wire*

By Angus C. Scott

Assistant Superintendent of Overhead Lines, Cleveland Railway

FOR several years a special trolley wire stringing truck has been in service on the lines of the Cleveland Railway. This truck permits the stringing out of the new wire at the tension desired and the taking down of the old wire in one operation. Formerly it was necessary to string out the new wire, attach the fixtures to it, and then either cut down the old wire in sections or reel it up. The cutting down of the old wire and reeling it up in the street is a hazardous operation at any time of the day or night. In stringing out the new wire, it was formerly necessary to pull the wire to the approximate tension desired about every thousand feet. This operation is now only necessary about every one-half mile.

With the new stringing equipment, a full reel of trolley wire is mounted on an arbor on the rear of the truck. A shaft to which two pulleys of pressed paper are attached secures the reel to the arbor. Brake bands lined with regulation automobile brake lining are then installed over the pulleys, and attached to a common crossbar by means of turnbuckles. When pressure is applied to the crossbar by means of a wing nut equal pressure is applied to both pulleys, and the tension at which it is desired to string the trolley wire is secured. The new wire is led over the top of the reel and spliced into the line. The old wire is led into the front of the truck through an opening equipped with rollers and secured to an empty reel. This reel is turned by means of hand labor, four men being required. While it would be possible to make this operation mechanical, it is felt that the initial expense would be too great to justify so doing.

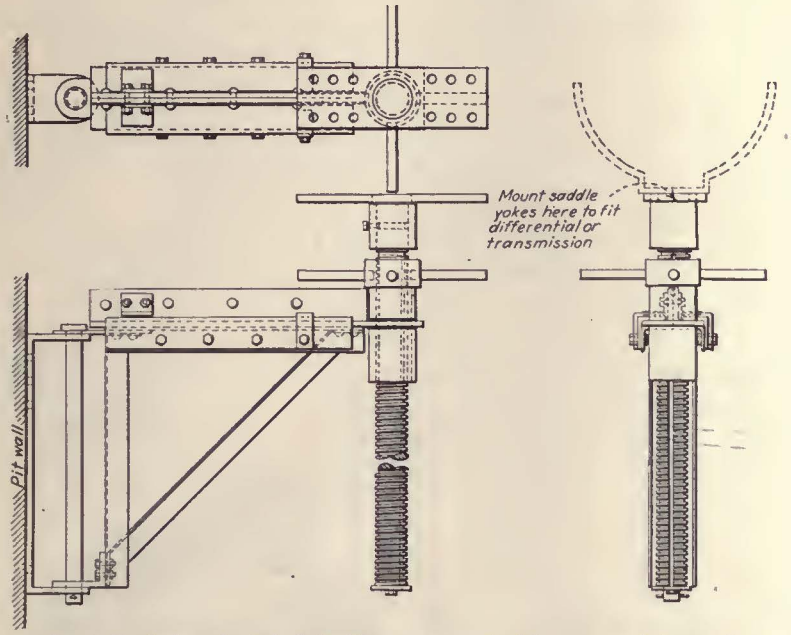
To facilitate loading and unloading the reels, an overhead chainfall has been installed on a runway inside the truck. The truck is well equipped with lights for night stringing. The truck has been equipped with a winch and collapsible derrick which permits of its usage for other work than just wire stringing.

In actual usage, a line truck precedes the stringing outfit and removes the old wire. Behind the reel truck another line truck ties the new wire to the span wires. They also install about every fourth feed-in ear for safety. Another truck follows the stringing crew and clinches the ears and aligns the trolley wire. When a car approaches the stringing crew the three trucks pull off to the side, close

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

Use of this double-reel truck has facilitated the process of stringing trolley wire at Cleveland

the Last Contest Period



Specially designed pit jack facilitates removal of bus transmission units in shops of Cleveland Railway

up, and the car coasts by. By this method a mile of wire may be taken down and new wire completely installed on hangers in 2¼ hours.

This method of wire stringing and the operation of the truck have both proved economical. One foreman can control the whole operation, there is very little vibration in the overhead due to the fine performance of the reel brake, and the wire may be restrung and taken down in a minimum of time.

Pit Jack for Removing Bus Transmission Units*

By Leonard Rose
Assistant Superintendent Motor Coach Department, Cleveland Railway

PIT jacks, suitable for use in installing or removing transmissions or differential carriers, are almost a necessity in a motor coach overhaul shop having any amount of this kind of repair work to do. The pit jack developed for this purpose by the Cleveland Railway is mounted on the pit wall by means of a hinge pin and wall bracket. By mounting one wall bracket at the front-center of the repair pit, just under the location of the transmission, and another at the rear of the pit at about the location of the rear axle, it is possible to place the jack in either of these two positions by simply removing the hinge pin and reassembling the unit in the desired location. With two brackets located in this manner it is possible to handle all of this kind of work in one pit. Since the brackets are neither bulky nor cumbersome, any number may be mounted along the pit wall at strategic points, to take units of various makes of coaches and different wheelbases.

In operation, yokes or a properly shaped saddle to fit the unit to be removed are mounted on the jack head. The jack is then raised into place, the unit dismounted and the jack lowered. By swinging it around to the pit wall, the unit may be rolled off onto the floor and a replacement rolled on to the jack.

While a jack of this kind is not essential on some equipment, it is almost a necessity on others. The installation of one similar to that shown in an accompanying illustration eliminates much of the difficulty encountered in handling heavy units under the coach, permits faster and more efficient work, and removes an accident hazard of no small importance.

Submitted in Electric Railway Journal Maintenance Contest.

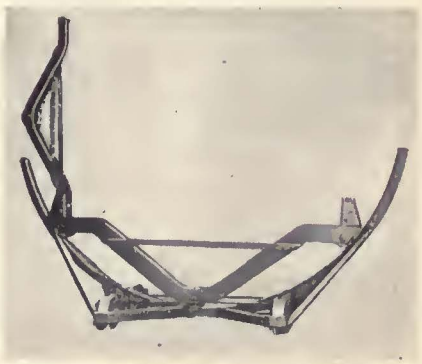
Car Body Turn-Over Truck*

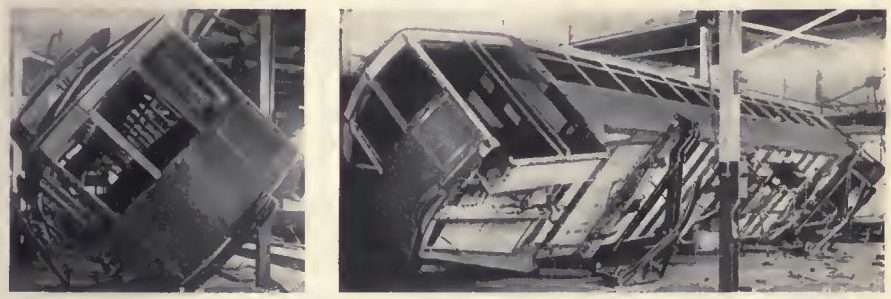
By E. J. Jonas
Superintendent of Equipment Cincinnati Street Railway

WORK on the underside of car bodies is made easier by means of a combination shift truck and car body turn-over device designed and built in the shops of the Cincinnati Street Railway.

All bearings are anti-friction, which makes it possible for four men to push a car body off or on the transfer table, while two men on chain blocks can turn the body over to an angle of 90 deg. to permit work on the roof if desirable.

The greater efficiency with which the men can perform their work—such as cleaning, painting, cable work, and piping on the underside of cars—has resulted in a saving of 25 per cent in time. Additional trucks are to be built and used as shift trucks with the idea that any car body undergoing repairs can be rolled over.





Trucks designed to permit turning over of car bodies in the shops of the Cincinnati Street Railway

Armature Tests and Testing Equipment Surveyed

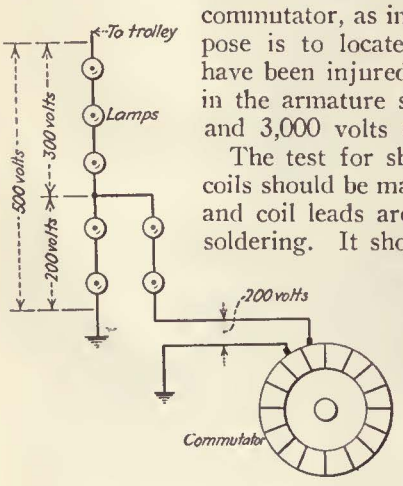
By R. S. Beers
Railway Engineering Department General Electric Company, Schenectady, N. Y.

ARMATURE testing equipment in railway repair shops varies from a minimum of a bank of lamps and a careful, skillful workman to a maximum of a complete testing laboratory where each rewound armature is given a stand test at full load. The minimum testing equipment seems inadequate, and the expense of the maximum seems unjustified. In an effort to strike a happy medium, a survey of the tests used by 30 representative electric railways throughout the United States has been made.

It was found that the tests commonly used when rewinding armatures include: (1) Bar to bar test of commutator; (2) high-potential test of commutator; (3) position of armature coil leads; (4) high-potential test of coils; (5) short and open-circuited coils; (6) high-potential test of complete armature, and (7) running test. Tests 5, 6 and 7 should be applied to overhauled armatures.

The bar-to-bar test of the commutator is a high-potential test to insure good insulation between adjacent bars. The customary method is to use a lamp or lamps in series with the testing terminals. Some operators use trolley voltage on new commutators, while the majority use 110 to 125 volts. This latter seems too low, and the trolley voltage too high for an old commutator. It would appear that a voltage of 200 to 250 would be better. This can be obtained readily by connecting lamps across the trolley, as shown in an accompanying sketch.

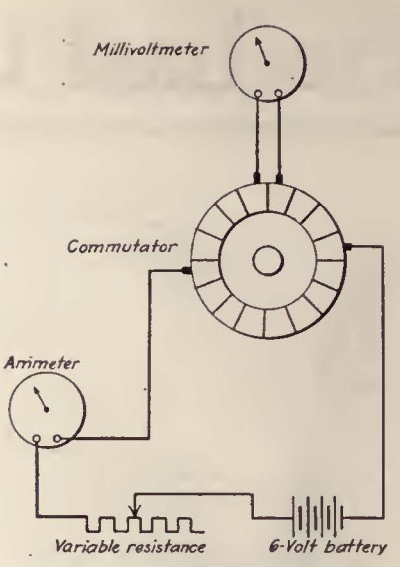
The high-potential test of the commutator is to make sure of good insulation between the commutator bars and the shell. A piece of bare wire is wound around the bars, connecting them together. High potential is applied between shell and bars. Between 2,000 and 3,000 volts should be used. To check the position of armature leads, each armature coil is rung out to insure that there are no connections between adjacent coils, and further to make sure the coil leads come out of the coil in correct order. The high-potential test of coils is made with the coils in place in the armature, bottom leads in place but top leads not connected. A wire is wrapped around the commutator, as in test No. 4. Its purpose is to locate any coils that may have been injured when they were put in the armature slots. Between 2,000 and 3,000 volts should be used.



Method of connecting lamps in a 600-volt circuit to obtain 200 to 250 volts

The test for short or open-circuited coils should be made first when all coils and coil leads are in place and before soldering. It should be repeated after the armature is completed and the commutator turned and slotted. Either a transformer (armature growler) or a millivoltmeter may be used. When applied to overhauled armatures the millivoltmeter will locate broken and partly broken armature leads much better than any other method.

A final high-potential test of the complete armature should be made when the final bindings are in place. A voltage of 2,000 to 3,000 should be used on rewound armatures, and 1,000 to 1,300 volts on overhauled armatures. After the armature is installed in the motor frame, a short run at full speed and load, or a run light at full speed, is very desirable. It tests the bearings and electrical connections in a way none of the other tests does.



Connections for making a bar-to-bar test with a millivoltmeter

The current lead should be located on the commutator so as to obtain a midscale reading of the millivoltmeter. The current should be from 6 to 10 amp. When the current value is determined it should be held constant by means of the variable resistance. The voltmeter will show the same reading between each pair of bars if the coils are right. A broken lead gives a higher reading and a shorted coil a lower reading.

The survey shows some railways believe that any potential test higher than trolley voltage spoils good apparatus. Their idea of testing is to locate existing faults. Those who apply a test voltage higher than trolley voltage believe a test should locate incipient faults as well as existing ones. The latter method is obviously the correct one and is used by the majority, although individual cases can be selected to show the former equally successful.

While high-potential tests vary from trolley voltage to as high as 3,000 for 600-volt armatures and motors, whether old or new, the majority of railways make a distinction between rewound and repaired or overhauled armatures. For the former 2,000 to 2,400 volts, and for the latter 1,000 to 1,300 volts, is the usual practice. The equipment for high-potential testing may be very simple and cheap if one is satisfied with two definite voltages, such as ten and twenty times the local lighting circuit voltages. Where it is desired to vary the test voltage by small increments over a range from 800 or 1,000 volts to 4,000 or 5,000 volts, high-potential testing equipment is required.

Transformer or "growler" testing for short or open circuits in armature coils provides a quick means of locating these defects. It does not indicate partial short or open circuits as effectively as a millivoltmeter. For this reason a millivoltmeter should be used for the final testing for open and short circuits in armatures. The millivoltmeter test of armatures for open and short circuits is the most successful test available for this purpose. When properly made, it will detect cracked and partly broken armature leads, as well as partly shorted armature coils, with more certainty than any other test.

Since this test is but a comparison of resistance values, it is obvious that the current should be held constant. This is best accomplished with a 6-volt storage battery, ammeter and a variable resistance. The customary practice of using trolley current through a bank of lamps, without an ammeter, for this purpose does not insure a sufficiently constant current flow for best results.

Devices and Practices Found Useful in Expediting

MAINTENANCE WORK

Time and labor saving devices used in electric railway shops and garages.

Hand tool for the removal of mica slivers from commutator slots

Undercutting Railway Motor Commutator Mica

By P. A. Pontius
Renewal Parts Engineer Westinghouse Electric & Manufacturing Company

MICA between commutator bars on the brush wearing surface of commutators should be undercut to insure good contact between the carbon brushes and copper bars. It is desirable that all mica and mica slivers be removed $\frac{3}{64}$ in. to $\frac{5}{64}$ in. below the wearing surface of the copper bars. An undercutting machine should be used which holds both the armature and undercutting saw in their proper relative positions. The accompanying illustration shows a hand tool for removing the remaining mica slivers after the undercutting operation.

The undercutting saws should be equal to or about 0.003 in. thicker than the thickness of the mica segments. If the bearings in which the arbor for the saw runs are in good condition and the arbor rigidly supported, a saw 0.003 in. thicker than the thickness of the mica should be used. With a shaky arbor and worn bearings the thickness of the saw should be equal to the thickness of the mica. However, the saw should remove a small amount of copper along with the mica. A saw with twenty teeth regardless of diameter has given the most satisfactory performance. The outside diameter of the saw should be $\frac{3}{4}$ in. to $1\frac{1}{4}$ in., considering that the larger the diameter the more rigid should be the support of the saw carrying arbor. The diameter should be small, otherwise the saw cuts into the commutator neck.

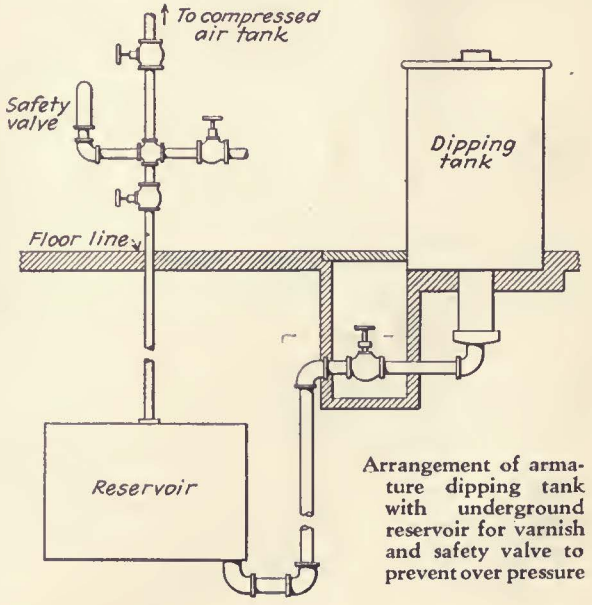
The best cutting speed is approximately 2,000 r.p.m. The saw should be made of high-speed steel. Carbon steel dulls quickly and does not produce a clean cut slot.

Armature Dipping Tank With Underground Reservoir*

By D. D. Wendel
Street Railway Engineer Alabama Power Company, Montgomery, Ala.

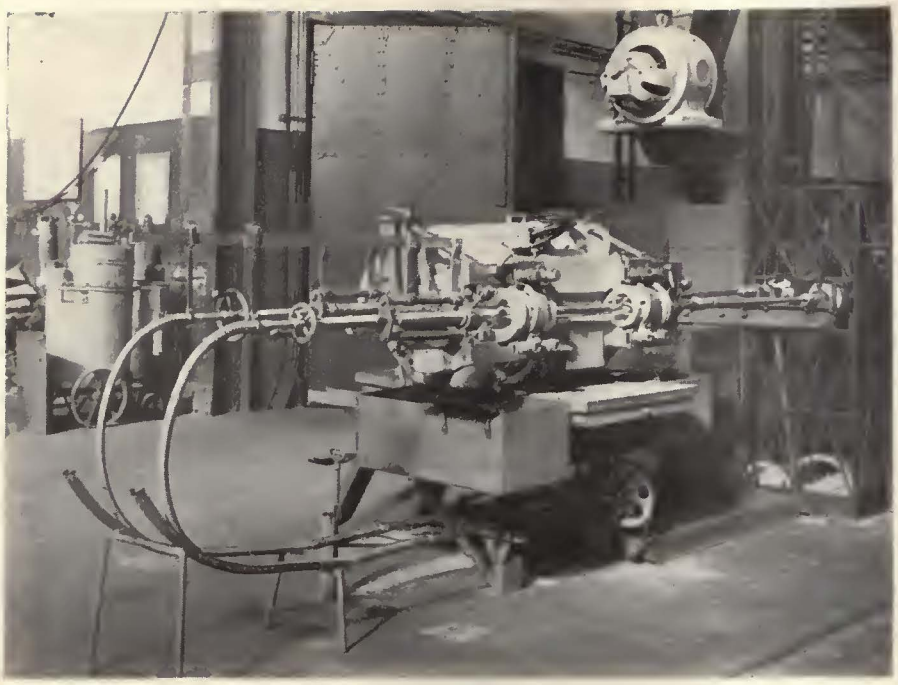
AT THE Montgomery carhouse of the Alabama Power Company an armature dipping tank with an underground reservoir has recently been designed and put into service.

This apparatus consists of a standard 55-gal. steel drum in the bottom of which is welded a short piece of 6-in. pipe. This is connected with a $1\frac{1}{2}$-in. pipe to the bottom of a similar tank buried several feet in the ground. The latter acts as a reservoir for the varnish which is brought to the dipping tank under air pressure. The section of 6-in. pipe acts as a well for the armature shaft. In the bottom of this well, a strainer is provided to keep foreign matter from entering the reservoir in the ground. A valve in the pipe line prevents evaporation, while a safety valve set to pop at 15 lb. prevents over-pressure. A vent valve releases air from the reservoir and allows the varnish to flow back after it has been used. Special precautions have been taken to insure that the air furnished to the reservoir is free from water and oil.



Arrangement of armature dipping tank with underground reservoir for varnish and safety valve to prevent over pressure

*Submitted in Electric Railway Journal Prize Contest.



Simultaneous boring of motor and axle bearings is accomplished with this machine by the elevated railways in Hamburg, Germany

Boring Machine for Armature and Axle Bearings*

By A. Hansmann
Shop Foreman Hamburg Elevated Railway, Hamburg, Germany

A HANDY machine for boring armature and axle bearings simultaneously is in use at the main repair shop of the Hamburg Elevated Railway. All the motors on which this apparatus is used are of the same type. The boring tool has two definitely and unchangeably located arbors, one for the armature bearings and one for the axle bearings. These arbors are bolted against the machined surfaces of the motor cases and thus brought accurately in line.

Each of these two arbors carries two cutters that can be adjusted within .0004 in. shaft clearance. The arbors are driven from a jack shaft over extension couplings with universal ball joints. Mechanical connection with the driving motor is made by means of a clutch, operated remotely with a pull rope at the operator's stand. The feed of the cutters is automatic through a flexible shaft.

When these bearings were bored individually, the method formerly employed, their centers did not line-up, due to variations in the bearing bushing and inaccuracies of the set-up. To insure an accurate line-up so that both bearings fitted the shafts properly, subsequent filing and lapping were required. Too much play in the bearings resulted in a considerable loss of lubricating oil, and a reduction of the maximum life of such bearings to about 37,500 miles. With the present method of boring, a life of 75,000 to 93,750 miles is easily obtained. The savings resulted from this new method are primarily the 100 per cent longer life of the bearings, the reduced loss of oil, the small number of hot-boxes and the greater ease with which the two bearings are simultaneously bored.

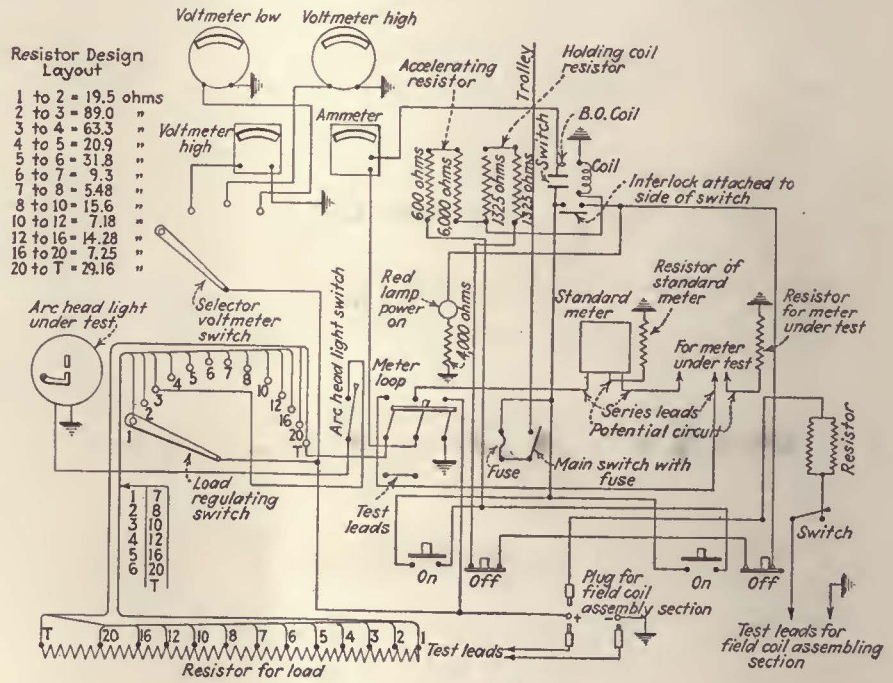
*Submitted in Electric Railway Journal *Prize Contest.*

Equipment Test Board Proves Time Saver*

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

ELECTRICAL apparatus used on cars is tested on a special board in the shops of the San Diego Electric Railway. The right-hand side is devoted to testing Economy meters. An element removed from an Economy meter is used as a standard rotating meter. This has been placed in a glass case to keep out dirt and to maintain its accuracy. The resistor of the potential circuit of the standard meter is mounted on the back of the board. The meter to be tested, together with its element, is mounted next to the rotating standard meter. A rack is provided in the upper right-hand corner of the board on which elements are placed for cleaning and repairing.

By throwing the circuit switch to its upper position, which is marked "meter loop," and with the regulating load switch set for the desired load on the ammeter, the meter is connected in circuit. With the switch thrown to the down position, which is marked "test leads," connection is made to place the leads in circuit. Additional tests can be made by pulling out the test lead marked with a plus sign and inserting the test lead which goes to the motor frame field coil assembling section. Other tests are performed by the aid of the load-regulating and



Connections for equipment test board

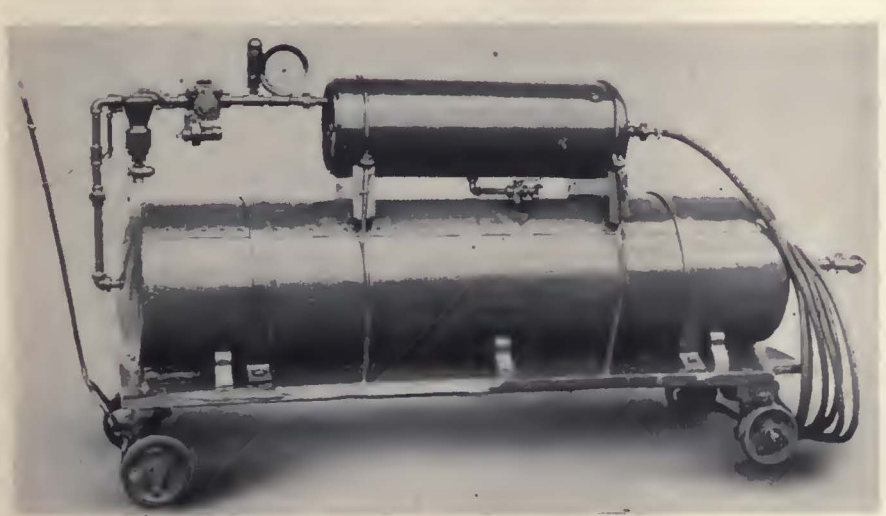
selector-voltmeter switches. Power is switched on or off the testing board by means of a push-button station located at the board and in the motor frame field coil assembling section. These push-buttons operate magnetic-type switches. It has been found convenient to use the trolley voltage without resistance at the test lead. By removing a stop marked T, the regulating load switch arm comes in contact with the trolley button and gives line voltage. Arc headlights are tested by setting the load-regulating switch to give the desired voltage at the arc and then by closing the arc headlight switch and switching power on and off by means of the push-button station. The testing board has proved a great time and labor saver as it enables testing operations to be performed quickly.

Auxiliary Tire Inflater

By Del A. Smith

General Manager Department of Street Railways, Detroit, Mich.

GARAGES of the Department of Street Railways in Detroit have long felt the need of a portable inflater which could be taken to any place whenever tires need to be inflated. To this end a truck was constructed on which was placed a 21-cu.ft. air tank built for a pressure of 300 lb.. On top of this a smaller tank was placed designed for a pressure of 140 lb., and connected to the larger tank through a reducer valve. An air gage with two indicators showing the pressure in both tanks at all times was installed in the line. Air at 300 lb. pressure in the large tank is obtained from the adjacent carhouse, which carries high-pressure lines.



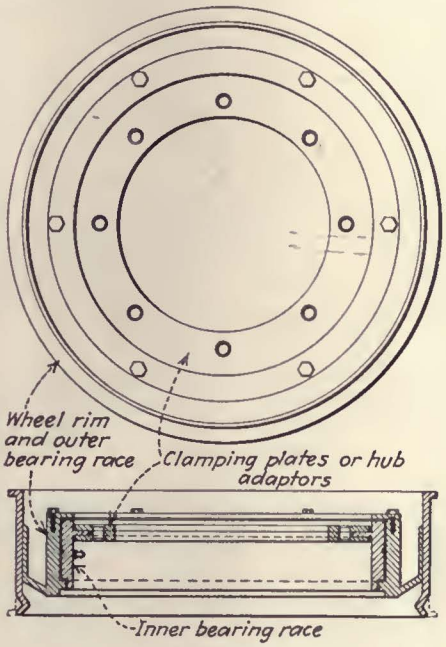
Light-weight portable tire inflater recently constructed by the Department of Street Railways in Detroit

Dummy Wheels for Towing in Disabled Buses*

By Hoy Stevens

Assistant Superintendent of Maintenance Cleveland Railway, Cleveland, Ohio

THE necessity of removing from the road quickly and economically a coach equipped with a semi-floating axle, which had suffered a differential failure, led to the development of



Dummy wheel used by the Cleveland Railway in towing disabled buses off the road

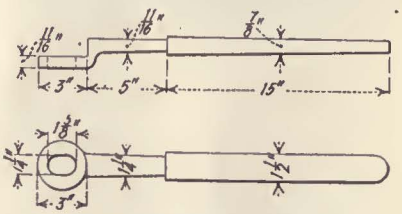
dummy wheels by the Cleveland Railway. When such a failure occurs, any attempt to drag the vehicle often results in serious damage to the gears, bearings, the spider or even the housing itself. It is not always possible to lift the rear end of a bus, and for long hauls the so-called "towing dollies" are clumsy, and often useless. These considerations, coupled with a desire to get the coach off the road, and our practice of performing all repair work in the garage whenever possible, caused us to develop this spare set of wheels.

Essentially, these wheels are designed with integral bearings so that they can be bolted onto the hubs in place of the regular wheels. The service brakes are then locked and the coach towed in the customary manner. Of course, a spacing tow-bar must be used, because there are no brakes on the coach. When the front wheels are brake-equipped, the cylinders or cams must be disconnected. As may be seen from the illustration, the tire is mounted on a part of a standard wheel which has had the stud holes cut away and then welded to a large steel "bearing" ring which forms the outer race of the bearing. The inner bearing is a bronze casting, grooved for grease, and welded to a small flange. Various sets of adaptors are used to clamp on this flange and fasten it to the various hubs of different types of coaches.

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

Air Compressor Commutator Nut Wrench

LOSS of time, destruction of material and an increase in expense resulted in the shop of the Richmond Railways, Staten Island, N. Y., due to the practice of removing commutator nuts of Westinghouse D.H. 16 air compressors with improper tools.



This wrench has simplified the maintenance work of compressors

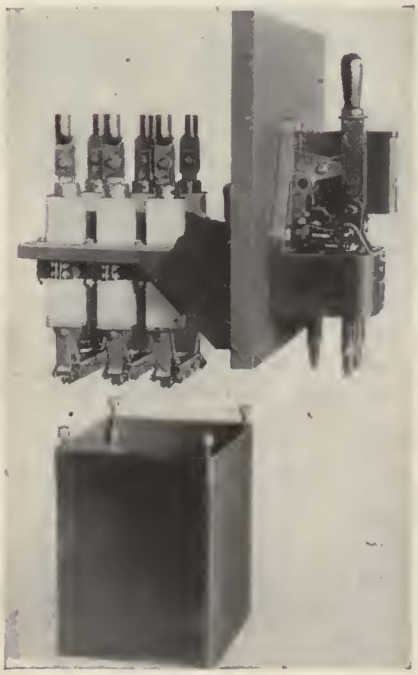
The wrench shown in the accompanying sketch was designed and constructed to eliminate this expense and simplify removal. The handle is made from $\frac{7}{8}$-in. x $1\frac{1}{2}$-in. stock, whereas the head stock is 3 in. x $1\frac{1}{16}$ in. The overall length of the wrench is 23 in. The handle is provided with a $\frac{3}{4}$-in. offset and is $\frac{11}{16}$ in. thick and $1\frac{1}{4}$ in. wide for a distance of 5 in. from the head stock. The remaining 15 in. of the handle is $\frac{7}{8}$ in. thick x $1\frac{1}{2}$ in. wide. The head is designed with an oval slot $1\frac{1}{4}$ in. x $1\frac{5}{8}$ in.

New Products

New Oil Switch

A NEW type of oil switch made in capacities from 200 to 2,000 amp., from 2,500 to 15,000 volts and with interrupting capacity from 20,000 to 40,000 kva. is announced by the Roller-Smith Company, New York City. The switches are made as two-pole and three-pole devices, automatic and non-automatic, single and double throw for switchboard, wall and cell mounting. They are also made for hand operation, normal and remote control, and electrical operation.

A few of the outstanding characteristics claimed for this new line of oil switches are, first, continuous laminated conductor from terminal to moving member; second, self-aligning contact of drawn copper gives a strong, highly conductive, light-moving, high-speed member; third, arcing tips are of large volume of copper and are designed especially to utilize electromagnetic stresses to increase contact pressures; fourth, the entire mechanism is completely inclosed and is the straight-line type; fifth, conductors are rigidly clamped in heavy wet process porcelain insulators; sixth, the frame is a heavy casting, internally ribbed and dome-shaped for strength; seventh, the heavy welded tank is supported on a frame by large short bolts; eighth, a double flange for the tank seat permits free venting between tank and frame, with great reduction in tendency to oil throw; ninth, the wooden contact rod is of specially treated material in one piece; tenth, the tank is lined with insulation material especially selected to resist the burning of the arc; eleventh, the volumes for oil and gas expansion are exceptionally large.



This new oil switch has a continuous laminated conductor

Heavy-Duty Swing Grinder

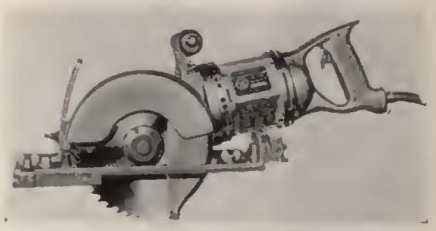
SIMPLICITY of design and ruggedness of construction are features of a new heavy-duty swing grinder recently put on this market by the Kinney Iron Works, Los Angeles, Cal. The motor is connected directly to the wheel through a flexible coupling and heavy shaft. Both ends of the shaft are mounted in heavy, dust-sealed ball bearings, while the motor also has ball bearings which are dust-proof. One of the important features of this new frame grinder is the absence of gears and the resultant wear. Another advantage is the continual observation of the work by the operator which is made possible by the position of the wheel which runs at right angles to the frame. The grinder is suspended by a sliding collar which permits a perfect balance as the wheel wears, and which facilitates suspension from any available hoist or chain block. Considerable flexibility is afforded by this coupling.

New swing grinder designed for heavy duty

Electric Hand Saw

ELECTRIC hand saws which will cross cut and rip lumber up to 3½ in. thickness were recently put on the market by Black & Decker Manufacturing Company. They will be sold in three sizes, 6-in., 8-in. and 10-in. — these sizes designating the diameter of the circular saw that each will accommodate. They can be used also with a special metal cutting saw for cutting light gage metal or with an abrasive disk for cutting slate, marble, tile, porcelain, etc.

The saw blades are inclosed in telescopic guards so that as the saw progresses in the work the guard automatically telescopes and when the cut is finished the guard snaps back, entirely covering the saw blade. The saw is arranged with an adjustable shoe which can be set to cut at any depth up to the capacity of the saw for cutting rabbets, etc. The shoe is adjustable also for cutting at any angle up to 45 deg. for mitering or for the jointing of long edges. It maintains the angle throughout the entire length of the cut, which is difficult, if not impossible, on a very long cut with an ordinary hand saw. The shoe is notched to make it easy to follow a pencil line on the work. These saws are provided with Universal motors, which will operate on direct or alternating current. They are shipped in substantial carrying cases as a convenience for men who take them out on the job.



Electric hand saw with telescopic guards

They are very light in weight and the "pistol grip and trigger switch" affords ease in handling and controlling. The saws are equipped with full ball-bearing with chrome nickel gears and shafts throughout. They are air cooled and will operate continuously without overheating. Gears

for the Railways' Use

run in grease in grease-tight compartment. Standard equipment consists of: one rip and one cross-cut saw; one adjustable saw fence; three-conductor cable with attachment plug (one wire for grounding); and substantial carrying case.

Sill Heater Prevents Ice Forming On Window

New electric window sill heater

ICE on windows is a serious menace to safe car operation and which often requires the motorman to stop his car and clean the window. To prevent this formation of ice, the Consolidated Car Heating Company, Albany, N. Y., has devised a new type electric heater. This apparatus is only $3\frac{7}{8}$ in. wide, $2\frac{1}{4}$ in. high and 24 in. long. It is placed directly across the line voltage and rated at 300 watts.

Powder for Cleaning Solution

FOR making a cleaning solution a powder with unusual qualities has been put on the market by the National Railway Appliances Company under the trade name of Soilax. In its original state, Soilax is a pink powder. In a proper solution with water it turns green. However, if too much powder is used, the solution will turn yellow. This feature prevents waste. The claim is made that 1 lb. of Soilax will do the work of 4 to 6 lb. of soap at a saving of 25 to 50 per cent in monthly cleaning costs. It is especially adapted for cleaning enameled or varnished surfaces, either inside or outside of street cars or buses.

Electrode Holder for Metallic Arc Welding

TO FACILITATE the operation of welding, a new electrode holder called model T has been developed by the Lincoln Electric Company, Cleveland, Ohio. The welding electrode is held firmly by a device consisting of a powerful clamp with an easy release to permit the rapid changing of electrodes. The grip is designed for easy holding and remains cool because the welding current is carried from the point of cable entry to the jaws by copper strips of low resistance. In the older types of holder, the high-amperage welding current was carried through the steel frame of the holder itself and uncomfortable heating frequently resulted under continuous service.

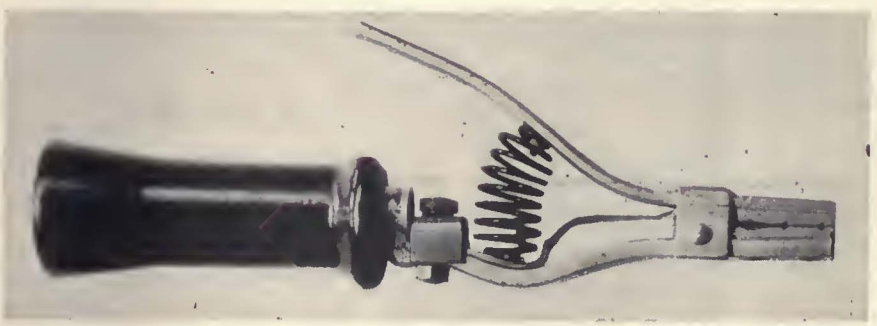
Copper tips on the jaws reduce the sticking of the electrode, resulting in quicker and easier change of electrodes and longer life for holders. The shape of the holding clamps has been altered to give greater compactness to permit working in closer corners. All metallic parts of the holders are coated with non-tarnishing plating.

Machine for Removing Insulation From Wire

DESIGNED to reduce shop cost in removing insulation or skinning the leads of armature coils, the Type KP Peerless wire insulation remover is being placed on the market

This machine removes insulation from wires

by the Electric Service Supplies Company, Philadelphia, Pa. The machine has a special revolving brush, and by bringing the leads in contact with it, the insulation is removed thoroughly and effectively without damage to the copper wire. The revolving parts are guarded. Pressure is applied to force the wire into contact with the brush and is controlled through a foot-operated treadle.



This type of electrode holder has copper strips of low resistance which carry the current from the terminal to the copper

NEWS *of the Industry*

Writing of Chicago Ordinance Begun

The actual writing of a new railway ordinance for Chicago has been begun early by the City Council subcommittee to which the task has been assigned. According to present plans the work will be completed by Sept. 1 and the ordinance will be submitted to the voters at the election on Nov. 5. If the ordinance is to go on the Nov. 5 ballot, it must be passed by the City Council not later than Sept. 24.

While the ordinance is being written the subcommittee charged with doing that work will hold a series of public hearings on subways in the hope of acquiring more information as to how much additional track space is needed for rapid transit through the central congested area. At the present time the Aldermen have no definite policy on subways.

Every subway plan except one makes provision for a tunnel in State Street, but there has been no decision as to where any bores will be located. The number of tracks to be provided also differs in each plan. To aid them in their work, the Aldermen are studying the subways in other American cities and in Europe.

Two-Cent Wage Advance in Toledo

Employees of the Community Traction Company, Toledo, Ohio, broke a deadlock of almost three months' duration on July 20, when they balloted three to two in favor of a compromise proposal submitted after they had demanded arbitration and had previously turned down a 2-cent wage increase with modified working conditions. Steps will be taken immediately to draft the plan into contract form and sign it. The new contract will be retroactive to June 1.

Trainmen, bus operators and car shop employees will receive a flat increase of 2 cents an hour making the scale 52 cents an hour for beginners in the first three months, 54 cents for succeeding nine months and 57 cents an hour for all employees with the company more than a year. Five cents additional is paid to one-man car and bus operators.

A new feature of the contract this year will be a premium of 1 cent an hour for any month during which the employee shall not have had any accidents which cost the company money chargeable to him.

Watchmen will receive $5 a month raise.

Regular employees will receive not less than two hours' pay for any call for extra work.

In case of split runs, when a man is called for three periods in a day, he shall receive not less than 10 hours' pay, and all workers shall receive not less than nine hours' pay for a day.

In the garage expert mechanics will receive 10 cents an hour increase. Here the working day is changed from a nine-hour to an eight-hour basis.

The compromise terms were arrived at in a conference between union officials and company representatives in the presence of Hugh D. Friel, conciliation commissioner of the Federal Department of Labor.

It was estimated that the changes would add more than $75,000 a year to costs.

High-Speed Service in Kansas City

Kansas City Public Service, Kansas City, Mo., has been busy putting into effect high-speed service on three of its main trunk lines by a limited stop system and making of the routes of these lines stop streets. The speed of cars under the new plan has been increased more than 20 per cent. Company officials are said to feel that if they are able to hold the limited stop plan intact they will have accomplished, on these lines, at least, something really worth while.

The company laid its plans for a stop program before the Public Service Commission. That body approved the proposal before it went into effect, subject to future jurisdiction and revision by the commission. Patrons in general appear to be well pleased with the increased speed and increased service. Such petitions as have been presented for the restoration of stops have in practically every case originated with the local corner grocer, the drug store and the picture show operator. The plan went into effect on June 16. Up to July 11 the company had made no changes nor had the commission ordered any.

$33,000,000 Detroit Rapid Transit Project

Subway for surface cars suggested so designed as to permit ultimate conversion into a train-operated rapid transit line

MAYOR LODGE of Detroit, Mich., has received a report which proposes the construction of short sections on three routes of the four-line rapid transit system that the Detroit Rapid Transit Commission considers will ultimately be required, and the building of a section of subway for the special use of street cars, but so designed that trains ultimately may use all of its mileage except the loops. The report was prepared pursuant to the direction of the Mayor to the Detroit Street Railway Commission and the Rapid Transit Commission given shortly after the election held on April 1, when the rapid transit project submitted jointly by these two commissions was defeated at the polls.

The new plan, prepared jointly by the two commissions, is proposed as a means to afford immediate relief to the traffic congestion existing in the downtown district. At the same time it would mark the beginning of a rapid transit program involving the least possible mileage. According to the report, the two commissions have kept constantly in mind the necessity of having each section of the underground so located and so designed as to permit of ultimate conversion into a train-operated rapid transit line. The total milage is 5.44 and involves an expenditure of $33,000,000.

The Rapid Transit Act and the City Charter provisions permit the initial construction of a rapid transit system to be financed through the Rapid Transit Commission by the use of (a) direct taxation plus faith and credit bonds, (b) mortgage bonds, (c) special assessment or any combination of these methods. On the other hand, the street railway charter contemplates that all construction costs ultimately shall be paid out of the earnings of the system. The right is not conferred to impose special assessments upon property that may be specially benefited by the construction of subways for street car or rapid transit train operation. Neither is there provision for raising any part of such costs by direct taxation upon the city at large.

The report points out the enormous benefits to property due to rapid transit lines as contrasted with surface transportation, for which reason the finance plans always have included special assessment for special benefit as an equitable and just provision. The electorate approved this method of financing by an overwhelming majority in 1924 and again in 1925. As to the present project the report states:

"Whether underground construction is initiated now or five years from now, or is started by the Rapid Transit Commission, the D.S.R. or some other body, the city should not fail to preserve its right to specially assess for special benefit. In our judgment there is no question of the status of the present proposal as a rapid transit project even though it may temporarily be operated by street cars."

While the use of street cars in the tubes

COMING MEETINGS

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.

Oct. 23-24—Public Utilities Association of West Virginia, Wheeling, W. Va.

Nov. 6-7—Association of Electric Railway Equipment Men, Middle Atlantic States, Richmond, Va.

Nov. 21-22—Public Utilities Association of Virginia, annual meeting, Chamberlain-Vanderbilt Hotel, Old Point Comfort, Va.

will not produce the full benefit to the downtown district, 83 per cent of the congesting surface car movement will be taken away. Accordingly the two commissions recommend division of the total cost into three equal parts, $11,000,000 each, one-third to the city at large, one-third to the locally benefited property, mainly in the central business district, and one-third to the car rider. While this division into three parts represents the recommendation of the two commissions, under the rapid transit act not more than 60 per cent of the estimated total cost may be raised by the first method. Accordingly the proposed financial plan involves the issue of faith and credit bonds to the extent of 60 per cent of the total, or $19,800,000, and the issue of mortgage bonds for the remaining $13,200,000. The faith and credit bonds and $2,200,000 of the mortgage bonds would be carried and retired by the contribution from the city at large and the locally benefited property.

Since the mortgage bonds can be secured only on the properties and revenues of the system, it is proposed that the revenues be secured by an inter-department operating contract whereby the D.S.R. pays a graduated rental to meet the interest and amortization of the $13,200,000 mortgage bonds, but for the full term of the contract will be equalized so that the car rider will finally have paid only the interest and amortization charges on his one-third share of $11,000,000. The plan outlined will accord completely with the intent of the Rapid Transit Act, states the report.

As to the merging of the Rapid Transit Commission and the Street Railway Commission, the report states that their legal powers are so widely distinct that it is not advisable. However, a Metropolitan Board is suggested which would have control of all transit matters in the region of Detroit to continue the work of the Rapid Transit Commission, and in which the Street Railway Commission would have representation.

SUMMARY OF DETROIT'S SUBWAY SUGGESTIONS

1. A line commencing at a portal at Woodbridge Street and running under Woodward Avenue to a portal at Temple Avenue. Three stations; length main line 1.16 miles. Estimated cost.....	$8,500,000
2. A line commencing at a portal on Michigan Avenue at Sixth Street and running under Michigan Avenue to Campus Martius to Monroe Avenue to Randolph Street to Gratiot Avenue and under Gratiot Avenue to a portal at Rivard Street. Four stations; length main line 1.55 miles. City Hall loop and connection to Fort Street, length 0.17 miles. Total, 1.72 miles. Estimated cost	9,700,000
3. A line commencing at a portal on Fort Street at Fifth Street and running under Fort Street to Cadillac Square to Randolph Street to Jefferson Avenue and under Jefferson Avenue to a portal at Hastings Street. Four stations; length main line 1.20 miles. Estimated cost	7,400,000
4. A line commencing at a portal on Grand River Avenue at Second Avenue and Elizabeth Street and running under Grand River West and Grand River East to Madison Avenue and under Madison Avenue to a temporary connection with the Vernor-Mack line at Gratiot Avenue and St. Antoine Street, with loop loading stations at Capitol Park and Library Park. Six stations; length main line 0.92 miles, loading loops 0.44 miles, total 1.36 miles. Estimated cost	7,400,000
Total estimated cost.....	$33,000,000
Total length all four lines, miles	5.44

What Happens When the Public Transportation Service Is Forced to Suspend

Twenty-two Main Lines Reopened

New Orleans company fast recruiting train force locally. Railway directors state company position. Comment by Labor Secretary Davis

SERVICE has been restored on the 22 main street car lines of the New Orleans Public Service Company and officials declare the situation so far as patronage is concerned is improving daily. The company also has stated that the employment of trainmen is progressing so satisfactorily that it will soon have its entire personnel made up again of local men.

The Commission Council made a last effort on Tuesday to bring about a settlement between the company and the strikers, but it proved futile. The Public Service, through A. B. Paterson, vice-president, Bernard McCloskey, and A. M. Lockett, directors of the company, definitely informed the Council that the directors had decided they would positively not negotiate with the union on a closed shop contract. The directors declared that they could not deal with an irresponsible labor organization. Officials of the union, augmented by international vice-president Fitzgerald, and Mr. Quinlan of Chicago, refused to make any concessions and what was considered as a last conference was brought to an end without accomplishing anything. The Council, however, announced that it would continue its efforts to bring about industrial peace in the city.

Jitneys are being permitted to operate during the period of the strike without any regulation; that is, the usual $5,000 surety bond for such operations is not being exacted.

Labor unions throughout the city have adopted resolutions requesting members not to ride the cars, and the public is being asked to support them.

Traffic regulations have been virtually shot to pieces as a result of the enormous number of machines on the streets.

The threatened general sympathetic strike of all union labor organizations in New Orleans was not called on Tuesday night. The meeting of delegates representing the various trades decided not to strike, but to help the car men financially. They voted to give the car men 5 per cent of their pay per month. As a result of the meeting union men, headed by leaders who arranged city-wide mass meetings, marched in a body to the City Hall on Wednesday and their spokesman questioned the Council regarding resolutions adopted by the mass meeting. One resolution provided that the city take over the railway. Acting Mayor Walmsley announced that the Council would take up the question of issuance of bonds with the Board of Liquidation. The Acting Mayor also announced that the Council would not interfere with the operation of the jitneys, declining, however, to pass an ordinance which would eliminate the $5,000 surety bond feature of the law.

The union had also requested that R. S. Hect, J. C. Butler, and J. D. O'Keefe, directors of the Public Service, who are also members of the board of liquidation, be requested to resign the latter offices. Acting Mayor Walmsley announced that under the Constitution the city banks are authorized to select the members for life. It is not a Council matter.

At the close of the meeting with the Commission Council on Tuesday officials of the union issued a statement expressing regret that the efforts of the Mayor and Council had been defeated. The union places the blame for continuation of the difficulty on the shoulders of the company. A statement by the men concludes:

"There is nothing for the men to do in this struggle but continue on until justice and fair play are acknowledged by the company."

After receiving word from the New Orleans Public Service Company that the differences between the management and the striking employees are fundamental and cannot be arbitrated, the Secretary of Labor stated on July 24 that there is nothing more that the Federal Government's Conciliation service can do for the time being at least.

Secretary Davis said that he would keep Conciliator Rodgers in New Orleans be-

cause he believes that there is always the possibility that the company may change its mind. Conciliator Dines is in Washington at present preparing a report on the strike and it is stated that he will not be sent out again until additional orders are given by the Secretary. It was admitted by the Secretary that he had discussed the issue in the strike informally with Charles Rosen, attorney for the Public Service Company.

Asked to explain his conception of the differences between the company and the strikers, Secretary Davis said that the men claim they are seeking better wages while the company contends that it is seeking to preserve its right of discipline.

One-Man Cars on Buffalo Interurban Runs

One-man cars are to be operated on the Buffalo-Lockport and Lockport-Olcott interurban divisions of the International Railway, Buffalo, N. Y. If the experiment proves successful, the company will rebuild the Buffalo-Niagara Falls high-speed line interurban cars for one-man operation, thus placing its entire system on a one-man car basis. All local lines of the company in Niagara Falls, Lockport and Buffalo now are operated by one-man crews.

No Parking Recommended on Fifty New York Streets

The abolition of parking in lower Broadway and fifty other streets and alleys from 7 a. m. to 6 p. m., and the prohibition of parking altogether in 65 streets throughout the city was recommended to the Board of Estimate of New York City at its meeting on July 25 by the Citizen's Street Traffic Committee of the City of New York, Inc. The proposals are included in Part II of a report by the traffic committee's sub-committee on parking.

Broadway between Bowling Green and Twenty-fifth Street has been singled out among all the north and south thoroughfares of Manhattan as the one on which parking restrictions are most necessary, according to Chairman Banham, because of the regular all-day parking by business men.

Dates of Meetings Changed to Avoid Conflict

The date of the November meeting of the Association of Electric Railway Equipment Men, Middle Atlantic States, has been changed from Nov. 20-21, to Nov. 6-7, 1929, to avoid conflict with the meeting of the Virginia Public Utilities Association, which convenes at Old Point Comfort, Nov. 21-22.

Chicago "L" Hearing Put Over Until Sept. 15

When, on July 16, Congressman Frank Reid, special counsel for the city of Chicago, announced that the city had no further evidence to offer against the Chicago Rapid Transit Company's appeal for a 10-cent fare, Master in Chancery Roswell B. Mason continued the hearing until Sept. 15.

Congressman Reid contended that the Rapid Transit Company, during its nine months of presenting evidence, had failed to make a case. The company is asking the federal court to restrain the Illinois Commerce Commission from preventing the collection of the present 10-cent elevated fare in Chicago. The higher fare is being charged under the protection of a temporary injunction granted by the federal court.

The Rapid Transit company's recent evidence has centered about an attempt to show that its lines are worth at least $160,000,000 instead of the $60,000,000 valuation set by the city.

Prize for Traffic Solution Suggestions in Atlanta

To encourage public interest in the solution of this important public problem of traffic congestion, *Two Bells*, published by the Georgia Power Company, has announced the following contest:

"For the essay outlining the best and most practicable suggestions for solving Atlanta's traffic problems, a prize of $25; with a second prize of $15, a third prize of $10, and five prices of $5 each. Eight prizes, totaling $75, for writing out the thoughts you, no doubt, long have had in your mind about improving the traffic situation."

Everyone is eligible to compete with the exception of employees of the company and professional traffic experts and traffic engineers. The contest closes on Aug. 10.

Compromise on Substitution in Houston

The attempt of property owners on Fannin Street in Houston, Tex., to force the Houston Electric Company to remove street car tracks from that thoroughfare and substitute buses, has ended in a compromise.

The City Council has ordered contractors to proceed with widening and paving of the street, making no mention of the car tracks. As the paving will necessitate improvements to the track costing the company about $40,000, it is generally understood that no further effort will be made to secure removal of the tracks.

Jeff Alexander, general manager of the Houston Electric Company, agreed to operate express buses on Main Street—the next parallel street—"as an experiment."

The controversy began eighteen months ago when contracts were let for the paving and widening of Fannin Street. Residents demanded tracks be removed and that a bus service be instituted. Oscar Holcombe, then Mayor, secured the services of John A. Beeler, who suggested removal of the tracks through about one-third of their length on Fannin and rerouting of the South End loop back to the downtown district over McGowan, a cross street, to the Travis Street line. No action was taken and the Holcombe administration was defeated, the Fannin Street matter being one of the chief campaign issues.

Efforts of the Fannin Street group to have the City Council pass a resolution setting out that service on Fannin with street cars is inadequate, and instructing the company to furnish such service were unheeded by Council.

Fannin Street residents then asked the City Council to grant a franchise to an independent company to operate a two-way bus service on Fannin. This proposal was side-tracked when Mr. Alexander offered to establish a bus service on Main Street.

With the paving of Fannin, service by bus will be substituted for the shuttle line which serves Rice Institute on the south edge of the Southern city. This bus service will not run to the downtown section, but will connect with the street cars at the end of the loop.

Late News Briefs

Richmond, Va.—It is reputed here that the Virginian Railway may continue its plan of electrification to Charleston, W. Va., if the New York Central bridge is constructed at Deep Water. While no announcement was made by the Virginian and nothing came out at the hearing to indicate the plans of the Virginian and the New York Central, the feeling is that this is the general scheme.

Omaha, Neb.—The safety campaign which the Omaha & Council Bluffs Street Railway is conducting in connection with the purchasing of new uniforms by all the trainmen is proving highly successful. The company has agreed to pay the entire cost of the uniforms for all men who operate for six months without an accident costing the company more than $15. From July 1 to July 20, there was only one such accident—a new safety record.

Toledo, Ohio—The last of the changes in routing contemplated by the transit ordinance of July, 1928, in Toledo was put into effect by the Community Traction Company when the East Broadway bus feeder line connecting also with the Oak Street car line in a loop operation was put on its new route during the week ended July 20. It replaces a portion of car line on East Broadway. Cars in city service continue out Woodville Road beyond the corner of East Broadway and Woodville following the Lake Shore Electric and Toledo, Fostoria & Findlay interurban routes.

Worcester, Mass.—Because operators of the 35-cent flat rate taxicabs established in Worcester sometime ago have been charging various rates the license board of that city has ordered the tariff to be printed on cards and displayed conspicuously in the cabs. The defense of the cab companies was that some of the drivers took an unfair advantage of their passengers.

Indianapolis, Ind.—Rates for commuters on all electric and bus lines operated by the Terre Haute, Indianapolis & Eastern Traction Company will be reduced from 1.65 cents a mile to 1.25 cents.

Waterloo, Ia. — Frank McDonald, superintendent of stores and purchases for the Waterloo, Cedar Falls & Northern Railroad, is chairman of the convention committee for the Iowa Electric Railway Association, which will hold its annual convention here Nov. 7 and 8. Terminal electrification will be one of the principal topics at the meeting, but the outline of the program has not yet been completed.

Detroit, Mich. — The Council has called a public hearing on parking situation as a result of demands from Business Property Association, Washington Boulevard Association and Retail Merchants' Association that police be directed to enforce strictly parking regulations in downtown district and be provided with sufficient men and towing equipment to do so.

Louisville, Ky.—Direct through service between Indianapolis and Louisville was resumed by the Interstate Public Service Company recently when the new

$3,500,000 Big Four bridge across the Ohio River was opened to interurban traffic. Passengers no longer need to transfer at Sellersburg as was necessary for a year while the bridge was under construction.

Richmond, Va.—School tickets will be issued for the bus service in the Ginter Park section of Richmond when the tracks on Chamberlayne Avenue, Laburnum Avenue and Brook Road have been removed and bus service installed, under a tentative agreement reached between the city and the Virginia Electric & Power Company. There is still a difference of 1 cent in the railway and the bus fares, the former being 7 cents and the latter 8 cents.

Hartford, Conn.—All persons, associations and corporations owning or operating taxicabs in Connecticut are now common carriers, subject to the jurisdiction of the Public Utilities Commission. A law to this effect has been signed by Governor Trumbull. Within 60 days, owners must have certificates from the commission in order to continue operation.

New York, N. Y.—The 25th anniversary of the Interborough Rapid Transit Company was celebrated on July 20. While the first train was not run for the public's convenience until October 27, 1904, July 20 was the day on which the first unit of the tunnel system was completed and instruction started for train crews. The first section completed extended from the Brooklyn Bridge to Grand Central Terminal.

Roanoke, Va.—A car of the Roanoke Railway & Electric Company painted according to an experimental color scheme has been placed on the lines for the criticisms and suggestions of the public. The car has an Abbott gray body with Cherokee gray trimming above the window posts. The border is trimmed in green. The company may make a change, if a color scheme satisfactory to the patrons and distinctive for Roanoke can be decided upon.

St. Louis, Mo.—The special committee of the Transportation Survey Commission headed by Erastus Wells, vice-chairman of the commission, has taken no action yet on the suggestion of Engineer Kelker made in May recommending the rerouting of thirteen railway lines, the discontinuance of six lines, the establishment of one new line and a reduction in the stops to an average of eight to a mile.

Chicago, Ill. — Plans for a circular street car subway in Grant Park connecting with the Roosevelt Road surface lines by a tunnel under Michigan Avenue to Wabash Avenue have been submitted to the City Council's committee on railway terminals by its engineer, Edward J. Noonan. The plans were drawn upon the instructions of the Aldermen to permit street cars to enter Grant Park without destroying the beauty of the park.

Indianapolis, Ind.—The State Supreme Court has reversed a decision in the Circuit Court, which would have forced the state highway commission to stand the expense of improving the right-of-way of the Terre Haute, Indianapolis & Eastern Traction Company in a public highway near Richmond. Litigation resulted from action of the commission in 1923 in paving approximately 1¼ miles of roadway in the National road, including the railway's right-of-way. The commission alleged that under the state law, the railway was required to improve the space between the rails and 18 in., on each side when the tracks are laid on the public highway.

Rockaway, N. Y.—Chairman John H. Delaney, of the New York Board of Transportation has assured a representative of the allied transit committee of the Rockaway section that plans for transit relief in that area would be made public "within a few months." Mr. Delaney's statement was taken to indicate that transit relief for the Rockaways would be embodied in the second "$600,000,000 subway building program," for which surveys are now being made. Residents of the Rockaways would like to see the branch of the Long Island Railway now serving their shore resorts made part of the city system.

London, Ont.—Employees of the London Street Railway decided on July 11 to accept the company's wage proposals for a two-cent-an-hour increase, effective on Sept. 1. The Ontario Railway and Municipal Board reported in favor of an increase more than seven months ago, but the company was unable to comply with the findings for reasons set forth at length in the ELECTRIC RAILWAY JOURNAL for April, page 555.

Cincinnati, Ohio—Sixty-eight formal meetings have been held with relation to the adoption of the four ordinances which, as finally passed permits the $41,000,000 Union Terminal project to be started to which reference was made in ELECTRIC RAILWAY JOURNAL NEWS for July 20. Not willing to incur any possible difficulties due to technicalities or typographical errors in so important a project as the terminal, it was finally decided to call a special session of the City Planning Commission to go over the printed ordinances. A special meeting of the City Council then followed, to receive the Planning Commission's final report. Favorable action by the Council was then taken on the adoption of the ordinances.

Toronto, Ont. — Additional motor-coach service to that at present in operation in conjunction with the radial railways has been suggested, should the radial service be abandoned.

St. Louis, Mo.—The last of the open bench coaches of the St. Louis Public Service Company were burned at the company's graveyard in St. Louis County recently. The "moonlight" cars were used until 1927 on the Creve Coeur Lake line between the end of the Delar-Olive Street line in University City and Creve Coeur Lake.

Pittsburgh, Pa.—A resolution has been presented to Council to authorize the Pittsburgh Railways temporarily to abandon one set of the double set of tracks on Water Street between Wood Street and Smithfield Street.

New York, N. Y.—President Menden of the Brooklyn-Manhattan Transit Corporation, and President Hedley of the Interborough Rapid Transit Company at a public hearing before the Transit Commission on July 10, said that enforcement of the commission's recent ruling against the "keying" of trains past danger signals and automatic tripper devices, would make impossible the "practical operation" of rapid transit lines. They admitted that literal compliance with the order of "keying by" would prevent collisions, but contended that the rule would seriously delay traffic. Chairman Fullen adjourned the hearing until a later date.

Joplin, Mo. — The Joplin-Pittsburg Railroad on July 15 applied to the Public Service Commission for authority to acquire, operate and maintain the tracks and right-of-way of the former Joplin & Pittsburg Railroad between Joplin, Mo., and Pittsburg, Kan. The company would operate as a common carrier of freight. It crosses the Missouri-Kansas line at a point 1½ miles northwest of Asbury, Mo.

Baltimore, Md.—The park tax paid to the city of Baltimore by the United Railways & Electric Company showed an increase of $7,000 for the second quarter of 1929 as compared with the corresponding period of 1928. The tax is 9 per cent of the money taken in for fares on most of the lines. The money is used to maintain the city parks. The tax for the second quarter was $277,000 as against $270,000 for the second quarter of 1928. Receipts of the United for April, May and June totaled $3,963,276 and the park tax was paid on $3,105,013, the remainder being receipts from lines not subject to the tax. The monthly receipts for the period were: April, $1,331,013; May, $1,365,530; June, $1,266,732.

Windsor, Ont.—An injunction to halt the projected transfer of the Windsor, Essex & Lake Shore Railway to the people of Windsor and eight other municipalities along its right-of-way is sought by a member of the East Sandwich Township Council. Consummation of the plan required the passage of enabling by-laws by the Councils of all communities interested. The East Sandwich Township Council did enact this legislation, but it is now asserted that business transacted at that session was unconstitutional.

Boston, Mass.—An early morning car is being operated to Elm Street on the Fellsway in Boston as a special service to night workers by the Boston Elevated Railway largely as an experiment. Early cars on other routes may be tried later if this trial is successful.

Ames, Ia.—The Fort Dodge, Des Moines & Southern Railroad has been permitted to discontinue its car line between the Iowa State College campus and the business section of Ames, Ia., until the opening of the school term in September. A bus line, also operated by the company, is furnishing service between the two sections of the city during the summer.

Toronto, Ont.—The question of salary and working conditions for employees of the Windsor railway is left open indefinitely as the result of a conference here on July 20 between representatives of the men and the Ontario Hydro-electric Commission, which operates the system for the local municipalities. At the close of the conference the only announcement was that another conference is to be held in "a month or so."

Recent Bus Developments

Twenty-Five Cent De Luxe Service for Baltimore

Plans to operate a de luxe passenger bus service between the fashionable Roland Park section and the downtown area are being made by the United Railways & Electric Company, Baltimore. The application is now before the Maryland Public Service Commission.

The route to be covered will be about 6 miles and the fare will be 25 cents each way. Seven de luxe buses will be used to start the service, probably about Sept. 1. Each bus will carry nineteen passengers.

In establishing the service the United expects to eliminate much of the parking nuisance with which many of those living in Roland Park are forced to contend. The company promises to maintain a 10-minute headway in the morning and evening rush hours and 20-minute headway during the rest of the day.

Adrian Hughes, Jr., superintendent of the bus department of the United, conducted a thorough canvass of residents who would be served by the line. More than 1,000 persons were interviewed and many of them said they would patronize the line. Part of the Roland Park section is served by two car lines.

Buses on Idaho-Washington Run

The last electric railway system in Idaho will pass into history on Aug. 1 with the removal of the tracks on the interstate bridge between Lewiston in that state and Clarkston, Wash., completed in compliance with orders from the City Councils of both cities. Mark Means, secretary-treasurer of the Lewiston-Clarkston Transit Company, operating the street railway, has received a permit to operate a bus line.

New Chicago-Alton Service Approved

Holding that the request of the Chicago & Joliet Transportation Company, Alton Transportation Company, and Illinois Traction, Inc., filed in September, 1928, should not be approved the Illinois Commerce Commission on July 16 cancelled the certificate of convenience and necessity granted to the Alton Company and issued to the Tri-State Bus Company a certificate to operate motor coaches between Chicago and East St. Louis and intermediate points. The commission held that "by rendering a local transportation service that will transport passengers from intermediate points to 'all trains stop' stations," the bus service would "have a further tendency—to increase the amount of travel on the steam and interurban railroads."

It also held "that the existing steam and electric carriers cannot render service of the type, quality, kind and character so as to meet the demands of the traveling public and the people living on or near the proposed route," and, further "that by virtue of the difference charged in the per mile rate of fare, the bus traveling public, as counter-distinguished from the steam and electric public, is, in the great majority of instances, an entirely different class of the general traveling public."

Another Route Sought by County Transportation

The New York Public Service Commission was petitioned by the Port Chester-Glenville Bus Company and the County Transportation Company, Inc., on July 19 for authority to transfer to the latter its certificate of public necessity and convenience. The village authorities of Port Chester have approved the transfer. The County company now owns 60 buses and it will be able to assign buses and co-ordinate the various routes with the trains of the New York, Westchester & Boston Railway, to which the County company is allied, and provide increased facility of travel to the inhabitants of the territory covered. The commission will give a hearing later.

Alliance-Canton Service Still a Matter of Controversy

Claims that an effort is being made to wreck the Stark Electric Railroad were made by William Klinger, a member of the Ohio Public Utilities Commission, in his opinion opposing increased service between Alliance and Canton, Ohio, asked by the Salisbury Transportation Company. Stark Electric has opposed the Salisbury's request to run hourly service. At a hearing some months ago when the Salisbury company protested a request of the Stark Electric for increased service over a part of the Alliance-Canton route, it was charged that the bus line was being subsidized. Overriding Mr. Klinger's opposition, Roscoe C. McColloch, chairman of the commission, and Frank W. Geiger, granted the Salisbury company permission to follow a one-hour schedule. The two companies have battled before the Ohio Public Utilities Commission and the various courts of the state for months.

Supervision of New York Taxis Recommended

Taking up the perennial subject of taxicabs, the Citizens' Street Traffic Committee of New York suggests a new bureau to have charge not only of licenses but of regulation. The hope is expressed that by constant supervision, with adequate co-operation by the police, many of the existing inconveniences or abuses may be measurably abolished. It has been found, for example, that the stands where taxicabs are allowed to wait for fares are not so fully used as they should be. At special locations, also, there is evidence of favoritism and even of intimidation with respect to certain cab lines. The citizens' committee agrees with the Mayor that in New York there are too many taxicabs when they are not needed, and not nearly enough when they are. Whether this condition can be remedied by the proposed Board of Taxicab Control, says the New York *Times*, cannot be predicted in advance of actual trial.

Buses Between Allentown and Reading

Preparations are being made by the Allentown & Reading Traction Company to substitute bus lines for the interurban passenger routes. The trolley lines in Reading proper would be retained. The falling off of business between the two cities, and the need for a general realignment have brought about the change, particularly the fact that a fine highway connects both cities, affording excellent opportunity to serve passengers on the 35-mile run between the two Pennsylvania cities.

Baltimore, Md.—Permission granted by the Maryland Public Service Commission to the Baltimore Coach Company, a subsidiary of the United Railway & Electric Company, Baltimore, to operate passenger buses on the Registerstown road, was opposed by the Park Heights Civic Improvement Association, which has now been refused an opportunity to present additional testimony.

Alameda, Cal.—The Citizens' Transportation Committee has applied to the Railroad Commission for an order directing the Key System Transit Company to abandon its franchises and remove its railway tracks from the corner of Park Street and San José Avenue, along Park Street and over the Park Street bridge, and to operate bus service in lieu of the railway service over Park Street and thence by the most direct route to East 14th Street in Oakland.

Columbus, Ind.—Two new buses of the Interstate Public Service Company intended to supplant street cars running from Columbus, Ind., to Maple Grove and East Columbus, have been put into operation.

Rochester, N. Y.—Authority was asked of the Public Service Commission by the New York State Railways on July 22 to substitute buses for trolley cars on the Rochester & Sodus Bay division of its line. It is proposed to use Mack and White parlor car type buses seating 29 passengers as well as two five-ton freight trucks and one tractor with two trailers. Ordinary baggage will be carried on the buses. The town boards of Irondequoit and Penfield and village of Webster have agreed to the substitution.

Worcester, Mass.—No decision has been reached by officials of the Worcester Consolidated Street Railway on the course to be pursued to obtain a permit to operate buses in Millbury and Bramanville in place of railway service. The Worcester license commission has authorized the Consolidated to operate in Worcester, but the Selectmen of Millbury have refused to permit the company to operate in that town. Consolidated officials probably will ask for a conference with the Millbury selectmen in an effort to settle the difficulty.

Newark, N. J.—The largest chartered bus order ever placed with the Public Service Co-ordinated Transport is that of the Wright Aeronautical Corporation, for an excursion of 120 buses from Paterson to Lake Hopatcong, N. J., on Aug. 2. This exceeds by nine buses the largest previous order, which was for a recent excursion of the Prudential Insurance Company.

Financial and Corporate

Earnings Improve in Baltimore

An increase in net over the corresponding month of 1928, after charging off the added amount for depreciation ordered by the Maryland Public Service Commission, is reported by the United Railways & Electric Company, Baltimore. It is the fourth consecutive month in which the company has shown increased net income. The increase in net for this June over the corresponding month of last year was $3,701, after setting up $67,794 more for depreciation than in June, 1928. Economies in management showed a saving of $57,766.92, or 6.70 per cent for June.

For the six months' period of 1929 passenger revenue increased $170,811, and economies in management saved $224,683, as compared with the first six months of last year. However, the increase in depreciation reserve amounted to $416,296 more in the first six months of this year than in the similar period of 1928, resulting in a net income so far this year of $195,687, as against $229,647.56 for the first six months of last year.

Insull Interests After Indiana Union Traction

Interests representing Samuel Insull are reported to be making final overtures to gain control of the Union Traction Company of Indiana. A bid of about $2,829,000 is said to have been made for properties of the company, now in receivership, against which more than $14,201,000 mortgage bonds are outstanding. It is understood that committees representing various bondholders' groups have been meeting the last few days in Philadelphia to sign an agreement with the Midland Utilities Investment Company, Insull holding corporation, for sale of the bondholders' rights on condition that 60 per cent of the outstanding securities be delivered.

Excellent Year in Toledo

The first twelve months of operation under the new transit plan at Toledo, Ohio, co-ordinating bus and railway service under direction of the Community Traction Company, and eliminating independent and competing lines, showed $3,900,274 revenue compared with $3,504,766 for the previous twelve months. This was a gain of 11.28 per cent, made during a period in which service was increased 16 per cent. Expenses increased only 5.20 per cent.

Some 52,596,378 passengers were carried, an increase of 5,016,859 over the previous year, or a gain of 10.54 per cent. Crosstown lines, operated for the first time by the company, carried 943,704 passengers. Special school buses carried 45,806 passengers in addition to those using regular lines.

The company is spending more than $100,000 a month now on its improvement program. This includes new tracks on all streets in which the city is laying new pavement.

The company has abandoned $1,500,000 of property since the Milner ordinance became effective and has increased its plant investment account $750,000 since 1921. It has outstanding $6,181,000 of first mortgage bonds and $1,226,000 of 7 per cent preferred stock. The city now owns $1,819,000, par value, of the railway's common stock.

During the last twelve months $160,504 was credited to the stabilizing fund.

The favorable showing of the company is one of the achievements claimed by Mayor W. T. Jackson in his campaign for re-election. Thus the city transportation system is injected into the city campaign for the first time in history to advertise its good record.

Holding Company Case at St. Louis Appealed

On July 19 the City of St. Louis and former Judge Henry S. Priest acting on behalf of certain minority stockholders of the St. Louis Public Service Company appealed to the Cole County Circuit Court from the ruling of the Public Service Commission on April 26, last, which authorized the City Utilities Company, a Delaware corporation, to acquire and control more than 10 per cent of the capital stock of the St. Louis Public Service Company. The city contested the holding company's application on the ground that it was not legally qualified to do business in Missouri and further that it was not adequately equipped to render the railway the financial and administrative assistance promised.

Review of Boston "L" Year

Careful economy made it possible for company to avoid deficit—Against further extensions at expense of car rider

FOR the year ended June 30, 1929, the Boston Elevated Railway was able to meet all operating expenses and fixed charges. No balance is available over and above the amount necessary to restore the reserve fund to the original amount of $1,000,000 as provided in the Public Control Act. At this time, therefore, no further payment can be made in reduction of the balance still due to the municipalities on the assessment made in 1919. Only through the most careful economy was the railway able to avoid a deficit. With respect to service rendered, the railway, during the last year, actually operated 65,000 more miles than in the previous year.

Receipts declined $697,127 for the year ended June 30, compared to last year. Partially offsetting this decrease in receipts was a reduction of $610,061 in operating expenses as compared with the actual operating expenses applying to the year ended June 30, 1928. From actual operations covering the year ended June 30, 1929, there was an excess of cost of service over receipts of $180,153 compared to an excess of receipts over cost of service of $82,811 from actual operations during the year ended June 30, 1928.

The deficit of $180,153 was met in part by a dividend of $150,000 from the Transit Mutual Insurance Company created in 1921 to carry the workmen's compensation insurance of the company. This dividend represents savings to the car riders through the operation of the Mutual Insurance Company. The balance was met by inventory and other profit and loss adjustments

Conspectus of Indexes for July, 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	Last 5 Years Low
Street Railway Fares* 1913 = 4.84	July 1929 7.76	June 1929 7.76	July 1928 7.64	July 1929 7.76	Jan. 1924 6.91
Electric Railway Materials* 1913 = 100	July 1929 147.5	June 1929 145.8	July 1928 141.8	March 1924 163.9	Feb. 1928 139.5
Electric Railway Wages* 1913 = 100	July 1929 230.9	June 1929 230.8	July 1928 229.2	July 1929 230.9	Jan. 1924 217.4
Am. Elec. Ry. Assn. Construction Cost (Elec. Ry.) 1913 = 100	July 1929 199.0	June 1929 199.7	July 1928 203.3	March 1924 206.8	July 1929 199.0
Eng. News-Record Construction Cost (General) 1913 = 100	July 1929 204.8	June 1929 205.6	July 1928 200.6	March 1924 224.7	Nov. 1927 202.0
U.S. Bur. Lab. Stat. Wholesale Commodities 1926 = 100	June 1929 96.4	May 1929 95.8	June 1928 97.6	Nov. 1925 104.5	April 1927 93.7
Bradstreet Wholesale Commodities 1913 = 9.21	July 1929 12.49	June 1929 12.46	July 1928 13.14	Dec. 1925 14.41	July 1924 12.23
U. S. Bur. Lab. Stat. Retail Food 1913 = 100	June 1929 154.8	May 1929 153.3	June 1928 152.6	Nov. 1925 167.1	May 1924 141.0
Cost of Living Nat. Ind. Conf. Bd. 1914 = 100	June 1929 160.0	May 1929 159.4	June 1928 160.9	Nov. 1925 171.8	April 1929 159.3
Industrial Activity Elec. World—Kw.-hr. used 1923-25 = 100	June 1929 135.2	May 1929 136.9	Juue 1928 116.4	Feb. 1929 140.4	July 1924 73.4
Bank Clearings Outside N. Y. City 1926 = 100	June 1929 102.2	May 1929 102.5	June 1928 104.5	Feb. 1929 110.1	May 1924 84.4
Business Failures Number	June 1929 1477	May 1929 1733	June 1928 1639	Jan. 1924 2231	Sept. 1928 1348
Liabilities (Millions)	64.22	44.90	46.16	122.95	23.13

*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.

incidental to the closing of the year's accounts.

Attention is directed to the reduction this year of $610,061 in operating expenses, a sum lower than for any year since that ended June 30, 1923, when a lower wage scale was in effect than at present.

The decline of $697,000 in gross revenue is attributed by Edward Dana, general manager, to two factors: First, continuing and increasing depression in summer riding; and second, the increase in automobile riding, especially during the open winter last year. Neither factor is one over which the railway has control.

As evidence of the increased need of mass transportation, Mr. Dana points out that in spite of the decline in total passenger revenues, there has been a substantial increase in weekday traffic for the eight months of the year from October to May, inclusive. This average weekday traffic during the eight months period is more than 1,120,000 passengers under the present 10-cent and 6½-cent fare, compared to 984,619 in 1920, the first year of the 10-cent fare, and 1,088,548 in 1917, the highest point of the 5-cent fare.

The additional rental of $30,000 a month on the portion of the Dorchester Rapid Transit Extension in use when rental began in October, 1928, added to the burdens to be overcome during the past year. The total rental charges on subway, tunnel and rapid transit lines increased by $291,116 this year as compared to last year. In conclusion Mr. Dana says:

"Since it is very evident that present revenues are barely sufficient to meet the present cost of service, it should be apparent that further rapid transit extensions at the expense of the car rider alone cannot be undertaken."

COMPARATIVE DIVISION OF RECEIPTS AND EXPENDITURES OF THE BOSTON ELEVATED RAILWAY FOR THE YEARS ENDED JUNE 30

	1928	1929
Total receipts	$35,009,933	$34,312,806
Operating Expenses		
Wages	16,826,418	16,295,105
Material, supplies and other items	3,155,788	3,064,407
Injuries and damages	1,191,690	1,210,168
Depreciation	3,814,336	2,847,900
Fuel (does not include gasoline for buses)	1,094,966	1,055,746
Total operating expenses	$25,083,391	$24,470,322
Taxes	1,793,128	1,605,086
Dividends (including rent of leased roads)	3,149,857	3,139,874
Subway and tunnel rents	2,269,193	2,560,315
Interest on B. E. bonds and notes	3,553,097	2,538,583
Miscellaneous items	78,448	85,771
Total cost of service	$34,927,121	$34,492,959
Loss or gain not including profit and loss items	82,811	*180,153*
Profit and loss delayed items	812,706	180,153
Total loss or gain including profit and loss items	$895,518	$00

Terms of Tentative Key Plan

The reorganization committee of the Key System Transit Company, Oakland, Cal., has promulgated a readjustment plan whereby it is proposed to reduce funded debt to $4,675,000 from $19,436,000.

Holders of the $1,175,000 of 5½ per cent equipment bonds will receive 50 per cent in cash and 50 per cent in new 6 per cent equipment trust certificates plus $200,855 interest in cash. Holders of the $8,862,000 general and refunding second mortgage bonds will receive preferred stock of two series conditioned on bond interest. Holders of the $2,500,000 collateral trust 6s will receive convertible preferred. All of this stock is to be issued on the basis of one share for each $100 par of bonds.

Holders of the present prior preferred will receive 1½ shares of new Class A common for each share of prior preferred held. Holders of the present preferred will receive two shares of Class C for each share held. Holders of the common will receive one share of Class C for each share held.

In order to obtain the funds to cancel the first mortgage, every exchange below the first mortgage is conditioned upon the compulsory subscription to one share of the new preferred at $25 a share for each $100 par value of existing securities. The new preferred carries $1.50 dividend.

The present second mortgage bondholders will be required to subscribe to only such portion as may not be met by securities junior to this mortgage up to the limit of one share for each $100 par held.

The plan will be effected by foreclosure of the first mortgage. It is stated that the foreclosure price will undoubtedly leave no values for any undeposited securities junior to the first mortgage and failure to subscribe will result in the cancellation of such junior equities. Option is extended to the first mortgage holders to receive in full equipment trust certificates instead of part cash. The committee says a substantial amount of bondholders have so elected in advance.

Depreciation Accounting Reply

The St. Louis Public Service Company, St. Louis, Mo., on July 22 filed with the Public Service Commission a reply to the recent complaint of City Counselor Muench demanding an accounting of an $8,369,931 depreciation reserve which the city alleged the company took over from Receiver Rolla Wells of the United Railway on Nov. 30, 1927. Stanley Clarke, president of the Public Service Company, said:

"The property was sold at foreclosure free from all liabilities other than those set forth in the decree of the United States District Court. Receiver Wells was charged with the obligation of paying off the matured indebtedness of the receiver and the insolvent company. As a matter of fact there was an insufficient amount to pay off such obligations.

"As a result no depreciation fund whatsoever was acquired by the company from the receiver. Since Dec. 1, 1927, when it acquired the properties, the company has been setting up a depreciation fund pursuant to the orders of the commission."

The reply states that the present depreciation reserve as set up by the company is $756,331.

Mr. Clarke characterized the complaint of Counselor Muench as unwarranted and designed to mislead the people.

The company further asks the commission to increase the annual depreciation allowance to 3¼ per cent of the depreciable value of its properties, raising this item from $800,000 to about $1,400,000 annually. To sustain its request for a greater depreciation reserve the company pointed out that the city is now engaged in an extensive street widening program which will require the railway to remove or replace many miles of tracks imposing a burden heavier than it had ever faced before.

Dividend Action Criticized

Action of the Philadelphia Rapid Transit Company in declaring a $1 extra dividend on common was characterized as "a challenge to the people of Philadelphia" by Harold Evans, former Public Service Commissioner. He questioned the propriety of taking $600,000 out of the company's surplus. Criticism also was directed at the board's action because the Philadelphia Rapid Transit has been asking an increase in fares. S. Davis Wilson, city controller, urged action by the taxpayers in the event the City Council, acting under an agreement of 1907, failed to disapprove of the expenditure.

Action Soon in Indiana Merger

The $70,000,000 utility merger case in Indiana now pending before the Public Service Commission has moved a step nearer hearing with the completion of field work of the auditors who have been studying the books of the companies involved. Howell Ellis, a member of the commission, says the next step will be preparation of exhibits showing facts pertinent to the merger case. These exhibits will be made from the audits. Meanwhile engineers of the commission are at work investigating the condition of the physical properties of the various utilities sought to be merged. This investigation will not be completed for several weeks.

Among the companies involved in the merger are: Car Trust Equipment Company, Indianapolis & Northwestern Traction Company, Indianapolis, Crawfordsville & Danville Electric Railway, Indianapolis, Martinsville Rapid Transit Company, Indianapolis Street Railway, Terre Haute, Indianapolis & Eastern Traction Company, Terre Haute Traction & Light Company, and Terre Haute & Western Railway.

Chicago Railway's Principal

The Chicago Railways will begin paying off its $55,655,000 first mortgage bonds. On or about Aug. 1, the bondholders will receive about $5,565,000 as a 10 per cent payment on the bonds, which have been in default since Jan. 31, 1927, when the ordinances under which the Chicago Railways and the Chicago City Railway expired and the bonds matured.

This will be the first payment on the principal in the two and a half years the company has been in receivership. However, the semi-annual interest payments at the annual rate of 5 per cent have been kept up under order of Federal Judge Wilkerson, so that the bondholders will receive $1,390,000 additional as interest due on Aug. 1.

Albert W. Harris, chairman of the bondholders' protective committee, has appealed to holders who had not yet deposited their bonds with the committee to do so in view of the prospective reorganization.

Personal Items

Charles Gordon, Managing Director

Engineer, executive and journalist selected to succeed Lucius S. Storrs in American Electric Railway Association Post

CHARLES GORDON, editor of ELECTRIC RAILWAY JOURNAL, has been named managing director of the American Electric Railway Association, a post he is to assume on Sept. 1 next. He was selected for appointment by a sub-committee of the Advisory Council of the association on July 9 and the appointment was confirmed by the executive committee on July 12, at which time J. H. Hanna, who presided in the absence of President Barnes, officially notified Mr. Gordon of the recommendation of the Advisory Council and the action of the executive committee. Mr. Gordon succeeds Lucius S. Storrs, now chairman of the executive committee of the United Railways & Electric Company, Baltimore.

It is agreed that no editor can be an influence who is lacking in positive opinions and has not the power of reiteration. Dana, Raymond, Godkin, and in more recent times Cobb, were all men that met this measure, on which James Ford Rhodes, the historian, lays great stress. It is the measure that Charles Gordon meets. He has positive opinions. He has reiterated them time and time again, but not for the mere sake of writing. He expressed himself in the JOURNAL because his mind was full of the things to which he turned his pen—visions of the local transportation industry in its relation to city planning, its bearing on the terminal situation in our fast growing cities and in its other broad economic aspects.

Mr. Gordon has been nationally active in transportation affairs for a long period, and as editor of the JOURNAL he has traveled widely and spoken in the interests of modernization of local transit service. He has advocated modernization of electric railway properties and co-ordinated rail and bus service under single managements. Ever since he left the service of the Chicago Railways in 1923 to become Western editor of ELECTRIC RAILWAY JOURNAL he has carried on militantly as journalist and editor in advocacy of those things he recognized as likely to be for the greatest good of the industry. Recognition of the high editorial standards achieved in this activity came with the award to the JOURNAL in 1928 of the first Associated Business Paper medal for outstanding service by a business paper to its industry. In fact, it is doubtful if any other man in the industry has devoted himself with greater zeal and enthusiasm than has Mr. Gordon to the task of rehabilitating the electric railway as an agency of transportation and restoring it to its proper place in public esteem.

All the various phases of street railway and bus operation have attracted and held his attention. He has advocated the use of the bus not only as a supplement to the street car but to provide a service of its own wherever circumstances would warrant. In all these larger activities he has not, however, lost sight of the importance of personnel work, sound financial policy, the economics of street traffic, and the details of operation, maintenance and construction. Valuable in his new post should be his ability to express himself clearly, forcefully and candidly as a speaker.

Charles Gordon

Mr. Gordon was graduated from the University of Illinois, railway electrical engineering department in 1912. His first position was with the Chicago Railways Company. There he was engaged in electrical and mechanical test work under John Z. Murphy, then chief engineer. When the Chicago Surface Lines was formed as an operating entity he remained with that company until 1917, when he entered the Army Air Service. On his discharge in April, 1919, he joined the sales force of the Vacuum Oil Company as a special engineer. The following year he was appointed equipment engineer of the Chicago Surface Lines. In this capacity he served under H. H. Adams, superintendent of equipment, and was responsible for many phases of the development of rolling stock and maintenance practice on a system operating some 4,000 surface cars engaged in the most difficult of city service. He organized an equipment engineering department which quickly became a strong factor in the improvement of equipment department practice. From the Chicago Surface Lines he went to ELECTRIC RAILWAY JOURNAL as Western editor in 1923.

As this very brief review indicates, Mr. Gordon is an engineer by profession, an executive by training and a journalist by predilection. He will take to the task of managing director the broad, intimate contact that his work as editor has given him with all phases of community transportation, a type of experience it would be difficult to duplicate. In his new post he should loom even larger than he has in the past as writer and editor, as an influence in shaping the policies of organized mass transportation agencies in meeting their responsibilities as public servants, and in anticipating the opportunities for expansion offered by the growing problem of moving people and commodities in modern communities.

D. E. Druen in New Post

D. E. Druen, in the service of the Kansas City Public Service Company, Kansas City, Mo., since June, 1920, succeeds to the position of superintendent of equipment, made vacant by the resignation of R. S. Neal, who goes to the Texas Company in a street railway engineering capacity. In assuming the position vacated by Mr. Neal, Mr. Druen becomes the head of the mechanical department. In addition to the work he takes over at the Tenth and Lister shops he will still retain his title as superintendent of the bus and garage department.

Mr. Druen has been at the head of a special engineering department, at the Tenth and Lister shops, organized to carry on a widespread work of research, planning and inspection. In addition to this work, he has also remained at the head of the bus and garage department. His connection with the Kansas City property, as indicated previously, dates from June, 1920, when he entered the service of the Board of Control of the Kansas City Railways assigned to research and planning work concerned with the rehabilitation of the power plant at Second and Grand.

When R. W. Bailey became head of the power department, Mr. Druen was appointed assistant superintendent of power. This was in January, 1921. During the interval between 1921 and 1927, when the plant passed to the Kansas City Power & Light Company, the old power house, under Mr. Bailey's direction and Mr. Druen's supervision, was brought up from a questionable state of usefulness to one of the highest in efficiency. The scope of this work included the installation of a complete steam plant. The system of handling coal and ash was entirely revolutionized. The power producing facilities were also rehabilitated and the plant commenced to repay in the shape of savings to its owners. With the passing of the power plant, Mr. Druen was appointed superintendent of the bus and garage department. Here another job of planning and organizing confronted him. Thence he went to the special engineering department.

Don E. Druen was graduated from the University of Wisconsin with the class of 1913 with the degree of C.E. Immediately upon graduation he was appointed assistant city engineer at Miles City, Montana. In 1917 he was appointed city manager of Glendive, Montana, a position he resigned in 1920 to enter the services of the Kansas City Railways.

J. W. Welsh With Cleveland Railway

Executive secretary of American Electric Railway Association resigns to accept an executive position under President Alexander. To participate in work of co-ordinating surface and rapid transit operation

JAMES W. WELSH, executive secretary of the American Electric Railway Association since 1921, is to become engineering assistant to Joseph H. Alexander, president of the Cleveland Railway on Sept. 1. His appointment is the first major addition to the railway's executive staff since Metropolitan Utilities Inc., controlled by the Van Sweringens, took over the company.

As a specialist in engineering and traffic problems, Mr. Welsh is expected to devote much of his time to the problems which the railway will face in its great expansion period just ahead, when it must co-ordinate its surface and rapid transit lines and evolve policies of transportation to fit a changing situation. In this program Mr. Welsh will be called upon to assist in the development of a plan for

J. W. Welsh

the co-ordination of the company's present surface street car and bus lines and the rapid transit lines which the Van Sweringens will build to the east and west of the Public Square.

As his first work at Cleveland Mr. Welsh will devote considerable time to a study of the railway's traffic problems, its co-ordination plan and particularly to transportation research. The traffic study will be of a dual nature, attempting to speed up traffic and eliminate congestion in now crowded districts, and to determine where traffic will originate in the future.

Since Mr. Alexander is an engineer, his contacts in the past naturally have been more with the engineering departments of the railway. He now expects to be able to devote more time to other departments and other problems, with Mr. Welsh giving his attention to engineering problems.

In tendering his resignation to the association Mr. Welsh said:

"I wish to express my regret in severing a relationship which has existed for eight years in my present office, and to record my high regard for the wide acquaintanceship throughout the industry, and the closer friendships among the officers and committee members which I appreciate more than I can tell you. I wish the ensuing management of the association a full measure of success, and I pledge my co-operation."

Mr. Welsh has been secretary of the association since 1921. Before that he was the association's special engineer. Until his appointment as engineer of the association, he was in Washington, D. C., associated with A. Merritt Taylor, manager of the passenger transportation of the Emergency Fleet Corporation of the United States Shipping Board. Mr. Welsh, who served on Mr. Taylor's staff, assisted in providing transportation facilities to the various shipyards on the Atlantic and the Pacific Coast as well as correcting existing shortcomings where they were present.

Previous to that Mr. Welsh was electrical engineer and traffic agent of the Pittsburgh (Pa.) Railways, with which he became associated in 1906 as assistant electrician. In 1910 he was made electrical engineer and in 1913 took charge of the traffic department. Some of his earlier electrical engineering experience was gained in the employ of the National Tube Company, Wheeling, W. Va., and also in the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

Mr. Welsh was graduated from Wittenberg College in 1900, Harvard University in 1901, and Massachusetts Institute of Technology in 1903.

New South Wales Official on Tour

S. A. Maddocks is on a visit to the United States empowered by the New South Wales government to inquire into transportation administration and operation with a view to incorporating any methods he believes might be advantageously adopted by his home government, which has a traffic bill under consideration at the present time. He favors co-ordination of transportation so that the public might get the maximum benefit of each form. To illustrate his point, Mr. Maddocks mentioned Toronto, Philadelphia and Berlin as among the cities which have done most for co-ordination. He feels that the operation of the street cars and motor coach or bus systems under the one administration is infinitely wise. In New South Wales, he pointed out, the railways and tramways are government-owned, but the lack of co-ordination has led to an undesirable situation. Mr. Maddocks expressed admiration for the linked up transcontinental rail-air service.

A. L. Merritt Completes Twenty-Five Years as Superintendent

The twenty-fifth anniversary of Abraham Lincoln Merritt's connection with the Interborough Rapid Transit Company, New York, as general superintendent of the subway division was celebrated on July 20 when forty members of his staff surprised Mr. Merritt in his office. Mr. Merritt's well-wishers included some of the first corps of motormen, conductors and guards whom he had put to work in the original "Belmont Tube" in 1904. Mr. Merritt, in responding to the congratulations from his staff, described the first run made in the subway from City Hall to the Grand Central Terminal.

New Head of Columbus Property Has Had Varied Career

Benjamin W. Marr, who on July 1 was elected president of the Columbus Railway, Power & Light Company, of Columbus, Ohio, succeeding C. C. Slater, has had a varied business career. For a time he was a hardware merchant in Huntington, W. Va., and Catlettsburg, Ky. He later became vice-president and general manager of a company which manufactured hickory tool handles in Louisville, Ky. He is still a vice-president of the Gwinn Bros. Milling Company, Huntington, and was secretary of the Gwinn Milling Company, Columbus, for twenty-one years prior to last March, when he resigned to become chairman of the board of directors and chairman of the executive committee of the Columbus Railway, Power & Light Company. Prior to this he had been a director of the company for ten years.

C. C. Slater, retiring president, has been general manager, vice-president and president of the company. He was made president in 1928. During his régime the property was rehabilitated physically. He made

B. W. Marr

one cut in light and power rates, placed new cars in operation, started bus service, inaugurated the skip stop system of car operation, raised the street car speed limit, rebuilt practically all the trackage and paved streets at a total cost of about $2,000,000.

Sir Felix Pole With Associated Electrical Industries

Surprise was caused in British railway and other engineering circles by the announcement in June that Sir Felix Pole had resigned as general manager of the Great Western Railway to become chairman of Associated Electrical Industries, Ltd. For the last eight years Sir Felix has been general manager of the Great Western Railway, a post which he has filled with great credit and distinction. He will still retain his connection with the railway as a consultant. Associated Electrical Industries, Ltd., of which he becomes chairman, is a holding company recently formed which controls the British Thomson-Houston Company, the Metropolitan Vickers Electric Company, the Metropolitan-Vickers Electrical Export Company, the Edison-Swan Electric Company and Ferguson Pailin. All these are names of importance in the world of manufacture of electric machinery and appliances, traction and other.

D. W. Pontius Heads Pacific Electric

Other changes in personnel include appointment of A. T. Mercier as vice-president and general manager of that company and F. L. Annable to the presidency of the San Diego & Arizona Railroad

HIGH and well-deserved honors were bestowed with the election of D. W. Pontius, formerly vice-president and general manager of the Pacific Electric Railway in Southern California, to the presidency of that property on July 1. He succeeds Paul Shoup, formerly president of both the Southern Pacific (Pacific System) and Pacific Electric Railway.

Advanced to the position formerly held by Mr. Pontius is A. T. Mercier. He leaves the post of president and general manager of the San Diego & Arizona Railroad, while the vacancy created by Mr. Mercier's advancement will be assumed by F. L. Annable, previously general superintendent of the Pacific Electric, who now becomes president of the San Diego & Arizona property.

Mr. Pontius made his start in 1891 as clerk in the roadmaster's office of the Pennsylvania Railroad in Ohio at $30 a month. Step by step he has advanced in his chosen field, having served successively as operator, agent district freight and passenger agent, traffic manager, general manager, and vice-president and general manager, serving during his railroad career with the Pennsylvania Railroad; Chicago-Great Western Railway; Northern Pacific; Union Pacific; San Diego & Arizona Railroad; Southern Pacific, and Pacific Electric Railway.

During the World War he was sent to San Diego as general manager of the San Diego & Arizona Railroad, which was under construction at that time. When this project was completed he returned to the Pacific Electric Railway as vice-president and general manager, a post he has filled until the resignation of Paul Shoup.

In addition to his efficient management of the world's largest electric interurban railway system, Mr. Pontius has for the past several years been active in civic affairs. He is president of the Los Angeles City Health Commission, executive vice-president of California's Mission Play, treasurer and member of executive committee of the Los Angeles Traffic Commission, and director of the United States National Bank.

One of Mr. Pontius' hobbies has been the promotion of social and group activities among employees of the company. Among his many accomplishments in this regard are the development of a $120,000 employees' mountain resort in the San Bernardino Mountains, and the erection of a $450,000 club building for the Pacific Electric employees, now being completed by the railway under his direction.

Mr. Mercier a Former Traffic Man

As vice-president and general manager, Mr. Mercier's addition to the executive forces of the Pacific Electric Railway brings to that property a man of many creditable achievements, both as an engineer in construction work and railroad operation. Mr. Mercier is a graduate of Rugby Academy, a preparatory school for entering Tulane University, in which institution he completed a course in civil engineering. He began his railroad career in 1904 with the Southern Pacific as traffic man, continuing until 1906 as roadmaster and assistant gang foreman at Los Angeles.

During 1906 and 1907 he was assistant engineer in charge of reconstruction work in the Colorado River District, following which he was engineer in charge of steel construction for the Southern Pacific in Southern California. From 1908 until 1917 he was assistant division engineer and later division engineer of several operating divisions of the Southern Pacific. In February, 1917, he was appointed assistant superintendent of the Shasta Division. In September, 1918, he was made superintendent of the Portland Division, where he remained until his appointment as general manager of the San Diego & Arizona Railroad. With the death of J. D. Spreckles about a year ago, Mr. Mercier succeeded to the presidency of the San Diego & Arizona Railroad, having held the office of president and general manager until his appointment as vice-president and general manager of the Pacific Electric Railway early last month.

Mr. Annable began his railroad career with the Atchison, Topeka & Santa Fé Railway (Coast Lines) at San Bernardino in 1893. He was later transferred to Los Angeles and then to Winslow, Ariz., with the same company. From 1904 to 1910 he held the position of chief clerk to the superintendent of the Los Angeles & Salt Lake Railroad in Los Angeles. For two years he was superintendent of the Arizona & Swansea Railroad at Swansea, Ariz. In 1911 he went to the Pacific Electric Railway as assistant superintendent. Later he was advanced to division superintendent, having served in that capacity during successive years on each of the Pacific Electric's three divisions. In 1913 he was made general superintendent, a position he filled capably until he was made president of the San Diego & Arizona Railroad.

Top, D. W. Pontius. Lower left, A. T. Mercier. Lower right, F. L. Annable

R. S. Neal With The Texas Company

R. S. Neal has resigned as superintendent of equipment of the Kansas City Public Service Company, Kansas City, Mo., to become associated with The Texas Company as electric railway engineer. He will work out of Chicago, Ill. through Ohio, Indiana, Illinois, Missouri, Kentucky, and part of Michigan.

On March 16, 1918, Mr. Neal joined the Kansas City Power & Light Company in the way and structures department. He was transferred to the board of control on July 16, 1918, as assistant engineer for the installation of the Westinghouse stokers in the Missouri River Power Station at Second and Grand. He resigned on May 19, 1919, to go with the Burrell Engineering Company as mechanical engineer in charge of machinery layout. For a short period he was also assistant engineer of the Witte Engine Works. He returned to the Kansas City Railways on Nov. 12, 1920, to take charge of the engineering work for the mechanical department, organizing the original engineering department, which included designing work, making up of specifications, shop work, planning, and general drafting. This position he held until April 1, 1922, when he was appointed assistant superintendent of equipment in charge of the mechanical department. A few years later he was appointed superintendent of equipment, in charge of the maintenance of all equipment for the Kansas City Public Service Company, including the mechanical work at both the shops and divisions. The extensive car rehabilitation program during 1927-1928 was handled under Mr. Neal's administration.

Changes in Interurban Coach

An effort further to co-ordinate general management of the Mid-West Motor Coach Company and the Shore Line Motor Coach Company has resulted in the appointment of J. C. Johnson, general manager of the Shore Line Motor Coach Company, as general manager of both organizations. F. E. Snyder, manager of the Gary office of the Mid-West Motor Coach Company, will retain this position and take up the additional duties of assistant general manager of the Shore Line Company. Henry P. Bruner, Chicago, vice-president of the Mid-West Motor Coach Company, says the two bus lines will continue to operate as separate organizations, without any alteration in policy. No further changes in the management are contemplated.

R. H. Horton in Philadelphia Progress Movement

R. Harland Horton has resigned as assistant vice-president of operations of Mitten Management to take up his duties as executive director of the Philadelphia progress movement, the purpose of which is "to bring greater progress and prosperity to the city of Philadelphia."

Mr. Horton's immediate task will be to make a complete survey of all of the industrial advantages of Philadelphia; to collect and organize all of the important facts concerning the city, culturally, institutionally, geographically and socially, and to set forth how desirable a city Philadelphia is in which to live, to work and to play. An important part of Mr. Horton's responsibilities will be to make the three-year campaign now about to get under way beneficial to the city as a whole, to make it enhance the prestige of the city's present industries and to make it bring new, worthwhile profitable industries to Philadelphia.

Mr. Horton was born in Olean, N. Y., on Aug. 30, 1889. He received his technical education at the Carnegie Institute of Technology. He worked as a rodman for the Pennsylvania Railroad and later had practical experience in the shops of the Carnegie Steel Company. He came to Philadelphia in 1910 to work with a nationally known firm of consulting engineers in the investigation of the Philadelphia Rapid Transit Company for the Pennsylvania State Railroad Commission.

In 1912 he was engaged on further work of P. R. T. investigation and a plan for rehabilitation of the company. When this work was complete he remained in Philadelphia as traffic engineer for P. R. T. and in this capacity made studies of the city's high-speed transportation development with special relation to the Frankford Elevated, and of the company's intangibles in valuation proceedings. In 1921 he visited the principal cities of the United States to study each city's resources, its industries and its transit problems and methods. The following year he spent three months in Europe on a similar study. Upon his return he became vice-president of the International Railway, Buffalo, under Mitten Management, and held this post until 1925, when he returned to Philadelphia to set up the organization of the Philadelphia Rural Transit Company, operating buses. In 1926 he was made vice-president of the P.R.T. Air Service. In the summer of that year he took part in the conference of air-mail operators with Secretary of Commerce Hoover and subsequently was director of the Air Transport Survey, upon completion of which he returned to Mitten Management as assistant vice-president of operations.

Dean Kimball a McGraw-Hill Director

Prof. Dexter S. Kimball, dean of the College of Engineering of Cornell University, has been elected a member of the board of directors of the McGraw-Hill Publishing Company, publisher of the ELECTRIC RAILWAY JOURNAL. Dean Kimball has long been a leader in the field of engineering education and an active contributor to the scientific and engineering press. He became a member of the faculty of Cornell as assistant professor of machine design in Sibley College in 1898 and served until 1901. He again joined the Sibley teaching staff in 1904. From July to October, 1918, he was acting president of Sibley. In 1921, he became dean of the College of Engineering. Professor Kimball is a member of the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education and the author of several books.

Harold G. Morris in New Providence Post

The board of directors of the United Electric Railways, Providence, R. I., at its meeting on July 18 appointed Harold G. Morris assistant general manager. In announcing the appointment First Vice-President and General Manager Williams said:

"Mr. Morris is one of the outstanding figures in the modernized transportation industry. He is a man of tremendous energy with great ability for organization. Through his appointment the company should benefit greatly as it has in the past

Harold G. Morris

through his associations with it over these years. It greatly pleases me to make the announcement."

Mr. Morris previously held the position of assistant to the general manager. He has been with the United Electric Railways and its predecessors since Aug. 16, 1917. All of this time he has been in the executive offices of the company. At first he was stenographer in the office of A. E. Potter, president, and was later appointed clerk for the receivers of the Rhode Island Company on March 4, 1919, the duties in connection with this office he assumed in addition to the clerical position he held at the time.

In July, 1921, Mr. Morris was promoted to chief clerk and held that position until Feb. 1, 1929. With the appointment of Alonzo R. Williams to the position of general manager, Mr. Morris again was promoted, this time to the office of assistant to the general manager and assigned to Mr. Williams' staff.

On Aug. 1, 1928, Mr. Williams was elected to the position of first vice-president and general manager and thereupon Mr. Morris' scope of activities became greatly enlarged. He is thirty years of age.

Edward Jacobs Succeeds Captain Hearn at Shreveport

Edward Jacobs has been elected president of the Shreveport Railways, Shreveport, La., succeeding Capt. H. B. Hearn, who has become vice-president of the City Savings Bank Trust Company, Shreveport. He became a member of the staff of the company in 1918. He was elected secretary-treasurer in 1919 and vice-president in 1926.

Duties Reassigned on Indianapolis & Southeastern

W. A. Kirkpatrick, for six years freight agent at Rushville, has been made general freight and passenger agent of the Indianapolis & Southeastern Railroad. J. E. Ray, Indianapolis, who has been superintendent of transportation for the last year, will become head of the traffic department with the title of director of traffic and transportation. J. A. Rothermel and W. A. Patton, both of Indianapolis, formerly in train service, will become division traffic representatives in the reorganization of the traffic department. They will co-operate on both divisions of the railroad to give better freight and passenger service. L. E. Watkins, who has been division traffic representative, at Connersville, Ind., has resigned.

Temporary Appointments at Toronto

Toronto's Council has sustained the Board of Control's recommendation for the appointment of George Wilson, commissioner of finance, and George H. Ross, former commissioner of finance, as members of the Toronto Transportation Commission, in charge of the municipal railway and bus lines, for the balance of the respective terms of the late P. W. Ellis and George Wright, resigned.

C. W. Gifford, general superintendent of the Gary Railways, Gary, Ind., for the last four years, will assume charge of the Des Moines Railway, Des Moines, Ia., on Aug. 1. Before going to Gary, Mr. Gifford was connected with railway systems in the East, among them the Bay State Street Railway, and the Eastern Massachusetts, and the Brockton & Plymouth Street Railway. Under his supervision the operation of one-man cars has been extended over the Gary lines, and considerable additions have been made through incorporation of the Hobart and Valparaiso lines as part of the Gary system. A successor to Mr. Gifford at Gary has not yet been appointed.

Edward P. Warner, formerly assistant secretary of the Navy for Aeronautics, recently elected president of the Society of Automotive Engineers and formerly professor of aeronautical engineering in the Massachusetts Institute of Technology, has been appointed editor of *Aviation*. Appointment of the former assistant Navy secretary to head the oldest weekly in America devoted to aviation is the latest development to follow recent acquisition of the publication by the McGraw-Hill organization. Mr. Warner, in addition to his duties as editor, will serve as aviation advisor to the company's 26 engineering, industrial and business publications.

Gerard Swope, president of the General Electric Company, has been elected a director of the National City Bank, New York. The election marks the first occasion on which he has associated himself as a director in any enterprise outside the electric and power field and marks also the resumption of an active association between himself and Charles E. Mitchell, chairman of the bank, the

ground work of which was laid more than 30 years ago, when both were in the employ of the Western Electric Company.

Neil Currie, Jr., managing engineer of the motor department of the Pittsfield works of the General Electric Company for the past five years, has been named manager of the Philadelphia works of the company. Robert V. Good, section superintendent in the Schenectady works, has been named assistant to the manager at Philadelphia.

Charles E. Moore, Jr., since Sept. 1, 1926, junior assistant utilities engineer of the Maryland Public Service Commission, has resigned, effective on Aug. 10, to accept a position as planning engineer with the Western Electric Company.

Major R. J. Lockwood, assistant general manager of the St. Louis Public Service Company, was elected president of the Midwest Electric Railway Association at the closing session of the three-day meeting at the Chase Hotel, St. Louis, Mo., on June 15.

J. H. Shepherd, engineer and manager of the Dunfermline & District Tramways Company, has been appointed chairman for the ensuing year of the Scottish Tramways & Transport Association. L. Mackinnon, general manager of the Glasgow Corporation Tramways, has been appointed vice-chairman.

Obituary

John J. Russell

John J. Russell, supervisor of maintenance of way for the Lehigh Valley Transit Company, Allentown, Pa., is dead. Mr. Russell was born in Friendship, N. Y., 70 years ago. As civil engineer for the Erie Railroad he supervised the building of much trackage. He also helped to build the large yards at Salamanca, N. Y., for that company. He also had a part in double-tracking the Erie from Buffalo to Pittsburgh, and assisted in the construction of the Pennsylvania station, in New York City. He next worked with the Interborough Rapid Transit Company in superintending the construction of tracks. He went to Allentown in 1912 to supervise the maintenance of the Philadelphia division for the Lehigh Valley Transit Company. He was advanced until he exercised supervision over all but the Easton division of the Lehigh Valley.

Samuel M. Perry

Samuel M. Perry, vice-president of the Denver Tramway, Denver, Colo., died on July 21. Mr. Perry was born in Knoxville, Ill., 80 years ago. He went to Colorado in 1887 and in 1890 built an electric railway to Aurora. This line was later merged with the Denver Tramway, Mr. Perry becoming vice-president, a post he held at the time of his death. In 1902 when the Denver & Salt Lake Railroad was built, Mr. Perry became financially interested in the line and opened the Moffat Coal Company at Oak Creek on the railroad. He was also president of the Moffat Coal Company from its inception until he died. He was an enthusiastic sportsman.

John E. Davis

John E. Davis, trainmaster of the South Side Division, Chicago Rapid Transit Company, died in Chicago on June 27, at the age of 67.

Mr. Davis joined the South Side "L" on July 15, 1892, only a few weeks after this first unit of the present Rapid Transit Lines was placed in service. His first duties were as fireman on one of the steam "dinkey" engines then furnishing motive power for elevated trains on what was popularly called the "Alley." Shortly after he was promoted to engineer.

When the power was changed from steam to electricity in 1893, Mr. Davis likewise changed his title from "engineer" to "motorman." He rose through the various stages of promotion until his appointment as trainmaster in 1926.

George T. Chaffee, pioneer electric railway owner, manufacturer and banker, died on July 15 in Rutland, Vt. Mr. Chaffee entered the railway business in 1891 as owner of the Rutland Street Railway, then a horse car line. He was instrumental in its change to electricity in 1894, and was prominent in the industry for a number of years. Mr. Chaffee was connected with the F. Chaffee & Sons lumber dealers, and was a part owner of the Patch Wegner Company, machinery manufacturers, and a director of the Glens Falls Machine Company. He had been president of the Rutland Trust Company since 1904, and a director of the Killington National Bank since 1883. He was formerly State Senator.

John M. Sweeney, president of division 308, Amalgamated Association, Chicago, is dead. Mr. Sweeney was born at Belvidere, Ill., on July 3, 1870. He entered the employ of the Chicago Rapid Transit Company on July 13, 1917, as trainman on the south side division. His rise in union circles was rapid, culminating in his election as head of division 308.

Louis E. Bean, chairman of the Oregon Public Service Commission, died in Salem, Ore., on July 6, following a heart attack. For nearly three years Mr. Bean had served as a member of the commission and during the last two years had been its chairman.

James G. Murdock, son of the late Samuel T. Murdock, pioneer in interurban and power development in Indiana, died recently in Indianapolis. Mr. Murdock was born in Lafayette thirty-six years ago. He attended Wabash College and Yale University. He assisted in his father's business enterprises until the latter's death some months ago.

Book Reviews

Arc Welding

Lincoln Prize Papers Submitted to the American Society of Mechanical Engineers. Edited by Edward P. Hulse. Published 1929, by McGraw-Hill Book Company, New York City. Cloth, 6x9 in., 421 pages. Price $5.

Last year prizes aggregating $17,500 were awarded for the best three papers disclosing advancement in the art of electric arc welding. While these were financed by the Lincoln Electric Company, the contest was sponsored by the American Society of Mechanical Engineers and the awards were made by a disinterested committee of eight prominent engineers. This book, composed of the three prize papers, of two receiving honorable mention and two others of the 77 submitted, is ample evidence that the incentive was adequate. It is easily the most important contribution yet made to the literature of arc welding.

"Arc-Welding—Its Fundamentals and Economics," brought the first prize of $10,000 to James W. Owens. It reflects the author's extensive experience as director of welding for the Newport News Shipbuilding & Drydock Company, but he finds ample space in the 180 pages of his paper for the fundamental treatment of arc welding in general. The attention given to definitions, nomenclature, standards and specifications, and the author's definitely practical viewpoint throughout, add much to the value of the paper.

"Fundamental Principles of Arc Welding," for which Prof. H. Dustin of Brussels, Belgium, received second prize of $5,000, proceeds from systematic analysis and tests of the elementary welds to an experimental study of joints for structural work. His conclusions are general in their application.

Commander H. E. Rossell of the U. S. Naval Academy, who won third prize of $2,500 with his paper "Electric Welding of Ships' Bulkheads and Similar Plated Structures," makes a distinct contribution to the science and art of naval architecture. Incidentally he adds definitely to structural knowledge in general.

It is not generally realized that newly developed types of expansion joints make welding as applicable to the unpaved tracks of steam railways and interurban electric roads as to the paved tracks of street railways. The field for welded rail joints is therefore very large. In his paper on the "Theory and Application of the Base Plate Arc Welded Rail Joint," Frank B. Walker, chief engineer Eastern Massachusetts Street Railway, outlines extensive tests of rail joints in laboratory and field and gives designs and cost figures for commercial applications.

"Stable Arc Welding on Long-Distance Pipe Lines," by B. K. Smith, president of the Big Three Welding & Equipment Company, is mainly a brief history (with costs) of the laying of 45 miles of arc-welded pipe line for natural gas.

"Arc Welding as applied to Constructive Work at the Philadelphia Navy Yard" describes the construction of a steel pressure-resisting boiler test room and experiments on the welding of T bars to armor plate. The authors are M. M. Kennedy and F. H. Wieland of the Philadelphia Navy Yard.

In "Arc Welding of Duplicate Structures," W. G. Hines describes methods used in the publication of interchangeable arc-welded truck-switch frames.

Undoubtedly these papers, particularly the three prize papers, add much to our practical knowledge of the rapidly developing art of arc welding.

Industry Market and Trade News

Increased Activity in Car Buying

ESTIMATES made early in the year in the Annual Statistical issue of this paper to the effect that 1929 would be marked by heavier purchases of rolling stock than have been made for several years past have been confirmed within the past 30 days by authorizations which should lead to the placing of orders for more than 650 new cars by properties in this country and Canada.

As the result of the recent merger of the Brooklyn City Railroad with surface lines of the Brooklyn-Manhattan Transit Corporation into a new organization to be known as the Brooklyn & Queens Transit Corporation, the immediate purchase of 100 new cars has been authorized. While complete specifications are not available at this time it is announced that the new cars will be provided with high acceleration motors, special brakes, and other modern equipment, to insure the safety and comfort of the passengers as well as to maintain high speed operation under present day traffic conditions. They will be of the front entrance, center exit type, with seats for 50 passengers and equipped for one-man operation. It is estimated that the new cars will cost in excess of $15,000 each.

The approaching completion of the new subway system being developed under the direction of the Board of Transportation of the City of New York has led the authorities to ask for the submission by manufacturers of sealed proposals for the construction and delivery of 300 steel passenger cars. Bids must be in the hands of the Board at its office, 49 Lafayette Street, New York City, not later than August 20. For more than a year engineers of the board, aided by experts in car construction and design, have been studying the problem, with the result that the new cars will be faster and more commodious than any now in use in the city.

Preliminary specifications call for cars 60 ft. 6 in. in length, 10 ft. wide and 12 ft. high, with four double doors on each side. While the seating arrangement will be similar to that of the present B.-M. T. cars an attempt will be made to achieve greater passenger comfort by allowing more knee room. Each car will seat 60 passengers.

Authority has been granted by the Cleveland City Council to the Cleveland Railway to purchase 100 new street cars at an estimated cost of $1,800,000. The company had requested permission to retire 254 cars of an older type, replacing them with new equipment, but the Council would only consider the retirement of 100 at this time. It is understood that the cars will be of the single end, double truck, one-man, two-man, Peter Witt type, similar to the 50 cars ordered in 1928 from the G. C. Kuhlman Car Company. The cars previously supplied are 53 ft. 6½ in. in length, weigh 44,800 lb., and seat 55 passengers. Bodies are of semi-steel construction, with arch roofs, and doors at both center and end.

Following experimental operation extending over a period of several weeks with one of the small type of Brill standardized car, the Lynchburg Traction & Light Company, Lynchburg, Va., has placed an order with that company for twenty double-end, double-truck units. The new cars, which are ordered for city service, will be equipped with four motors, and will have an over-all length of 43 ft. 3 in., and will seat 50 passengers. Of more than usual significance is the fact that the cars are being purchased in accordance with builders' specifications.

With the appointment of two additional members on the board of the Toronto Transportation Commission, raising that body to its full quota, there would appear to be removed the last obstacle to the placing of an order for 55 motor cars and 55 trail cars for that property, recommendations for which have been pending for several months. Specifications have been agreed upon and bids have been submitted by several Canadian manufacturers of car bodies and supplies, consequently prompt action can follow any proper authorization from the commission.

According to preliminary specifications each motor car and trailer will form a two-car train, the motor cars to be provided with four motors each and the trailers with two. By the provision of auxiliary switching control it will be possible to move the trail cars around the carhouses under their own power. In general the cars will resemble the Peter Witt cars now being operated by the commission, with the exception that the new cars will be 50 ft. in length over all, with seats for 56 passengers, as compared with an over-all length of 52 ft. and a seating capacity of 60 passengers in the present standard equipment. The new trailers will seat 52 passengers each, the same as the present trailers. Cost of the new rolling stock and its equipment is expected to total in excess of $1,500,000.

Another Canadian order conditional upon the adjustment of certain franchise legislation, which now appears to have been satisfactorily disposed of, is that of the British Columbia Electric Railway, Vancouver, B. C., for fifteen cars of the one-man two-man front entrance, center exit type, similar to certain cars recently ordered for Cleveland and Toronto. Total cost of the new cars will exceed $300,000.

Lehigh Valley Considering Electrification

Engineering surveys recently have been made of a 75-mile section of the Lehigh Valley Railroad, extending from Mauch Chunk to Wilkes-Barre, with the view of its possible electrification. The estimated cost of the project is placed at between $7,000,000 and $10,000,000. The section under consideration runs through mountain territory, and the management believes that electrification would permit the movement of heavier trains at greater speed than is now possible with steam. It is thought that the maintenance cost of electric locomotives would be considerably below that of steam equipment. The relative advantages of direct and alternating current are under consideration, as well as the question of voltage. Lehigh Valley officials are also making a close study to determine whether the use of more powerful steam locomotives would compensate for the advantages promised by electrification.

Recent Bus Orders Numerous

Electric railways continued to be the dominant factor in the bus field during the past month by placing numerous orders for new automotive equipment. While there were no exceptionally large purchases the orders were widely representative and the aggregate was considerable. By the purchase of nine 40-passenger Twin Coaches, the Boston Elevated Railway increased its fleet of these vehicles to 35. Other purchasers of Twin Coaches were the Savannah Electric Company, The Burlington Rapid Transit Company, Burlington, Vt., and the Milwaukee Electric Railway & Light Company, each of which has bought five. The Capital Traction Company, Washington, D. C., and the Philadelphia & West Chester Railway have ordered eleven and three units respectively. The New Orleans Public Service, Inc., has placed an order with the Twin Coach Corporation for one 42-passenger trackless trolley, to be equipped with 50-hp. motors. An order for eleven trackless trolleys has also been placed with the Twin Coach Corporation by the Utah Light & Traction Company, of Salt Lake City.

The American Car & Foundry Motors Company reports the delivery of two 29-passenger parlor coaches to the Southern Michigan Transportation Company, of Jackson, Mich., three 29-passenger full headroom parlor coaches to the Motor Transit Corporation, Chicago, Ill., and an order of five 27-passenger and three 21-passenger parlor coaches to the Baltimore Coach Company, all electric railway subsidiaries.

The Indianapolis & Southeastern Railroad, of Indianapolis, Ind., has purchased four 22-passenger parlor observation cars from the Studebaker Corporation. Other Studebaker sales reported include seven 21-passenger buses of the de luxe street car type to the Eastern Massachusetts Street Railway, Boston, Mass., two 21-passenger street car type buses to the Fitchburg & Leominster Street Railway, Fitchburg, Mass., and one 21-passenger street car type bus to the Austin Street Railway, Austin, Tex.

Mack-International Motor Truck Corporation reports the sale of eighteen model AB four cylinder chassis to the Rochester Railways Co-ordinated Bus Lines, Rochester, N. Y., four six-cylinder model BK chassis to the Rochester Interurban Bus Company, and one six-cylinder model BK chassis to the Syracuse Railways Co-ordinated Bus Lines, Syracuse, N. Y. The three companies are all affiliated with the New York State Railways. Two six-cylinder model BK buses have also been delivered to the Boston, Worcester & New York Street Railway, Framingham, Mass.

Recent deliveries of the General Motors Truck Company include twenty-five type

Z-29 city service buses to the Department of Street Railways, City of Detroit, ten type W city service coaches to the Illinois Power & Light Corporation, six for Quincy and four for Galesburg, and two type Z-39 coaches to Coast Cities Railways, of Asbury Park, N. J. London Street Railway, of London, Ontario, has received five type W city service buses. Fifth Avenue Coach Company, of New York City, has taken delivery of eleven yellow coaches—five of the type W observation type, five type W's and one Z-240.

In addition to an order of eighteen Mack buses recorded above the Rochester Railways Co-ordinated Bus Lines, Rochester, N. Y., has also received ten White model 54-A six-cylinder buses. Other deliveries by the White Company include three model 50-B buses to the Alabama Power Company, Birmingham, Ala., fourteen model 54 buses to United Electric Railways of Providence, and six model 54 buses to the Penn-Ohio System, Youngstown, Ohio.

New Gas-Electric Bus by St. Louis Car Company

Tests have recently been completed by the St. Louis Car Company on a new type of gas-electric bus on which its engineering staff has been working for more than two years. The new vehicle will seat 40 passengers.

The gas-electric power unit is located in the rear end. It consists of a six-cylinder gasoline engine direct connected to a d.c. generator. The power is used in four 30-hp. motors, one geared to each of the rear wheels.

The tests show that the bus will attain a maximum speed of 45 m.p.h. From a standstill it will accelerate to a speed of 20 m.p.h. in eleven seconds. Dynamic braking is used, being controlled by a pedal, the rate of braking depending on the distance the pedal is depressed.

The doors are interlocked with the control, so that the bus cannot move unless all doors are closed. They are opened by push-button control, with a treadle for the exit door at the center of the vehicle. The main control has a dead-man safety feature which unlocks the doors and sets the dynamic brakes and automatically reduces the speed to not more than 2.5 m.p.h. on a steep down grade.

The bus is low hung, the floor being 26 in. from the ground and the step 13 in. The wheelbase is 210 in. The over-all dimensions of the bus are: length, 31 ft. 4 in.; width, 8 ft., and height, 8 ft. 11 in.

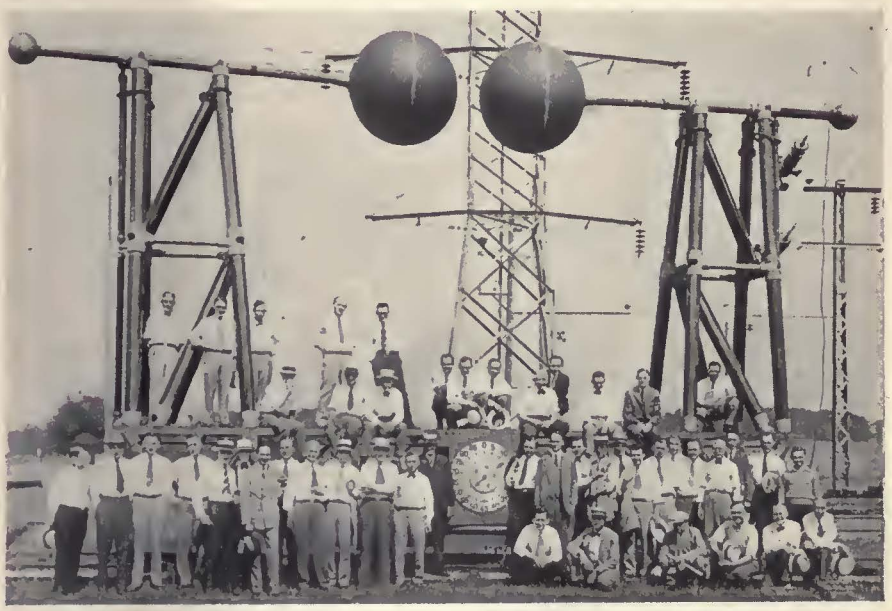
The bus was on display at the convention of the Electric Railway Association of Equipment Men, Southern Properties, being held at Lexington, Ky., on July 24-26. Following this it is planned to exhibit it at Louisville, Indianapolis and Terre Haute.

Brill Brings Out a Trolley Bus

A trolley bus, developed by the J. G. Brill Company, made its initial appearance at the recent convention of the Mid-West Electric Railway Association held in St. Louis. Through the use of aluminum alloy in body and fixtures the weight of the unit is kept down to approximately 14,500 lb. The side windows are fitted with single sash, with counterbalance spring. Circulating passenger load is accomplished by the provision of a rear exit door, pneumatically operated under control of the driver. Included in the equipment are four-wheel positive acting internal expanding air brakes, an emergency disk parking brake, pneumatic windshield wipers, cam and lever type steering mechanism designed expressly for balloon tires, two G. E. 35-hp. high speed motors, and PCM foot control. Seating capacity is provided for 30 passengers. Claims made for the new unit include economical power consumption, quick and smooth acceleration, noise reduction, flexibility in traffic and exceptional riding comfort.

Ohio Brass Entertains Electrification Engineers

Electrical engineers of many of the leading steam railroads that have electrified divisions or are contemplating electrification were the guests of the Ohio Brass Company at its Barberton plant on July 11 and 12. The two-day session was devoted to a study of problems of high-tension insulator design and catenary overhead construction, with special reference to insulation.



Steam railroad electrification men inspect high-tension laboratory of Ohio Brass Company at Barberton

The party inspected the insulator plant and saw the various manufacturing processes in the making of electrical porcelain. The indoor laboratory was then visited and a number of breakdown tests witnessed. The equipment includes a 750,000-volt transformer with a capacity of 750 kva. The transformer is excited by a special sine wave generator which is attached to the transformer case and is driven by a motor through an insulated shaft.

In the afternoon, tests were made at the outdoor laboratory, which is equipped with a set of similar generators that will deliver 3,000,000 volts at 25 or 60 cycles. Tests were made at normal frequency, as well as impulse tests using steep wave fronts, simulating lightning. Equipment for photographing the discharge in daylight was demonstrated.

In the evening and on Friday morning a discussion was held on means of obtaining reliability in catenary and transmission insulation. Various types of insulation were discussed and some were demonstrated at the evening session. Further tests in the indoor and outdoor laboratories were made on Friday afternoon.

Gear Inspection Standardized

The proposed American recommended practice "Inspection of Gears" has been completed by one of the sub-committees of the sectional committee on the standardization of gears. Copies of this proposed standard are now being widely distributed for criticism and comment. It is in tentative form for discussion, and criticisms should be mailed to C. B. LePage, assistant secretary American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.

This proposed practice covering the inspection of worms, hobs and cutters was developed by sub-committee No. 9, consisting of 31 men representing manufacturers, consumers and general interests, in conjunction with a committee of the American Gear Manufacturers' Association. As here presented, it is a composite of several sections on the subject as developed and approved as "Recommended Practice" of the A.G.M.A.

Bender Body Increases Capacity

Through additions to and rearrangement of the present plant the Bender Body Company, Cleveland, Ohio, plans a 30 per cent greater production of Bender bodies in the near future.

Work is already under way on a new building to serve for final assembly purposes. This structure is 163 ft. x 100 ft., of brick and steel with walls chiefly of glass, also monitor glass roof, assuring a maximum daylight.

A 150 ft. x 80 ft., addition to the eastern end of the present building will be used for the paint shop. It will contain the latest type spray booths and other modern developments.

Wagner Electric Corporation, St. Louis, Mo., announces the addition of W. H. Kretz to its transformer sales division. Mr. Kretz will travel the Southwest. He was formerly with the Public Service Company of Oklahoma and more recently has been Texas district representative for the Jeffry De Witt Insulator Company.

New Cars of Montreal Tramways

Details of 106 new cars recently completed for the Montreal Tramways, Montreal, Canada, by the Canadian Car & Foundry Company, announcement of which was made in the July issue of ELECTRIC RAILWAY JOURNAL, are now available. The order consisted of 60 single-end two-man cars, seating 42 passengers; 40 single-end one-man cars, seating 40 passengers, and six double-end one-man cars seating 40 passengers, all provided with P.A.Y.E. features and all designed for city service.

The 60 two-man cars have an over-all length of 46 ft. 2 in., with bolster centers spaced 22 ft. 7 in., and length over the body posts of 31 ft. 4 in. The weight of the car body is 16,000 lb., trucks, 10,000 lb., and equipment, 9,900 lb. The 40 one-man cars and the six double-end cars have somewhat smaller dimensions, being 41 ft. 2 in. in length over all, with a length of body of 26 ft. 4 in., and with bolster centers spaced 17 ft. 7 in. The double-end cars are slightly heavier, with a total weight of 38,100 lb., as compared with 35,250 lb. for the 40-seat single-end cars. All three are of semi-steel construction with arch roofs. All have an over-all width of 8 ft. 5 in., and height, rail to trolley base, of 11 ft., and are provided with trucks with 5-ft. 4-in. wheelbase. Detailed equipment specifications, which are substantially the same for all three types, are as follows:

Air brakes	Canadian Westinghouse Company, straight air with full safety features
Armature bearings	Plain, bronze
Axles	A.E.R.E.A. E-2, with 3½x7 in. journals
Car signal system	Faraday, 600 volt
Compressors	Canadian Westinghouse Company, D.H. 16
Conduit	Standard metal
Control	K-35 XB and Westinghouse Company type 806-J line switch
Couplers	Montreal Tramways, standard cast steel
Curtain fixtures	National Lock Washer Company
Curtain material	Pantasote
Destination signs	Keystone & M. T. Co.
Door mechanism	National Pneumatic Company
Doors	Folding
Fare boxes	Cleveland Fare Box Company
Finish	Enamel
Floor covering	Wood slats, with Kass safety treads
Gears and pinions	Nuttall, grade B. P.
Glass	Plate, 21 oz., double thick
Hand brakes	Peacock staffless
Hand holds	Rigid wood rail on aluminum brackets
Heat insulating material	Three-ply Salamander
Heaters	Canadian General Electric Company, Calrod with Railway Utility thermostatic control
Headlining	⅛ in. Agasote
Interior trim	Cherry
Journal bearings	Plain bronze, babbitt lined
Journal boxes	Cast iron, Montreal Tramways, standard
Lamp fixtures	Electric Service Supplies, compensating safety dome fixture
Motors	Four Westinghouse 510-A2, inside hung
Painting scheme	M. T. Co. standard green and cream
Roof type	Arch
Roof material	Wood and canvas
Safety car devices	Door and power interlock dead man handle
Sash fixtures	Robt. Mitchell Co. Montreal
Seats	Ottawa Car Mfg. Company and Canadian Car & Foundry Company
Seat spacing	30 in.
Seating material	Rattan
Slack adjusters	American Brake Company, Type E
Steps	Irving Subway Company, folding
Step treads	"Saf-Kar"
Trolley catchers	Keystone
Trolley base	U. S. 20-A
Trolley wheels	Canadian Ideal Company
Trucks	Canadian Car & Foundry Company, F-790
Ventilators	Railway Utility Company
Wheels	Cast iron, 26 in. diameter
Wheelguards or fenders	H.B.

Montreal Tramways has also placed an order for 25 two-car trains, each unit of which will be almost identical in construction with the standard single-end two-man cars described above, with the exception of the additional reinforcing made necessary to support the couplers. Full details of these cars are not available at this time, as motor equipments have not been determined.

Copperweld Steel Company, Glassport, Pa., announces the establishment of a northeastern district under the management of George F. Bain. The northeastern district includes all of the New England states and all of New York State north of Westchester and Rockland Counties. Mr. Bain's headquarters will be at 30 Church Street, New York City. Paul Van Wagner is now district manager for Greater New York City and for New Jersey, Pennsylvania and West Virginia.

F. L. Markham Advanced by Brill Company

F. L. Markham, identified with the Brill organization for 25 years, has been appointed sales manager of the American Car Company, St. Louis. In this capacity he succeeds the late Wirt L. Haymond. Mr. Markham started his career as a car salesman on July 15, 1904. On that date he joined the sales force of The J. G. Brill Company and was assigned to the Southern territory,

F. L. Markham

comprising nine states. Later he organized the Railway Supply & Equipment Company, with headquarters in Atlanta, Ga., which organization handled the sale of Brill cars, trucks, seats, etc., until September, 1918, when Mr. Markham joined the sales department of the American Car Company, the Brill associate plant in St. Louis. His recent appointment, therefore, is the culmination of eleven years of active service with the sales force of the American Car Company, of which he now becomes sales manager.

Johns-Manville Corporation, New York, has issued a 24-page illustrated circular entitled "Celite for Concrete." Celite, a product recently added to the company's line, is a specially prepared grade of diatomaceous silica which is said to improve the workability of concrete mixture, and at the same time to afford a maximum of water-tightness.

Lincoln Electric Company, Cleveland, Ohio, manufacturers of motors and arc welders, announces the appointment of B. W. Brown as district sales representative with headquarters at Milwaukee, Wis. G. O. Forseth, formerly sales representative at Detroit, has been promoted to sales representative at Minneapolis.

L. G. Avery, manager of the sales promotion department of the White Company since 1926, has been promoted to the managership of the Detroit district. Walter A. Maynard, White Company transportation engineer, has been appointed sales promotion manager. Mr. Avery goes to Detroit with seventeen years experience in automotive merchandising. Mr. Maynard has covered the country in the study of bus transportation and as manager of vocational sales promotion. He joined White in 1923. In the development of vocational sales he has become an authority on bus transportation and on warehousing and distributing operations.

ELECTRIC RAILWAY MATERIAL PRICES—JULY, 1929

Metals—New York

Copper, electrolytic, delivered, cents per lb.	18.
Lead, cents per lb.	6.75
Nickel, cents per lb., ingot	35.
Zinc, cents per lb.	7.15
Tin, Straits, cents per lb.	47 375
Aluminum, 98 to 99 per cent, cents per lb.	24.30
Babbitt metal, warehouse, cents per lb.:	
Commercial grade	62 00
General service	45.00

Bituminous Coal

Smokeless Mine Run, f.o.b. vessel, Hampton Roads, gross tons	$4 17
Somerset mine run, f.o.b. mines, net ton	1 82
Pittsburgh mine run, Pittsburgh, net ton	1 00
Franklin, Ill., screenings, Chicago	1 75
Central, Ill., screenings, Chicago	1 25
Kansas crushed mine run, Kansas City	2.50

Track Materials—Pittsburgh

Standard steel rails, gross ton	$43.00
Railroad spikes, drive, ⅝ in. and larger, cents per lb.	2.80
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 95
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 60
Galvanized barbed wire, cents per lb.	3 35
Galvanized wire, ordinary, cents per lb.	3 15

Waste—New York

Waste, wool, cents per lb.	13.
Waste, cotton (100 lb. bale), cents per lb.:	
White	12.5
Colored	9.5

Paints, Putty and Glass—New York

Linseed oil (5 bbl. lots), cents per lb.	12.9
White lead in oil (100 lb. keg), cents per lb.	13.2
Turpentine (bbl. lots), per gal.	$0.57
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 1, per thousand	$150
Wood block paving 3½, 16 lb. treatment, N. Y., per sq.yd., f.o.b.	2.70
Paving brick 3½x8½x4, N. Y., per 1,000 in carload lots, f.o.b.	51.00
Paving brick 3x8½x4, N. Y., per 1,000 in carload lots, f.o.b.	45.00
Crushed stone, ¾-in., carload lots, N. Y., per cu.yd., delivered	3.25
Cement, Chicago consumers' net prices, without bags, f.o.b.	2.05
Gravel, ¾-in., cu.yd., delivered	3.25
Sand, cu.yd., delivered	2.00

Old Metals—New York and Chicago

Heavy copper, cents per lb	14.375
Light copper, cents per lb.	12.375
Heavy yellow brass, cents per lb.	8.125
Zinc, old scrap, cents per lb.	3 15
Lead, cents per lb. (heavy)	4 75
Steel car axles, Chicago, net ton	$16 75
Cast iron car wheels, Chicago, gross ton	14.25
Rails (short), Chicago, gross ton	18.25
Rails (relaying), Chicago, gross ton (65 lb. and heavier)	28.50
Machine turnings, Chicago, gross ton	7.75

summer vacation land .....

It is a country of almost boundless natural resources.
It is a country of immense industrial possibilities, the development of which is proceeding apace.

Canada's leading cities combine great historic interest with a thoroughly modern and progressive spirit of development. Their transportation systems are modernized—both in equipment and maintenance practice.

Thermit-welding has as firmly established itself on most of the electric railways in Canada, as on the leading systems in the States.

Thermit-Welding Of Rails is Found In These Well-Known Canadian Cities

MONTREAL — WINDSOR — WINNIPEG
NIAGARA FALLS — ST. CATHARINE'S
EDMONTON

And also the year 1929 sees initial Thermit installations in Toronto, Saskatoon and Guelph.

***Thermit-welding is accepted*, for its permanence, for its freedom from maintenance requirements, and for the quiet smooth-riding qualities which it gives to the track.**

In Winnipeg, the wheat center of Canada, the Winnipeg Electric Company uses Thermit-Welding extensively, to secure freedom from future maintenance problems.

CORPORATION

NEW YORK, N.Y. SOUTH SAN FRANCISCO TORONTO

LOWER MAINTE

The Cities Service Grease Gun

Weighs 185 pounds.

Holds 85 pounds of grease.

Mounted on 4-wheel truck.

Operated by air, using 3 cubic feet of air per minute in continual operation.

Portable, with an operating radius of a 100 foot circle.

Designed to operate on the air supply generally found in bus shops.

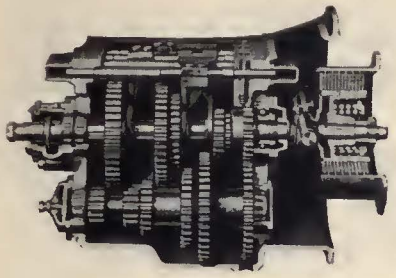
Gun is entirely automatic with opening and closing of control valve. Stops when grease is not actually flowing.

On 150 pounds of air, it is capable of delivering grease under 5000 pounds' pressure at the nozzle.

Delivers 2 pounds of free grease per minute.

Handles the heaviest types of grease.

Is extremely simple and capable of continual use without repairs.



Cities Service Company understands the problems of bus owners because it has had bus problems of its own. Several of its subsidiaries are transportation companies, operating fleets of buses. Cities Service brought its 67 years of experience in the oil business to the solution of their lubrication problems—and it offers you the benefit of this experience.

NANCE

COSTS

. . . for chassis, transmission and differential . . .

Buses receive as much shock and as many chassis strains in a year as the average passenger car experiences in its whole existence. Most of this is unavoidable but the extra strain and shock due to faulty lubrication costs bus owners millions of dollars yearly.

To take proper care of universal joints, shackles, etc., and to cope with the heat condition of wheel bearings, Cities Service developed Koolmotor Universal Grease,—made from high grade heavy cylinder stock—a superior grease which prevents metal to metal contact and stays in wheel bearings without leaking or allowing free oil to run.

Koolmotor Universal Grease is made in medium, heavy, and extra heavy bodies to meet all requirements. It is the correct complete chassis lubrication. Used with the Cities Service Grease Gun it is easy to apply.

Oil Division

CITIES SERVICE COMPANY

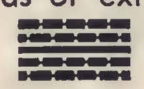
60 WALL STREET, NEW YORK CITY

KOOLMOTOR PRODUCTS

FUNDAMENTAL SUPERIORITIES

THAT ONLY . . THE WORLD'S LARGEST . . . PRODUCER . . OF RUBBER . . CAN BUILD . . INTO A . . . . .

HEAVY SERVICE TIRE

Trucks and buses all over America  are daily demonstrating the fundamental superiorities of U. S. Heavy Service Tires. Purer, tougher virgin rubber from our own plantations,  unimpaired by repeated workings and chemical processes, is the basis of these superiorities. Exclusive technical processes,  which we developed ourselves, put thousands of extra miles into the heavily reinforced side walls and the thicker, tougher treads  of these massive tires.

U.S. ROYAL

HEAVY SERVICE FOR TRUCKS AND BUSES

UNITED STATES RUBBER COMPANY

BACKGROUND

WHY should not men have flown years and years ago?

What made the telegraph, the telephone, the electric light and the automobile and radio such laggards?

The lack of associated experiences and an undeveloped belief of necessity in the human mind!

So in the motor coach field it is not just RAW horsepower you are seeking; not the mere revamping of what has been custom.

Look for Background!

PROBABLE CAUSE OF

FRANK R. FAGEOL

Who has sponsored most of the universally conceded advances in motor coach art since its inception.

WILLIAM B. FAGEOL

Whose work in building chassis and body integral reduced coach weight and revolutionized design.

PAUL H. BREHM

His background in the field maintenance of thousands of motor coaches produced Twin Coach simplicity of upkeep.

Twin Coach LEADERSHIP

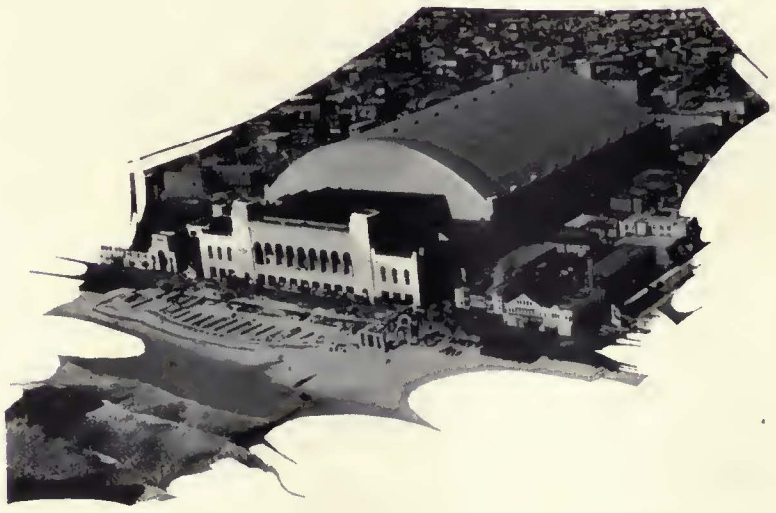
"Skipper, those fellows are showing this industry how to handle mass transportation—without rails"—*the prediction of more than one motor coach operator.*

Twin Coach
BY F. R. FAGEOL KENT, OHIO

FOREGROUND

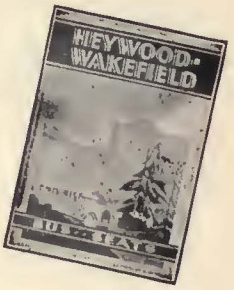
WHEN bus operation is more seriously countenanced by the members of the A. E. R. A. and its maintenance given the same concentration of thought as trolley car maintenance, the present scope of coach operation will dwarf into insignificance compared to that of the future.

Already there is a *changing mentality* in the ranks of the urban operators. You will hear echoes of it at Atlantic City this fall.



A Seat That Will Stand Abuse!

Here is an ideal seat for your bus equipment. It is a high back, all leather chair, with a selecied hardwood frame accurately joined and reinforced at all vital points by malleable iron braces. The 55 P Special will stand the hard usage which every bus chair is bound to receive, yet it is extraordinarily comfortable. It has spring-filled cushions over our deep, built-up spring construction and individual, spring-filled backs. The 55 P Special is mounted on double-clawed, malleable iron legs equipped with heavy rubber shock absorbers. Ask the nearest H-W sales office about this and many more of our modern, practical bus and railway seats.



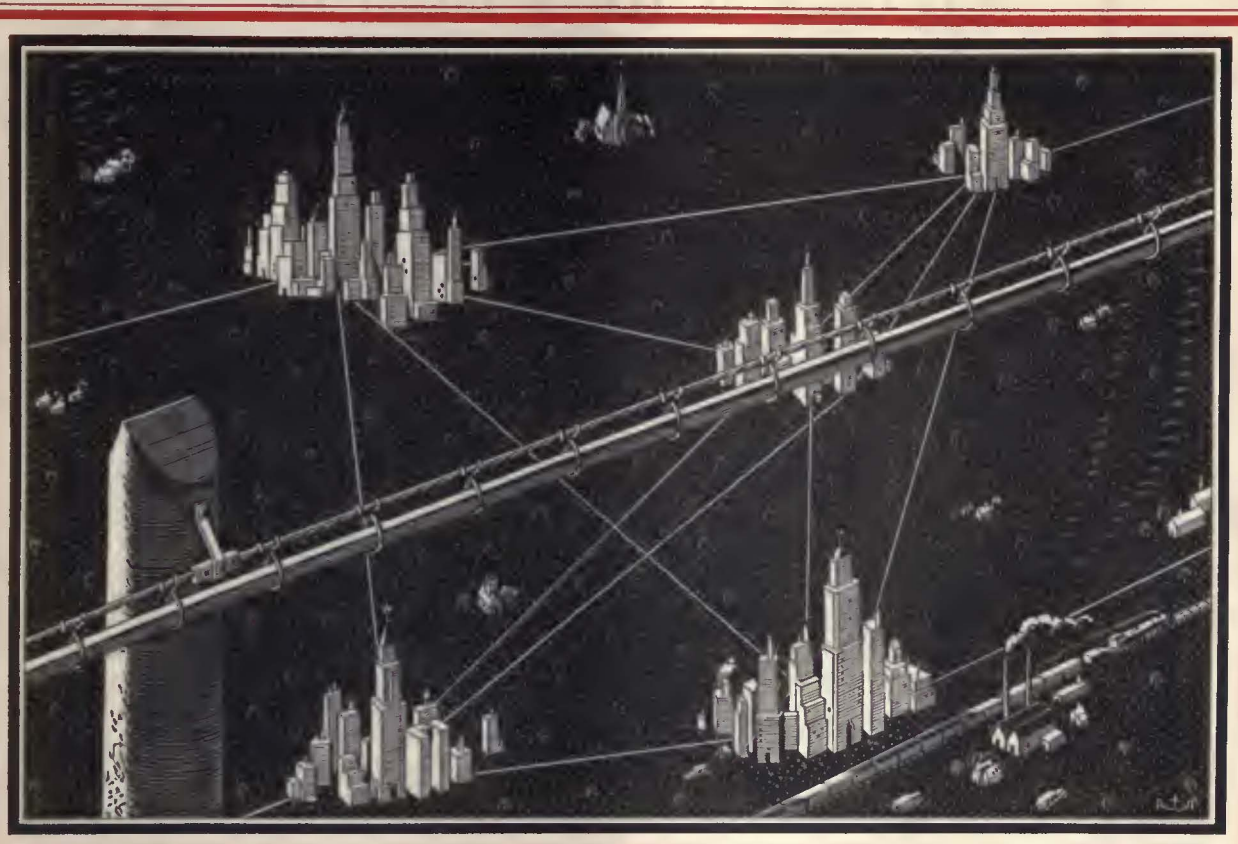
If you have not received a copy of our new Bus Seat Catalogue, write for it.

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

How Easy it is to Telephone between Cities



WHETHER it is a call to the next block or to another city, the telephone instrument on your desk is always ready. And it is easy to use. On calls to nearby cities, the operator will usually get the wanted telephone while you hold the line.

The simple act of using the telephone is often more effective than a trip in person. The representative of a Richmond grain company traveled 100 miles several times to call personally on a buyer without success. Then he called him by telephone—and sold him a carload of wheat. Cost of the call, 70c.

An Atlanta commission house started 10 carloads of potatoes across from Memphis. While the cars were rolling, 9 of them were sold by telephone in towns along the way. The last car was sold by telephone in Atlanta. Sales, $10,000. Cost of calls, $5.45.

The telephone habit is good for business men in every line. It is so convenient. What calls could you profitably make to other cities now?

Calling by number takes less time. Bell Telephone Service is *Convenient . . . . . Economical . . . . . Universal.*

BELL SYSTEM
AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES

The Electric Railway is an outlet of the power, machinery, car building, and other industries. It works for all of them. But its greatest service is to the riding public. Likewise where advertising promotes many interests, its chief function is its service to the consuming public. To long survive, any business must convey its benefits to the ultimate consumer.

BARRON G. COLLIER INC.

NEW · YORK · CITY

want, the patronage low cost you need— *profitable operation*

HUNDREDS of operators have found a way to insure themselves of profitable motor coach operation . . . . . They are putting Dodge Motor Coaches to work with the definite assurance that with these modern coaches they are able to decrease headway, gain patronage and obtain more revenue.

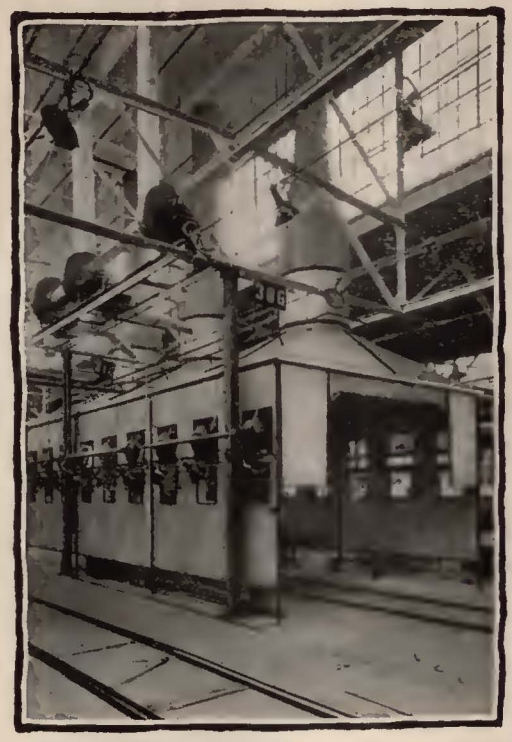
The practical size of Dodge Coaches—21-passenger capacity in the Street Car Coach and 16-passenger capacity in the Parlor Coach—plus their speed, acceleration and dependability, permit of greater frequency of service. Their comfort, safety and fine appearance attract and hold patronage. Their economy, in both operation and maintenance, results in low cost per mile, per trip or per passenger.

It will pay you to investigate Dodge Motor Coaches . . . . . Your investment will be a wise one—no matter what route you put them on.

BROTHERS COACHES

DODGE BROTHERS DEALERS EVERYWHERE

Simplify *your* Maintenance Problem *with* These Facilities



Spray painting equipment in railroad paint shops offers a definite solution for one of the greatest time consuming maintenance operations. ¶With proper facilities and the use of Duco, or similar fast drying finishes, painting costs on street cars and motor buses can be reduced 50% . . . and spray painting gives you a finer finish with much longer life. ¶Mahon engineers will cooperate in the arrangement of paint shops and the design of Spray Booths best fitted to individual requirements and existing conditions. These Spray Booth specialists, backed by years of experience involving hundreds of Spray Booth installations throughout the United States and Canada, are available to you, and will gladly make detailed recommendations. Do not hesitate to call on them . . . consultation with this staff of highly specialized Spray Booth experts places you under no obligation. Write today.

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 •

SALT LAKE CITY knows!

VERSARE ELECTRIC COACHES
PREDOMINATE
in the order just placed by
SALT LAKE CITY
for additional equipment

VERSARES ARE

—performance proves Versare superiority

VERSARE engineers no longer grope for facts. Versare purchasers are not asked to make their property a laboratory of experimentation.

The Versare Electric Coach ceased to be an experiment hundreds of thousands of miles ago.

Ask Salt Lake City—ask the Utah Light and Traction Company—they know!

Versare Electric Coaches in Salt Lake City have gone a total of over 250,000 miles, have carried more than 1,500,000 people in 9 months' time.

CHOSEN AGAIN

Here are the facts—

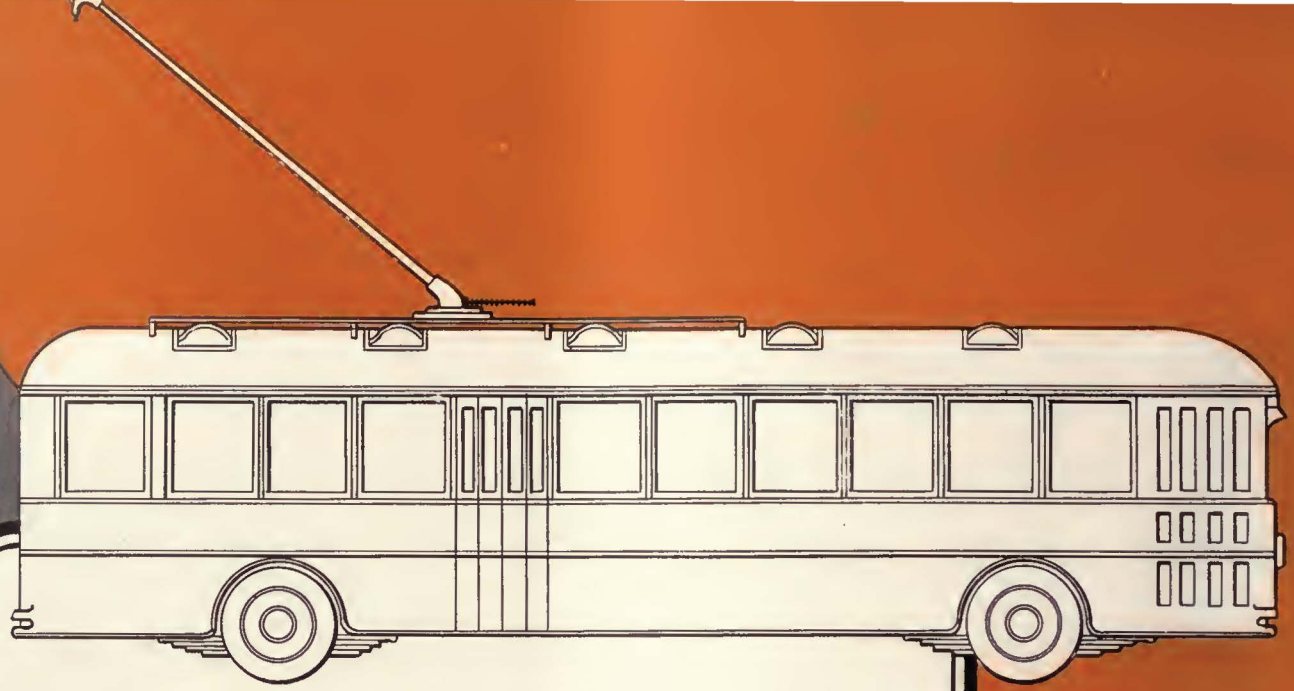
Weather conditions in Salt Lake City are not ideal. Winters are severe, snow storms frequent; summers are hot, with tourist traffic jamming the streets.

And Versare Electric Coaches showed an operating ratio of 62.9!

Compare that figure with your own.

We've got the facts,—and more than that—the experience. Our recommendations are authoritative and unbiased—for we make street cars, motor coaches, and electric coaches.

Let Versare performance speak for itself.

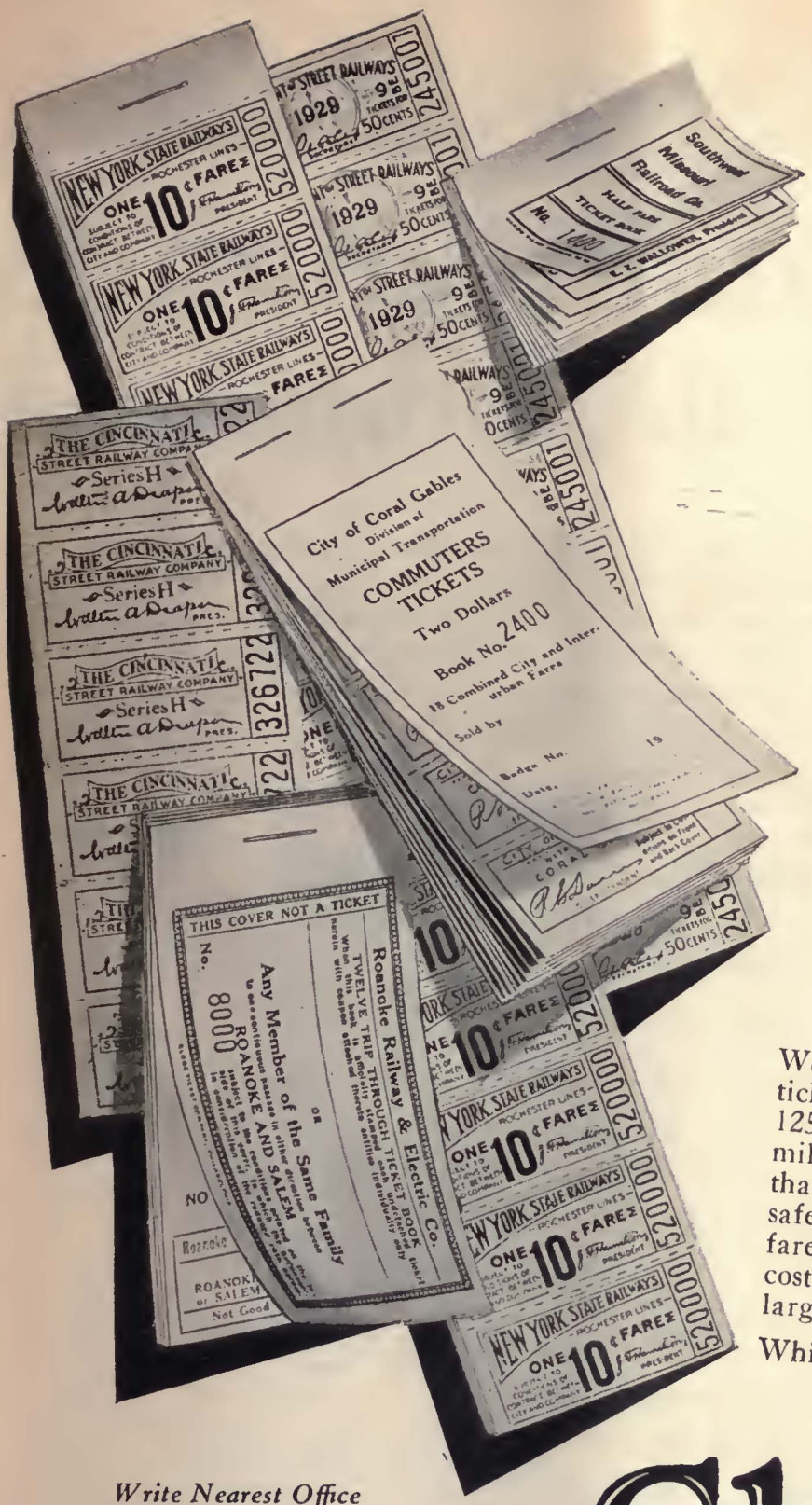


DETAILS

COMPLETE details of construction of the new Versare Electric Coaches for Salt Lake City will be announced next month. These new coaches will embody several desirable changes—many improvements, which will be of interest to every Electric Railway Executive.

There is no longer any reason for experimentation, no longer any reason for large operating ratios. Versare recommendations are based on practice, not hopes, Versare Coaches are built to do a definite job, they have more than demonstrated their ability to create economy—to build business.

THE CINCINNATI CAR CORPORATION
Winton Place
Cincinnati, Ohio



BOOKS PADS STRIPS

INCREASED Revenue possibilities of tickets in books, pads and strips are:

1. Attractive price to the public, yet *limited riding privileges;*
2. Faster collection and less change making;
3. Guarantee a definite number of rides which the auto will not get;
4. Secure money in advance;
5. Spent more readily than money;
6. Salable advertising space on covers and backs.

We recommend the 25/32 ticket size. It saves stock and 125 lbs. shipping weight per million, makes a small book that fits the pocket or handbag safely, does not fill up small fare boxes on long runs, and costs less per thousand in large lots.

Which style shall we send?

Write Nearest Office

Offices:	*Factories:*
Syracuse	Philadelphia
Baltimore	Los Angeles
Cincinnati	Boston
Cleveland	New York
Pittsburgh	Jacksonville
Springfield, Mass.	

Globe
TICKET COMPANY

112 North Twelfth Street
PHILADELPHIA

In WISCONSIN, *too,* their maintenance *this improved*

THE Northern States Power Company, operating throughout the western part of northern Wisconsin, has made extensive and profitable use of Carey Elastite System of Track Insulation. The photographs show how this advanced system was used at Eau Claire, in the Badger State, in connection with a standard 85-pound A.S.C.E. T-Rail and a roadway of concrete . . .

Showing the application of Carey Elastite System of Track Insulation on the Northern States Power Company's lines through Eau Claire, Wisconsin.

THE PHILIP CAREY

they lowered cost by using *traction development*

The completed installation—Carey Elastite System of Track Insulation, used in connection with a standard 85-pound A.S.C.E. T-Rail and a roadway of concrete.

Carey Elastite System of Track Insulation

is a resilient, durable, asphalt-and-fibre cushion. The asphalt has an extra-high melting point; yet, because it is blended according to a special Carey formula, it cannot become brittle even at sub-zero temperatures. It bonds firmly to the rail and to the pavement. It absorbs rail vibration and reduces excessive track noise. Invariably its use insures faster schedules, higher standards of service and lower maintenance cost.

If you are planning any development or track reconstruction work, it will be to your advantage to know Carey Elastite System of Track Insulation. Our representative will gladly call and supply you with the facts.

Carey Elastite

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

SYSTEM OF
TRACK INSULATION

COMPANY, *Lockland,* CINCINNATI, OHIO

◆◆ BEHIND THE PYRAMIDS—8 ◆◆

Small brushes are formed before the final furnace treatment

Presses for individual moulding of small brushes

SMALL brushes, such as those used on fractional horse-power motors and for automotive equipment, can be moulded to size direct from the powdered mix of carbon and pitch. Mechanical presses are used. Some of them operate much like the pill presses used by drug manufacturers.

The small brushes moulded in this way are quite accurate in size and shape, requiring little subsequent work to make them accurate to dimensions.

As these brushes come from the presses, however, they do not have the required electrical and mechanical characteristics. A long baking process followed by many mechanical operations is still necessary.

Because National Carbon Brushes are made with such scrupulous exactness they make your electrical machines more efficient—more powerful—steadier to run. These brushes allow your machines to operate for years without attention. We take pride in the fact that leading manufacturers of small motors use National Pyramid Brushes as standard equipment.

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.

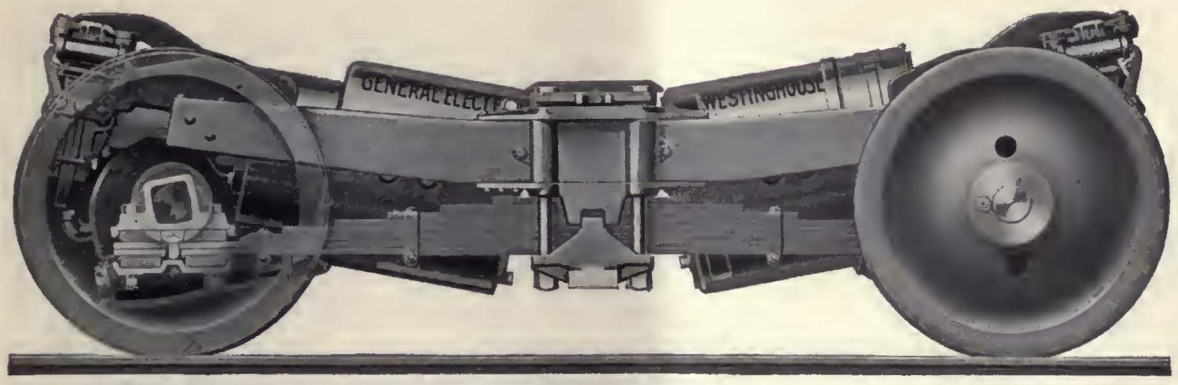
NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

Carbon Sales Division — SILVER STRAND CABLE TRADE MARK REGISTERED — Cleveland, Ohio

Branch Offices and Factories

New York Pittsburgh Chicago Birmingham San Francisco



Ring up more fares, cut operating costs—with quieter, smoother performance, less weight, longer equipment life, lower maintenance costs; with Timken Worm Drive Trucks for electric railway cars

Timken

WORM DRIVE TRUCKS for ELECTRIC RAILWAY CARS

THE TIMKEN-DETROIT AXLE COMPANY, DETROIT, MICHIGAN

OIL

FOR TROUBLED OPERATORS—

HOT boxes, worn gears, bumping springs, excessive wear and tear. All are the results of improper lubrication.

TULC

lubricants are specially compounded to meet street railway needs. The continuous use of TULC will give unexcelled lubricating results—produce longer life of bearings—show a saving in power consumption, etc.

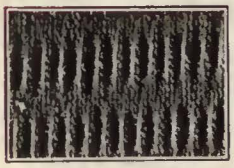
Make a test of TULC

THE UNIVERSAL LUBRICATING COMPANY
CLEVELAND, OHIO

mileage

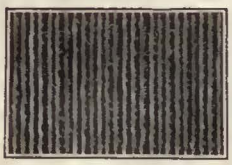
Free Rolling *means* Easy Riding

How FISK Motor Coach Balloons add to the safety and comfort of your passengers and increase your profits



Ordinary Cord

Cross-section of ordinary cord, showing how the cross-threads in the fabric cause an uneven deposit of rubber, and produce extra chafing and overheating whenever the carcass is flexed.



Fisk *All-Cord*

Cross-section of Fisk *All-Cord*, showing how the tough cords, free from cross-strings, are completely surrounded by live rubber. This revolutionary process prevents friction and overheating — explains Fisk's proved ability to deliver excess mileage.

Time to Re-tire
Get a FISK

TRADE MARK REG.
U. S. PAT. OFF.

All-Cord construction, perfected by Fisk, keeps Fisk Tires free from internal friction. This better process does away with cross-strings in the tire carcass—prevents unnecessary chafing and wear every time the tire flexes.

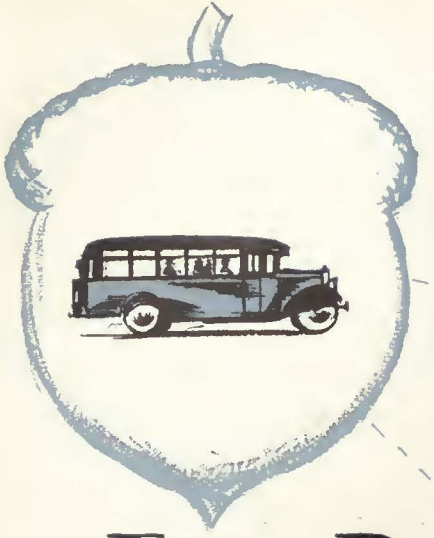
As a result, Fisk Tires roll easier than tires built the ordinary way. They yield without resistance to every road condition, giving maximum comfort and safety over any kind of going.

And because Fisk's *All-Cord* process prevents overheating, these sturdy tires deliver the kind of *mileage* that helps you pile up profits. If you want to carry the greatest number of passengers at the lowest cost per mile, equip your fleet with Fisk All-Cords.

FISK

Big sky scrapers grow on small sites

Great buildings rise on small parcels of land and yield big revenues . . . Likewise big returns on motor coach operation are often made as the result of a small investment . . . What follows is the story of what happened in a live city of 20-mile area.



a small exper
a profitable

Erie, Pa. proved this with YELLOW COACHES

A clear case of where the tail wagged the dog.

Erie, Pa. possessed the usual type of street railway, typical of a city of 140,000 inhabitants.

Faced with the necessity of establishing additional lines demanded by the public, and desirous of keeping out competition, the Erie Coach Company was organized as a subsidiary to the railway, and four Z-29 passenger Yellow Coaches were placed in service over one route in December, 1925.

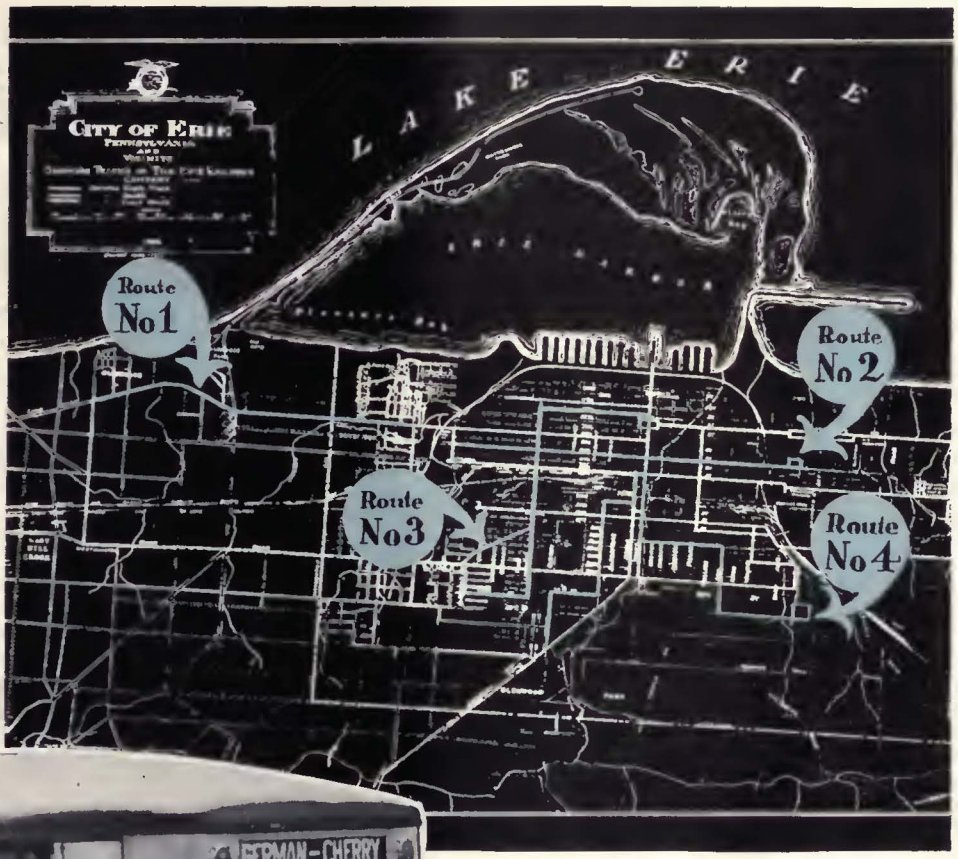
What was in reality an experiment and an effort to forestall competition grew rapidly into a profitable operation. More routes were selected for motor coach service and additional coaches added by a steady stream of re-orders as expansion of motor coach service was pushed rapidly to keep pace with the acceptance of the riding public toward this convenient form of transportation. It was not long before four new routes were established—all served with Yellow Coaches—22 in all.

How quickly a small experiment turned into a worthwhile major operation may be seen from the record of successive orders.

4 Z-29 passenger coaches in June, 1925
2 X-21 passenger coaches in June, 1926
1 X-21 passenger coach in August, 1927
1 X-21 passenger coach in October, 1927
1 X-21 passenger coach in April, 1928
2 X-21 passenger coaches in May, 1928
4 X-21 passenger coaches in July, 1928
2 W-21 passenger coaches in November, 1928
2 W-21 passenger coaches in March, 1929
2 W-21 passenger coaches in April, 1929
1 W-21 passenger coach in June, 1929

Results, gauged by revenues, make the company feel that they can profitably continue to extend their motor coach operations—all of which are within the City of Erie.

ment can grow into major operation.....



Give the public what it wants *and it will ride.*

The fact that the people of Erie rode Yellow Coaches turned an experiment into rapidly-growing and profitable operation.

1,048,000 passengers were carried last year, with revenue dropping off but very little during the summer months. The Yellow Coach fleet piled up a total of 484,000 revenue miles at an operating cost that earned a satisfactory return on the investment involved.

Erie experimented. The public responded. Results exceeded expectations.

Erie is only one of a great many progressive electric railway companies that began bus operation by first experimenting with Yellow Coaches in a small way on some unprofitable route or on some new route into previously unserved territory. The public responds. Revenue climbs. Results usually exceed expectations. Then follow in rapid succession more routes and more Yellow Coaches.

This explains why 80% of Yellow Coach sales are repeat sales. The successful experience, individually and collectively, of Yellow Coach operators naturally influences their choice of equipment. There is no other way of explaining the fact that *"80% of Yellow Coach sales are repeat sales."*

GENERAL MOTORS TRUCK COMPANY, PONTIAC, MICH.

Interurban Lines—

gain a new protection and service with National Fare Registers

The interurban operator today finds in National Fare Registers a new and better method of collecting fares, an assurance that all money collected is turned in and a decided operating economy. Interurban lines which have installed these machines have profited both from the protection and quick service which they provide and from the detailed information which is made available for the auditing department.

Typical expressions from users of National Fare Registers

We made a thorough investigation of up to date fare systems before adopting National Fare Registers. We are very well satisfied with the performance of the machines.

Cincinnati, Hamilton & Dayton Railway Co.

The records furnished by both the ticket office and car registers have materially aided our auditing department in checking fares and collections.

Chicago & Joliet Electric Ry. Co.

The same results which prompted these expressions of satisfaction are available to any interurban line. Our representative in your city will be glad to demonstrate the machine and to show in detail what it has accomplished for others and what it can do on your cars and in terminal stations.

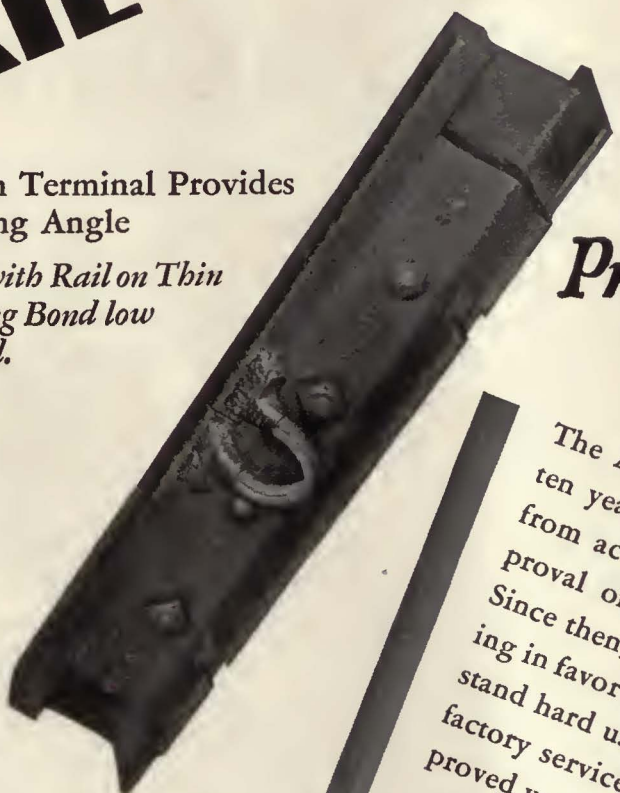
THE NATIONAL FARE REGISTER

Product of The National Cash Register Company
Dayton, Ohio

TYPE AB2 ARC WELD RAIL BONDS

New Design Terminal Provides Easy Welding Angle

—Contacts with Rail on Thin line—placing Bond low on Rail head.



EXPERIENCE *and* Quality *Produce Outstanding Performance*

The Arc weld bond was introduced ten years ago. Its design, developed from actual experience, won the approval of many traction companies. Since then, it has been steadily growing in favor because it is built to withstand hard usage and give long satisfactory service. Arc weld bonds have proved you can rely on them.

AMERICAN STEEL & WIRE COMPANY

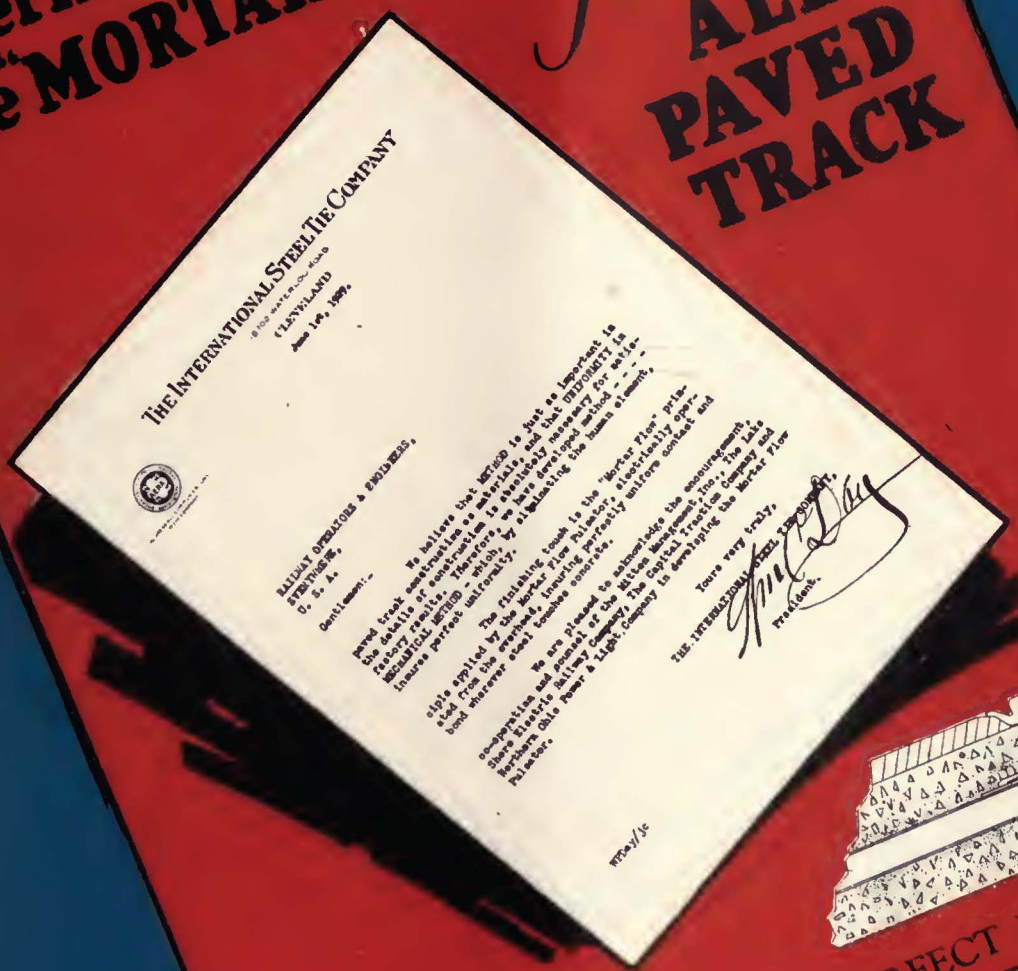
Subsidiary of United States Steel Corporation

208 S. La Salle Street, Chicago 30 Church Street, New York

Other Sales Offices: Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City Minneapolis-St. Paul Oklahoma City Birmingham Atlanta Memphis Dallas Denver Salt Lake City U. S. Steel Products Company: San Francisco, Los Angeles, Portland, Seattle *Export Distributors:* United States Steel Products Co., 30 Church St., New York

International Recommends the "MORTAR-FLOW" Principle for ALL PAVED TRACK

In the June issue of Electric Railway Journal we announced and recommended the "Mortar-Flow" principle.



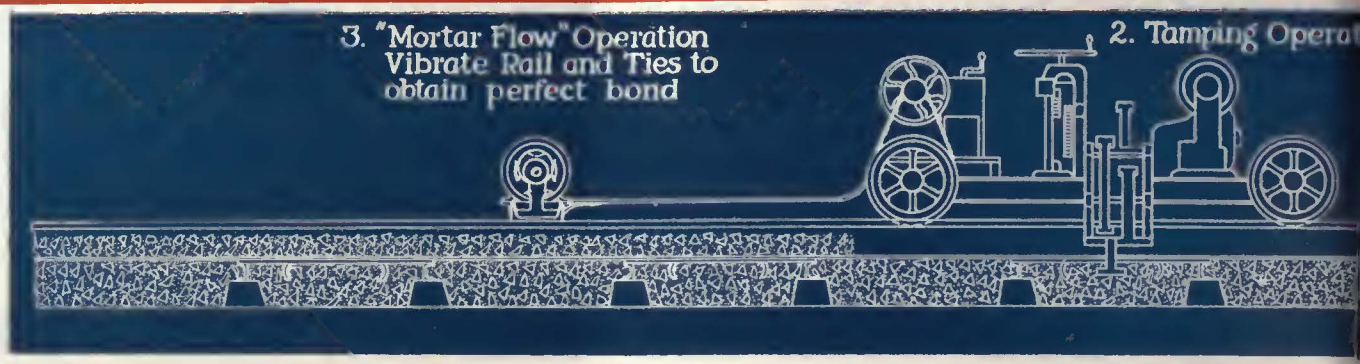
PERFECT CONTACT—PERFECT BOND
Wherever Steel Touches Concrete

(turn the page)

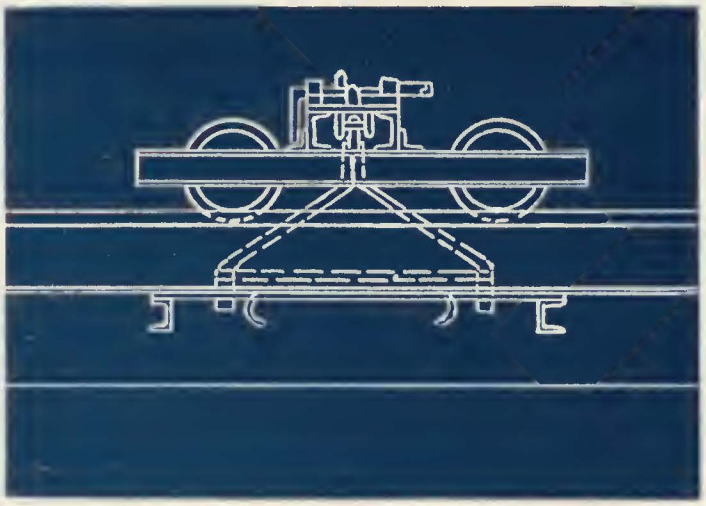
and now~ two months later

AKRON~DETROIT~WASHINGTON~BUFFALO~ TOLEDO~SANDUSKY~PHILADELPHIA~ BEAVER FALLS~AND CINCINNATI ~ ~ ~ recommend the "Mortar Flow" Principle for Paved Track Construction

PERFECT CONTACT~PERFECT



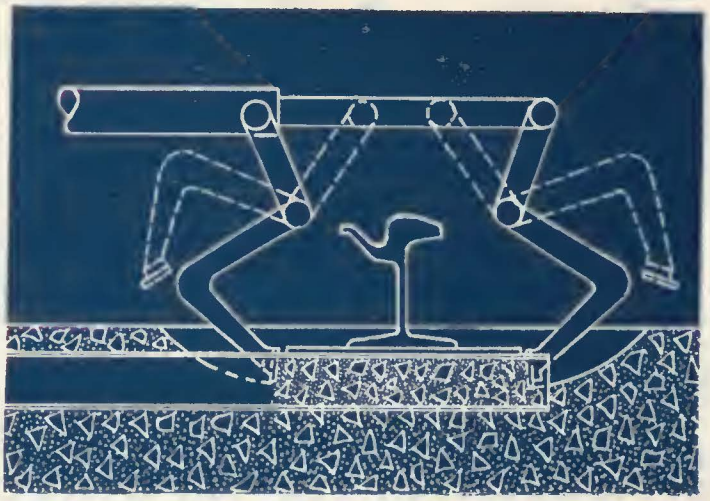
UNIFORMITY STARTS AT ASSEMBLY



UNIFORM CLIP FIT AND GAUGE

TO INSURE uniform track, all *parts* must be uniform and assembly must go smoothly. Steel twin ties are uniform. The D.S.R. Track Layer lifts steel twin ties to the rail base, requiring only *one* man. Assembly goes on smoothly, easily. Uniform results demand uniform methods.

TAMPING MUST BE POSITIVE

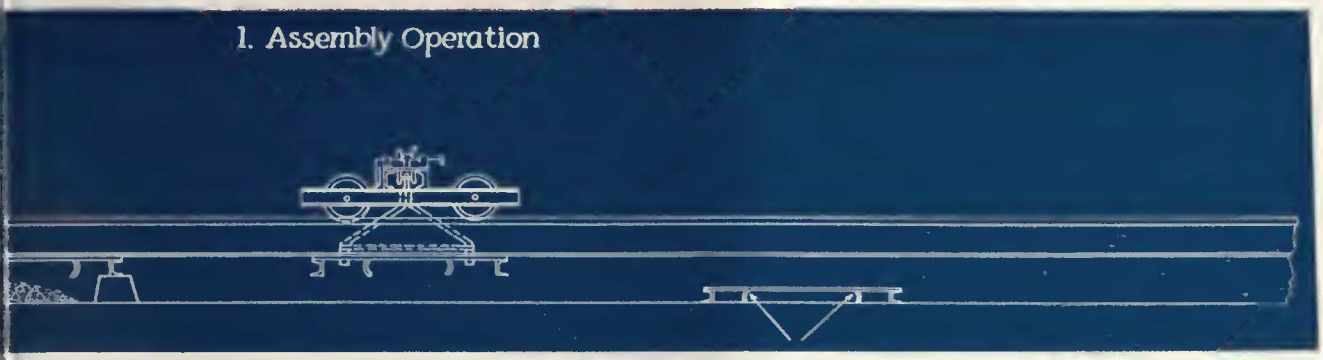


UNIFORM COMPRESSION TAMPING

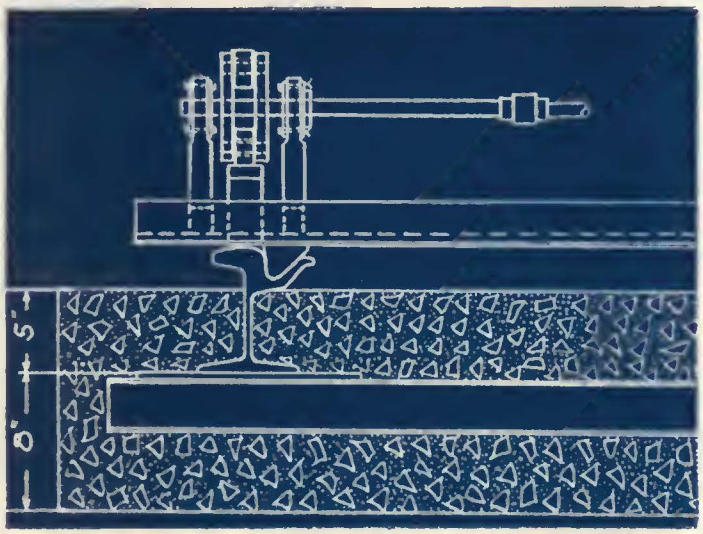
THE compression tamper exerts a uniform pressure on the concrete all-the-way-along. The tie base is assured 100% contact with the concrete. The compression tamper takes the place of many men with hand tools, speeds up the work; the compression tamper is vital where uniform results are to be obtained.

STEEL TWIN

BOND ~ UNIFORM TRACK



MINUTE VOIDS MUST BE REMOVED



UNIFORM BOND STEEL TO CONCRETE

TAMPING alone will not eliminate *all* voids. In Steel Twin Tie Track construction the finishing operation employs the "mortar-flow" principle. The "mortar-flow" pulsator delivers mechanically 4800 impulses per minute to the track. This causes a mortar flow which unites steel of rail and tie, and the concrete, in perfect bond — assuring absolute uniformity of track structure, and perfect contact of all elements.

UNIFORM RESULTS DEMAND UNIFORM METHODS

ASK Washington—ask Detroit—ask Philadelphia—ask any of the cities listed on the first page of this insert—they've used the complete International method of building paved track. They're enthusiastic about it—they've found out that uniform results can only follow uniformity in *all* construction operations—and that uniform results mean track that lasts longer—wears *evenly*—is *easier* to build. The "mortar-flow" principle is, we believe, the *only* way to be assured of "every-foot-just-like-every-other-foot" track.

And that kind of track is what all the shouting is about—that kind of track is what we've all been trying to build ever since the first rotted wood tie was pulled out from under the main line of the horse-car express.

Steel Twin Ties—mechanical track assembly—compression tamping—complete contact and bond—that's the formula for twenty-year track.

Write for delivered prices on Twin Ties, and the detailed progressive operation drawing.

THE INTERNATIONAL STEEL TIE CO., CLEVELAND, OHIO

TIE TRACK

YOU NEED~~

Modern Equipment To Meet Modern Methods

In keeping with the trend toward modern mass methods in track construction, materials must be brought to the job promptly and handled with dispatch.

Differential Dump Cars, Differential Truck Bodies with the 3-Way Dump—right, left or rear—Differential Electric Locomotive Cranes and Clark Concrete Breakers enable you to keep pace with the speed and uniformity of modern track laying methods.

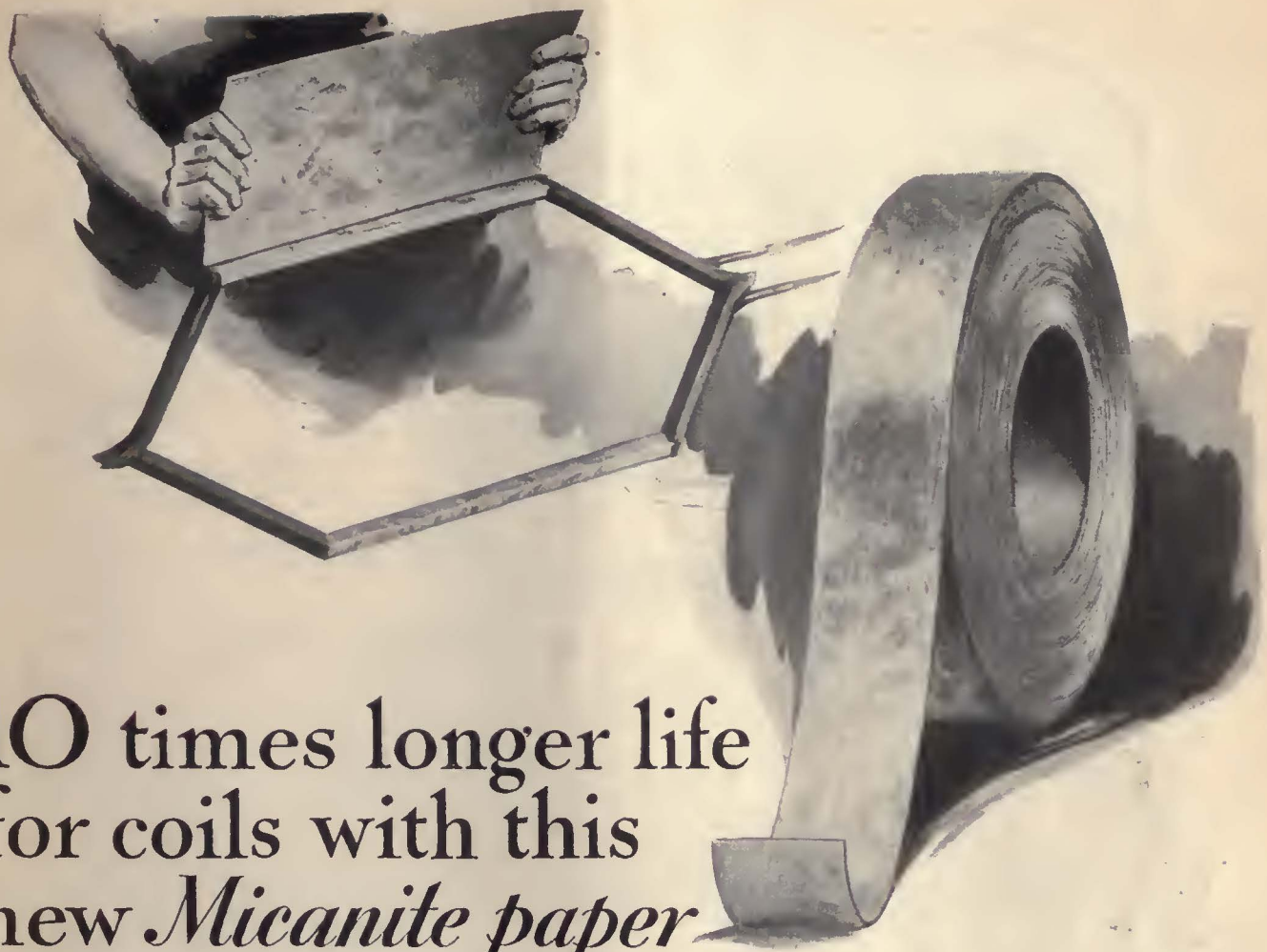
As evidence of this fact, ask any of the 67 representative electric railways who use and endorse Differential equipment.

We'll be glad to lay facts and figures before you. *Write.*

Differential Electric Locomotive Crane Car for Electric Railway Service

THE DIFFERENTIAL STEEL CAR COMPANY

FINDLAY, OHIO, U. S. A.



10 times longer life for coils with this new *Micanite paper*

Wrap the coils with No. 28 Micanite Paper. It's positive protection against heat and vibration. The paper may dry and deteriorate—as paper and cloth will with time—but the mica remains unaffected and securely held in place by the specially prepared binder. Tests prove conclusively that coils wrapped with this Micanite Paper have 10 times the life of coils wrapped with treated cloth.

This Micanite Paper is the product of years of development. Both sides of a strong condenser paper are uniformly coated with a special shellac binder. A layer of mica is bonded to only one side of this coated paper, so that, when coils are wrapped the shellac on the reverse side binds on the mica. A solid enduring coil is formed from which all air pockets are eliminated.

Manufacturers of electrical machines are invited to investigate this coil insulation. No. 28 Micanite Paper is made in rolls or sheets. Let us send you a sample for test.

MICA
INSULATOR CO.

New York: 200 Varick St.
Chicago: 542 So. Dearborn St.

Works: Schenectady, N. Y.
and London, England

Cleveland, Pittsburgh, Cincinnati, Seattle, Toronto, San Francisco, Los Angeles, Birmingham, Montreal

PERFECT MICANITE INSULATOR
REG. U.S. PAT. OFF.

Electrical INSULATION

PERFECT EMPIRE INSULATOR
REG. U.S. PAT. OFF.

MICA INSULATION OILED CLOTH INSULATION

90% of all interurban lines use OHMER Registers

It has naturally followed that Ohmer experience and prestige have made Ohmer Registers the preference in bus service also.

. . . many have been in use more than 30 years

ON THE PACIFIC COAST FOR EXAMPLE . . .

THE Key System Transit Co., Oakland, California, is now using 215 Ohmer Registers. The original contract, made in 1904, was recently again renewed. When the new contract expires, this company will have used Ohmer Registers for *31 consecutive years.*

The Pacific Electric Railway Co., Los Angeles, is now using 1,000 Ohmer Registers. Including the term of the contract which was renewed recently, this company will have used Ohmer Registers *continuously for 28 years.*

The Southern Pacific Co., San Francisco, has 200 Ohmer Registers in use. The latest contract renewal will give it *24 years of continuous Ohmer Service.*

And so the list goes on.

Ohmer Registers clearly indicate and untamperably record each fare in its proper classification at the time it is paid. That is why 90% of all electric interurban lines use Ohmer Registers. They have found that these registers speed up collections, stop losses, reduce overhead and increase profits.

And Ohmer has kept pace with transportation developments. The Ohmer ticket-printing registers likewise are preferred equipment for motor coach service . . . ideally adapted to the peculiar requirements of bus transportation.

Write today for full information about Ohmer money-saving, profit-building registers.

Here are a few of the many OHMER installations in electric railway cars and motor coaches

Aurora, Elgin and Fox River Electric Company, Aurora, Illinois.
Trenton & Mercer County Traction Corporation, Trenton, New Jersey.
Chicago and Joliet Electric Railway Company, Joliet, Illinois.
Chicago, South Bend and Northern Indiana Railway Company, South Bend, Indiana.
Coast Cities Railway Company, Asbury Park, New Jersey.
Interurban Transportation Company, Alexander, Louisiana.
Lake Superior District Power Company, Ironwood, Michigan.
Lehigh Valley Transportation Company, Allentown, Pennsylvania.
Monongahela Transport Company, Morgantown, West Virginia.
Monongahela-West Penn Public Service Company, Fairmont, West Virginia.
North Branch Bus Company, Bloomsburg, Pennsylvania.
Penn Bus Lines, Bridgeville, Pennsylvania.
Rockford Public Service Company, Rockford, Illinois.
Tri-State Transit Company, Huntington, West Virginia.
Automotive Transportation Company, Providence, Rhode Island.
Hamburg Railway Company, Buffalo, New York.
Atlantic City and Shore Railroad Company, Atlantic City, New Jersey.
Hudson Transportation Company, Glen Falls, New York.
Motor Coach Company, Long Beach, California.
Tennessee Transportation Company, Nashville, Tennessee.
Bohi Brothers, Inc., Albany, New York.
New York State Railways, Rochester, New York.
Vancouver Island Coach Lines, Limited, Vancouver, B. C.
Virginia and Carolina Railway Company, (Steam Railroad) Lumberton, North Carolina.
Northland Transportation Company, Minneapolis, Minnesota. (Subsidiary of the Great Northern Railroad)
New England Transportation Company, Boston, Massachusetts. (Subsidiary of the New York, New Haven and Hartford Railroad)
Yadkin Coach Company, Badin, North Carolina. (Subsidiary of the Yadkin Railway Company)
Southwestern Transportation Company, Little Rock, Arkansas. (Subsidiary of the St. Louis-Southwestern Railway Co., St. Louis, Mo.)
G. R. Wood, Inc., Pitman, New Jersey.

OHMER
REG. U.S. PAT. OFF. AND OTHER COUNTRIES
FARE REGISTER COMPANY
DAYTON, OHIO

Seven Steps

. . . . Each a stage in the journey that Leads to Multiplied Mileage

In the rolling operation seven rolls operate simultaneously on the rim and web of the wheel blank. The structure of the rim is refined, more mileage assured.

In the machining operation scientifically designed equipment machines the tread and flange, faces and rough bores the hub, and gives the wheel a workmanlike finish throughout.

. . . . . The course of Gary Wrought Steel Wheels from wheel block to shipping dock is a straight one toward multiplied mileage. Modern shop facilities, up-to-the-minute equipment, spacious buildings and painstaking inspection all contribute to high wheel mileage. Every wheel that leaves the warehouse helps to maintain and add to the reputation that Gary Wheels enjoy.

Our wheel engineers are at your command.

Illinois Steel Company
Subsidiary United States Steel Corporation
General Offices: 208 South LaSalle Street .. Chicago

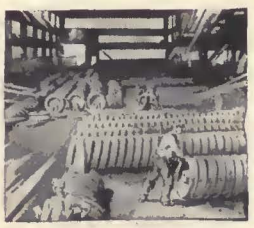
Rigid schedules, greater speed, frequent starting and stopping—all spell the need for durable and dependable wheels in electric railway operation. In Gary Wheels steel-making knowledge is combined with wheel-making experience to assure long and trouble-free wheel service.

The coning press forms the web of the wheel to the proper curvature or "cone." This is the last of the "hot" operations.

Here a ten-thousand-ton hydraulic press transforms a wheel block into a wheel blank. The hub is formed; the flange and rim partially formed.

After the wheel blank has been placed in centering die, a cylindrical block is removed from center of hub by the punching die.

In the Final Inspection men trained by experience examine every wheel thoroughly, in order that only perfect wheels may leave the plant.



GARY WROUGHT STEEL WHEELS

WHAT DOES A NEW POLE COST

Studies in Pole Line Design

Number four of a series of six. This is the fourth of six advertisements on pole line design. Number one discussed new pole strength. Number two, maintained strength. Number three, pole life. This one covers the first cost of poles. It is suggested that the series be preserved for future reference.

AMERICAN CREOSOTING COMPANY
LOUISVILLE, KENTUCKY

Why Specify an 8-inch Top When Economical Design Calls for a 28-inch Circumference at the Ground Line?

Are Low Priced Poles Economical?

While low first cost is not the sole criterion of economy in pole line construction, it is much sought after. The economy of a pole cannot be determined by a price quotation. The pole line designer knows that the delivered cost of the poles is only a small part of the total line cost. A low unit price on poles may mean a higher line cost because more poles are required. Conversely, the most expensive pole may make possible a design which will be the most economical in total cost.

How Pole Characteristics Affect Line Costs

The investment in a pole line includes in addition to the poles the cost of labor for setting, the conductor, cross arms and fittings, labor to install pole fittings and to string conductor, supervision and overhead. Of these items, only the conductor, supervision and overhead are unaffected by changing the poles. The strength of the pole affects the span and therefore the number of poles needed. The cost of setting, the cost of cross arms and fittings and labor for installing is, of course, directly proportional to the number of poles. The cost of stringing conductor is also affected somewhat by the span.

Pole length, span, allowable conductor sag, and minimum clearance above the ground are all inter-related factors that must also be studied to get the most economical solution for any particular line.

How to Determine the Most Economical Pole

The careful designer selects the most economical type of pole by process of "trial and error". The entire line cost is calculated with a number of pole types and sizes to see which gives a combination of costs with the lowest total. As pointed out in the first "study" the ground line circumference of a pole can be derived from the assumed loading and the known ultimate fibre stress of the wood. By adding the cost of a pole of that size to the other items of cost in the line the total is found, which is set down for comparison with totals similarly calculated for other types of pole.

Practical Considerations Limit Theoretical Design

Such comparative cost estimates generally indicate that the longer the span the lower the total cost. But this theory cannot be followed far without striking a number of practical difficulties. First, the strength of conductors limits the span. Then the sag in long spans may require poles too long for commercial standards and prohibitively expensive. Appearance is a factor that must also be dealt with since economy at the expense of public good will is too costly.

Howto SaveWithout Sacrificing Pole Strength

Even after the correct ground line circumference has been calculated for a pole that will give the most economical line within the limitations imposed by local conditions, there still remains the problem of so specifying the pole as to insure the calculated strength without unnecessarily increasing the cost of production.

Many of the old methods of specifying were satisfactory in the days of plentiful pole supply and consequent low cost. The wide range of sizes possible under such methods was also justified to a large extent by the fact that deterioration was rapid, and over-size in a pole provided an additional factor of safety. But with pole costs on the present level, the more accurate specification of sizes made possible by pole types which maintain initial strength over long periods becomes of vital importance.

Since wood poles are a product of Nature, there is no way to prevent a wide variation in the taper. If pole size is specified by the top dimension, this results in a wide range of size at the ground line. But the ground line is the critical section in which strength must be judged. It is logical, therefore, to specify pole size by circumference at the ground line, with a secondary requirement covering top dimension to insure a degree of strength at that point in keeping with the load to be carried by the pole. The accompanying table shows minimum dimensions for standard Amcreco Creosoted Southern Yellow Pine Poles.

TABLE OF POLE DIMENSIONS

Length of Pole (Feet)	Distance of Ground Line From Butt (Feet)	SIZE CLASSIFICATION BY MINIMUM CIRCUMFERENCE—INCHES													
		CLASS AAA		CLASS AA		CLASS A		CLASS B		CLASS C		CLASS D		CLASS E	
		Top	6 feet From Butt	Top	6 feet From Butt	Top	6 feet From Butt	Top	6 feet From Butt	Top	6 feet From Butt	Top	6 feet From Butt	Top	6 feet From Butt
16	4											16	20½	15	18½
18	4									17	23½	16	21½	15	19½
20	4					20	28	18½	26½	17	24½	16	22½	15	20½
22	4½					20	29	18½	27	17	25½	16	23½	15	21½
25	5	23	33½	21½	31	20	30	18½	28	17	26½	16	24½	15	22½
30	5½	23	35	21½	33½	20	32	18½	30	17	28	16	26½	15	24½
35	6	23	37	21½	35	20	33½	18½	32	17	30	16	28	15	26½
40	6	23	38½	21½	37	20	35	18½	33½	17	32	16	30	15	28
45	6½	24½	40	23	38½	21½	37	20	35	18½	33½	17	32		
50	7	24½	41½	23	40	21½	38½	20	37	18½	35	17	33½		
55	7½	24½	43	23	41½	21½	40	20	38½	18½	37				
60	8	24½	45	23	43	21½	41½	20	40	18½	38½				
65	8½	24½	46½	23	45	21½	43	20	41½						
70	9	24½	48	23	46½	21½	45	20	43						
75	9½	24½	49½	23	48	21½	46½	20	45						
80	10	24½	51	23	49½	21½	48								
85	10½	24½	52½	23	51	21½	49½								
90	11	24½	54	23	52½	21½	51								

Accurate Calculations and Proper Specifying Mean Low Cost

A combination of accurate calculations of the pole strength needed and careful specifications to take advantage of the strength available in high grade poles leads irresistibly to low first cost of pole lines. The Amcreco pole is usually found to be a money saver because its high initial strength and ability to maintain this strength over long periods make possible smaller sizes (or longer spans) and higher factors of safety.

For additional copies of this series of studies of pole line design or for quotations and information on AMCRECO Creosoted Southern Yellow Pine Poles, address the nearest sales office.

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY INCORPORATED
AMCREO LOWRY PROCESS CREOSOTED WOOD
GEORGIA CREOSOTING COMPANY INCORPORATED
LOUISVILLE ~ KENTUCKY

SALES OFFICES
332 S. Michigan Ave., Chicago
350 Madison Ave., New York City
401 W. Main St., Louisville, Ky.
Brunswick, Ga. Bogalusa, La.

The new proven method of lubricating car journals

With the progress that has been made in electric railway methods, equipment and rolling stock, it was inevitable that an improvement would appear in lubricating methods and lubricants.

Formerly all car oils were made in two grades—summer and winter. Sometime ago the Standard Oil Company began developing light bodied oils designed to meet the requirements of electric railway service for year 'round operation. The result was Superla Car Journal Oil.

Superla Car Journal Oil has set a new standard of car journal lubrication, casting into obsolescence the old theory that different grades of oil were necessary for winter and summer operation. It has proven successful in all seasons in high speed interurban and ordinary street car service. It has made possible marked savings in power and waste consumption, increased the life of bearings and reduced bearing temperatures.

This modern method of lubricating car journals offers such attractive economies and improved lubrication that you'll find it well worth investigating. One of our engineers will be glad to give you complete information.

An article written by one of our engineers discussing the use of light oils for car journal service contains much valuable information and shows many tests that have been made.

If you are interested in reducing lubrication costs you'll find this article well worth reading. We will be pleased to send a copy at your request.

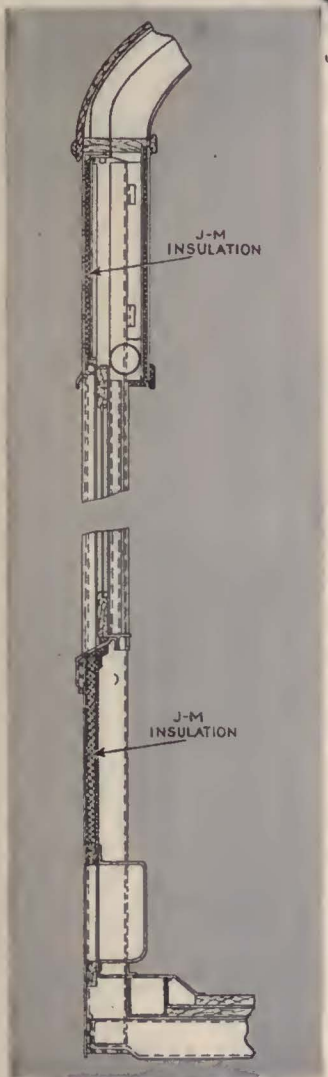
STANDARD OIL COMPANY (*Indiana*)

General Offices: 910 S. Michigan Ave. CHICAGO, ILLINOIS

Chicago	Duluth	Grand Rapids	Joliet	Mason City	Peoria	South Bend
Davenport	Detroit	Green Bay	Kansas City	Milwaukee	Quincy	St. Louis
Decatur	Evansville	Huron	La Crosse	Minneapolis	Saginaw	St. Joseph
Des Moines	Fargo	Indianapolis	Mankato	Minot	Sioux City	Wichita

1320

Pittsburgh Railways Company provides comfortable transportation for its passengers in many ways. The principle of car body insulation employed in these cars is in keeping with the spirit of modernity expressed by the comfortable seating arrangement shown here. Below is cross section diagram of J-M Insulation as applied to the body of a car.



Give *your* riders the *quiet comfort* of J-M Body Insulation

Rubber wheels cannot be used on high speed electric cars but the grinding noise of steel wheels, as well as car vibration can be largely excluded from the interior of the car by the use of J-M Insulation. This has been proved in actual operation. On one system alone, nine hundred high speed electric cars insulated by Johns-Manville are providing greater riding comfort for millions of passengers.

This insulation not only affords greater traveling comfort by keeping cars warm during cold weather, at reduced fuel cost, but it provides quieter operation and increased car comfort for passengers all year round.

In all types of electric railway equipment, the reduction of noise is becoming increasingly important. One street railway on the Pacific Coast has found the sound-absorbing quality of J-M Insulation an important asset in attracting passengers to its line.

J-M INSULATION *for* Cars *and* Buses

For many years J-M Insulation has been the standard insulation on steam railroad cars throughout the country. Its adoption by electric railways and bus operators has also grown rapidly to meet the higher standards of today set by a traveling public that demands every reasonable comfort.

J-M Insulation does not rot, pack down, or deteriorate. It retains its high initial insulating value long after inferior insulation has had to be replaced. It is easy to apply. It can be flanged around window posts, braces, carlines, purlins, uprights or any irregularities in sides, ends or roof framing, and can be curved to the radius of the decks.

Johns-Manville Insulation will play an important part in the reduction of excessive noise, and will afford protection during periods of extreme temperatures.

Johns-Manville
SERVICE TO TRANSPORTATION

JOHNS-MANVILLE CORPORATION
New York Chicago Cleveland San Francisco Toronto
(Branches in all large cities)

Please send me full information in regard to steel car insulation.

Name.....

Address.....

ENGINEERS *and* CONSULTANTS

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.

Positions Vacant and all other classifications, excepting Equipment, 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 inch $6.00
2 to 3 inches..... 5.75 an inch
4 to 7 inches..... 5.50 an inch

Other spaces and contract rates on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

R.J.

POSITION VACANT

TRACK foreman wanted, familiar with special track work on high-speed electric lines. $200 per month. Give age, experience and education. P-183, Electric Railway Journal, Tenth Ave. at 36th Street, New York.

POSITIONS WANTED

SUPERINTENDENT of electric railway property, superintendent of bus operation or a combination of both, desires a position. Highly recommended, earnest and hard worker, showed good ability in maintenance of cars, track, overhead and buses, gave good transportation service, had good control of men, kept peace in the family, proven a good operator. Now employed in construction work, but desires a change. First-class references. C. H. Copley, 553 George St., New Haven, Conn.

STREET railway man, 31, qualified by 14 years' experience in the operation and maintenance of cars and buses, at present superintendent of a small property operating lightweight cars and buses, would like to connect with a progressive property where varied experience would be an advantage. PW-184, Electric Railway Journal, Tenth Ave. at 36th Street, New York.

OFFICIAL PROPOSAL

Bids: August 20.

Steel Passenger Cars, Etc.

New York, N. Y.

Sealed bids or proposals, for furnishing and delivering three hundred (300) STEEL PASSENGER CARS, together with five (5) extra motor trucks and five (5) extra trailer trucks for the Independent System of City Subways in the Borough of Manhattan, City of New York, will be received by the Board of Transportation, acting for and on behalf of The City of New York, at the office of said Board at No. 49 Lafayette Street, Borough of Manhattan, New York City, until the 20th day of August, 1929, at eleven-thirty (11:30) o'clock a.m., at which time and place or at a later date to be fixed by said Board, the proposals will be publicly opened and read. A description of the work and other requirements, provisions, details and specifications are given in the Information for Contractors and in the Form of Contract, Specifications, Contract Drawings, Bond and Contractor's Proposal, which are to be deemed a part of this Invitation and copies of which may be inspected and purchased at said office of the Board.

The receipt of bids will be subjected to the requirements specified in said Information for Contractors.

New York, July 2, 1929.

BOARD OF TRANSPORTATION OF THE CITY OF NEW YORK,
By JOHN H. DELANEY, Chairman.
DANIEL L. RYAN,
FRANK X. SULLIVAN,
Commissioners.
FRANCIS J. SINNOTT, Secretary.

ALPHABETICAL INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Electric Railway Journal* assumes no responsibility for errors or omissions.

Searchlight Section—*Classified Advertising*

33-passenger Palace Highway Pullman combining increased seating capacity with increased luxury of appointment.

Extra wide interior, added seat comfort, full head room in aisle. Luggage inside, out of the weather.

Here's Increased Seating Capacity *for* Inter-City and Inter-State Hauls

ADD to the 33 stationary seats, 8 auxiliary seats (every one a comfortable one). A total of 41 in this popular type bus.

This additional capacity has been found by experience to be highly profitable on inter-city and inter-state routes.

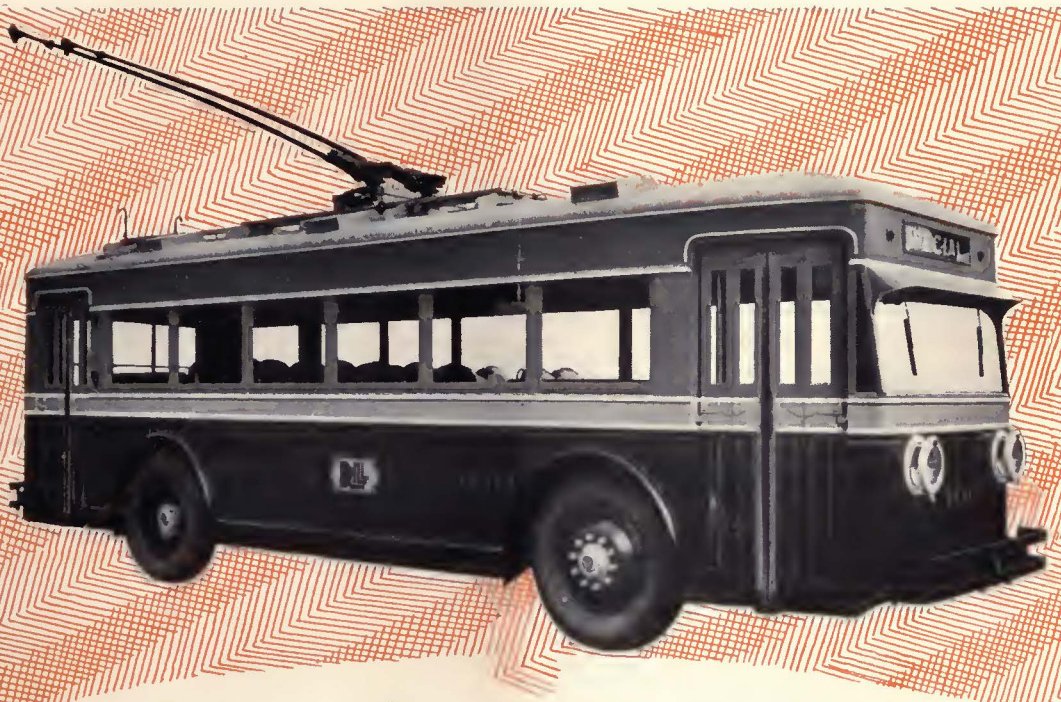
Paralleling the increased seating capacity has come increased luxury of appointment. Typical of this is the exhaust fan completely renewing the air every four minutes . . . greater comfort.

And increased passenger comfort means increased passenger revenue.

THE BENDER BODY CO.

W. 62nd and Denison Cleveland, Ohio

BENDER BODIES



Outstanding Features of the New Brill Electric Coach

Brill MASTER UNIT design—exceptionally light weight, 14,500 lbs.—flexibility in traffic—circulating passenger load—automatic foot control—rear axle drive through noiseless reduction gears—high rate of acceleration—smooth and positive stops through four-wheel internal expanding air brakes—cam and lever type steering mechanism designed expressly for balloon tires—two 35 H.P. high-speed motors—seats 30 passengers.

Those who have inspected this new development agree that it would be difficult to improve upon either its appearance, operation or workmanship. The Brill Electric Coach has also been designed with a seating capacity of forty, rear or center exit, and equipped with 50 H.P. motors.

Come to Philadelphia and see the Brill Electric Coach in operation or write for detailed information.

THE J. G. BRILL COMPANY
PHILADELPHIA, PA.

AMERICAN CAR CO. ST LOUIS MO — G.C. KUHLMAN CAR CO. CLEVELAND, OHIO. — WASON MANF'G CO. SPRINGFIELD, MASS

Pacific Coast Representative: Rialto Bldg., San Francisco

Brill MASTER UNIT Cars

HASKELITE

Three Canadian railways specify HASKELITE

MORE evidence of the preference shown by street car manufacturers and operators for strong, light weight HASKELITE panels is found in the specifications for cars recently ordered by three Canadian properties. HASKELITE was specified for the headlining of 7 cars purchased for the Regina Municipal Railway. The Saskatoon Municipal Railway specified HASKELITE for roof material and interior trim as well as for headlinings in a 5-car order. And the Quebec Railway, Light & Power Company specified 3-16 in. HASKELITE for the headlinings of 15 new cars.

The ever-increasing list of builders and owners who specify HASKELITE and its metal-faced companion, PLYMETL, testifies to the popularity of these materials for the construction of modern street railway cars and coaches. Both products possess light weight, great strength, beauty and both eliminate excessive drumming and vibration.

PLYWOOD
HASKELITE
PLYMETL

Write for valuable data on the use of HASKELITE and PLYMETL in street car construction.

Haskelite Manufacturing Corporation

120 South LaSalle Street, Chicago, Illinois

Railway Representatives:

Economy Electric Devices Co., 37 W. Van Buren St., Chicago
Grayson Bros., 600 LaSalle Bldg., St. Louis, Mo.
Railway & Power Engineering Corp., Ltd
Montreal, Toronto, Winnipeg, New Glasgow

PLYMETL

ERJ8 Gray