ELECTRIC RAILWAY JOURNAL

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Columbus Grove Substation on the Lima-Toledo Railway

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Electric Railway Journal

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1929

Vol. 73, No. 9 *Pages 347–382*

March 2, 1929

In This Issue

Columbia Gorge Motor Coach System, Portland, Ore., is 100% Goodyear-Equipped

2,400,000 Mountain Miles a Year— on Goodyears!

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A "MAN-HOUR" is not incorrigible. He can be reformed! While he has a bad habit of wasting too many fares (he equals 5.2 of them on the average), when using picks and shovels, mauls and crow-bars, he reforms instantly when you give him a machine and dignify him with a semi-skilled occupation.

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And the machine is quickly paid for in track construction by the "Man-Hours" it displaces and the improvement in the uniformity and quality of construction.

Use more machinery in track construction.

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STEEL TWIN TIE TRACK
THE BASE OF MODERNIZATION

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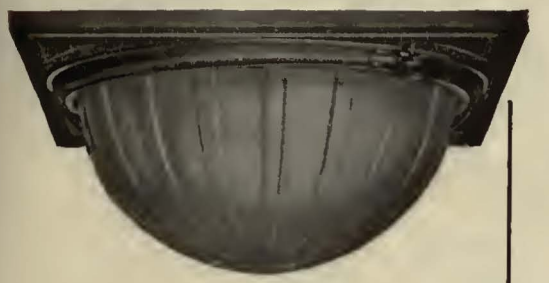

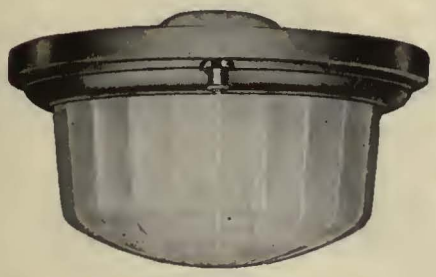

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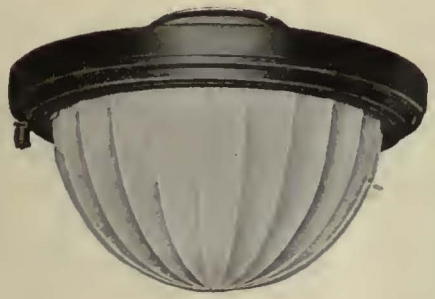

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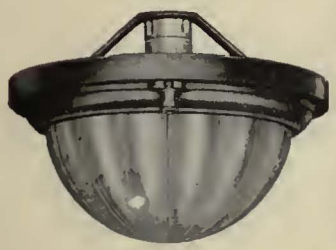

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ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURER OF RAILWAY, POWER AND INDUSTRIAL ELECTRICAL MATERIAL

With VARIOUS types of paving *on the* T. H. I. & E.

Used with brick paving, at Terre Haute, Ind.

Used with concrete paving, at Richmond, Ind.

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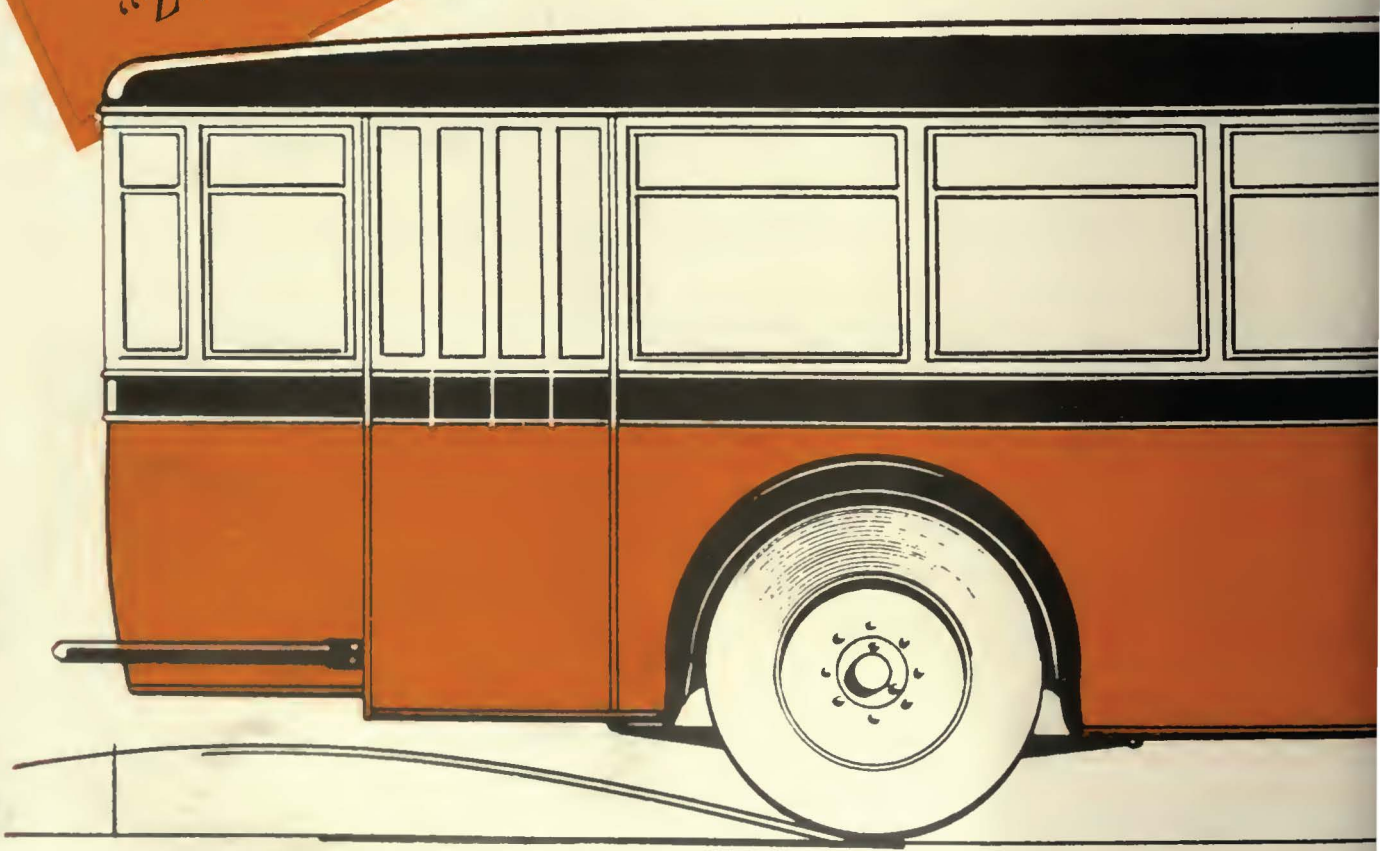

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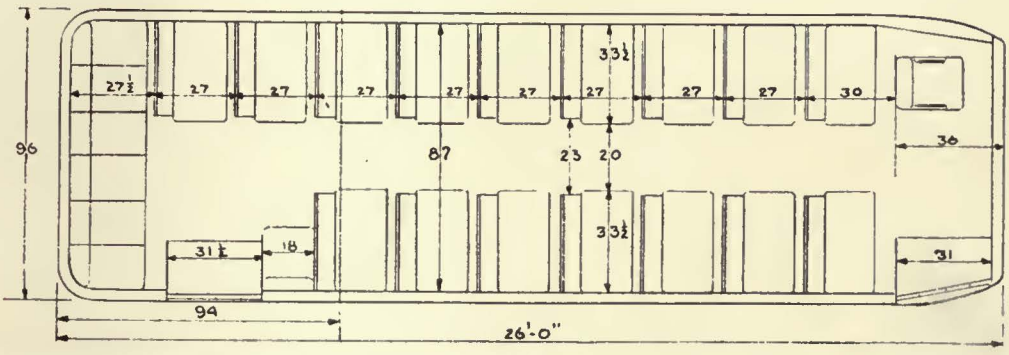

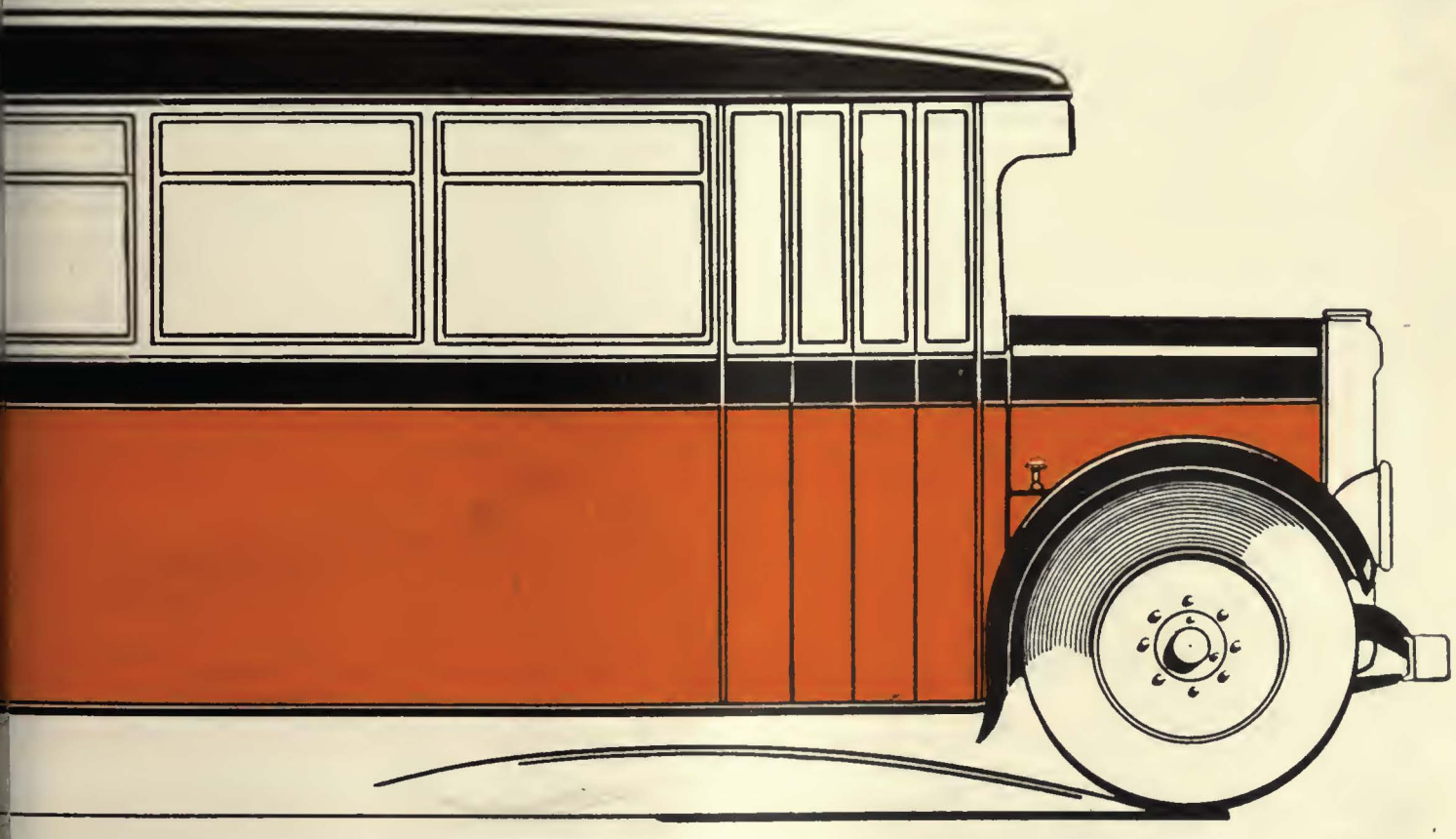

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General Motors Truck Company . . . . . Pontiac, Michigan

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the sign doesn't show it . . . . . !

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And Thermit welding is the way to get such track—*and keep it.* Once Thermit welded—and it's done for good.

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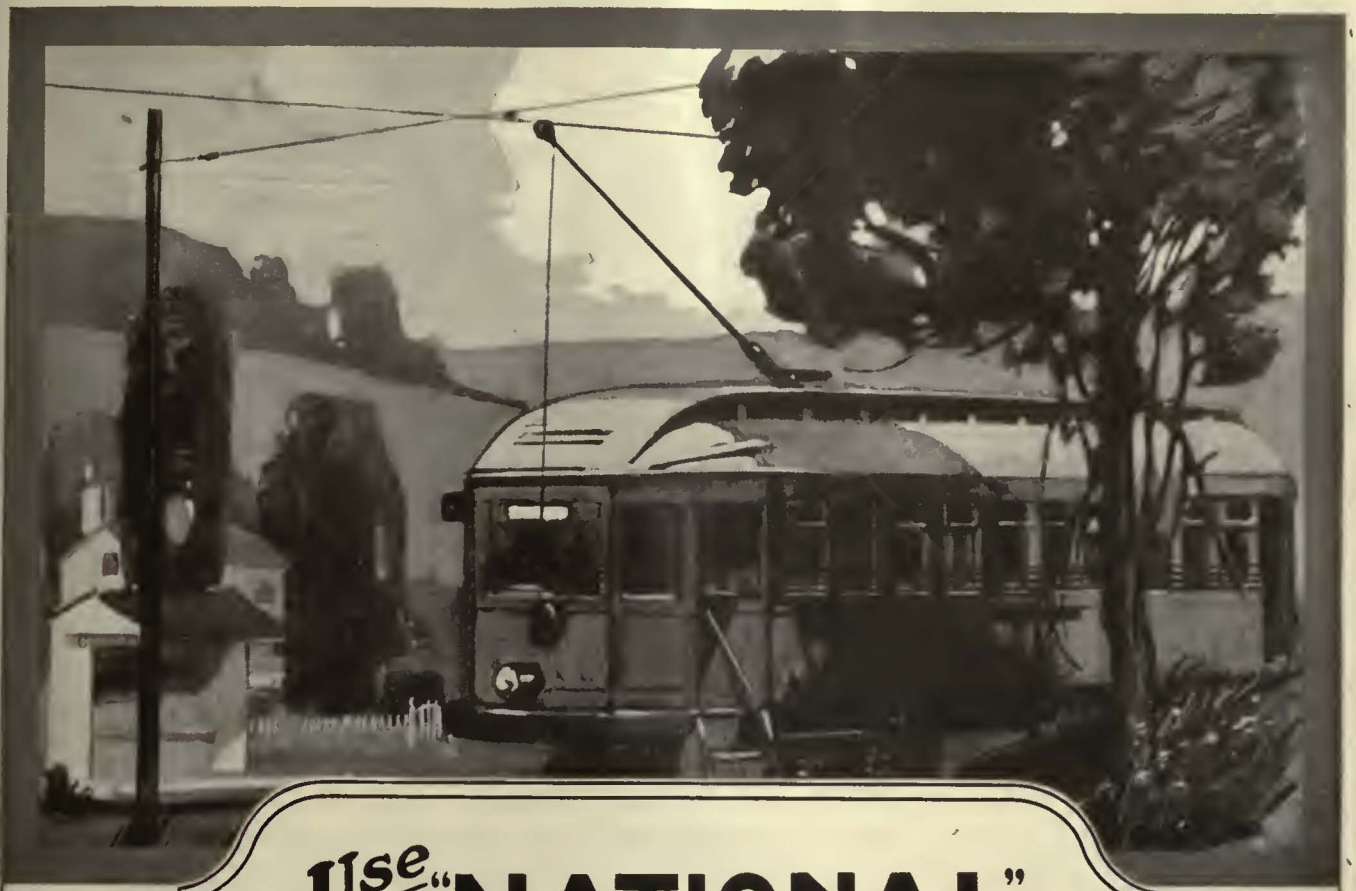
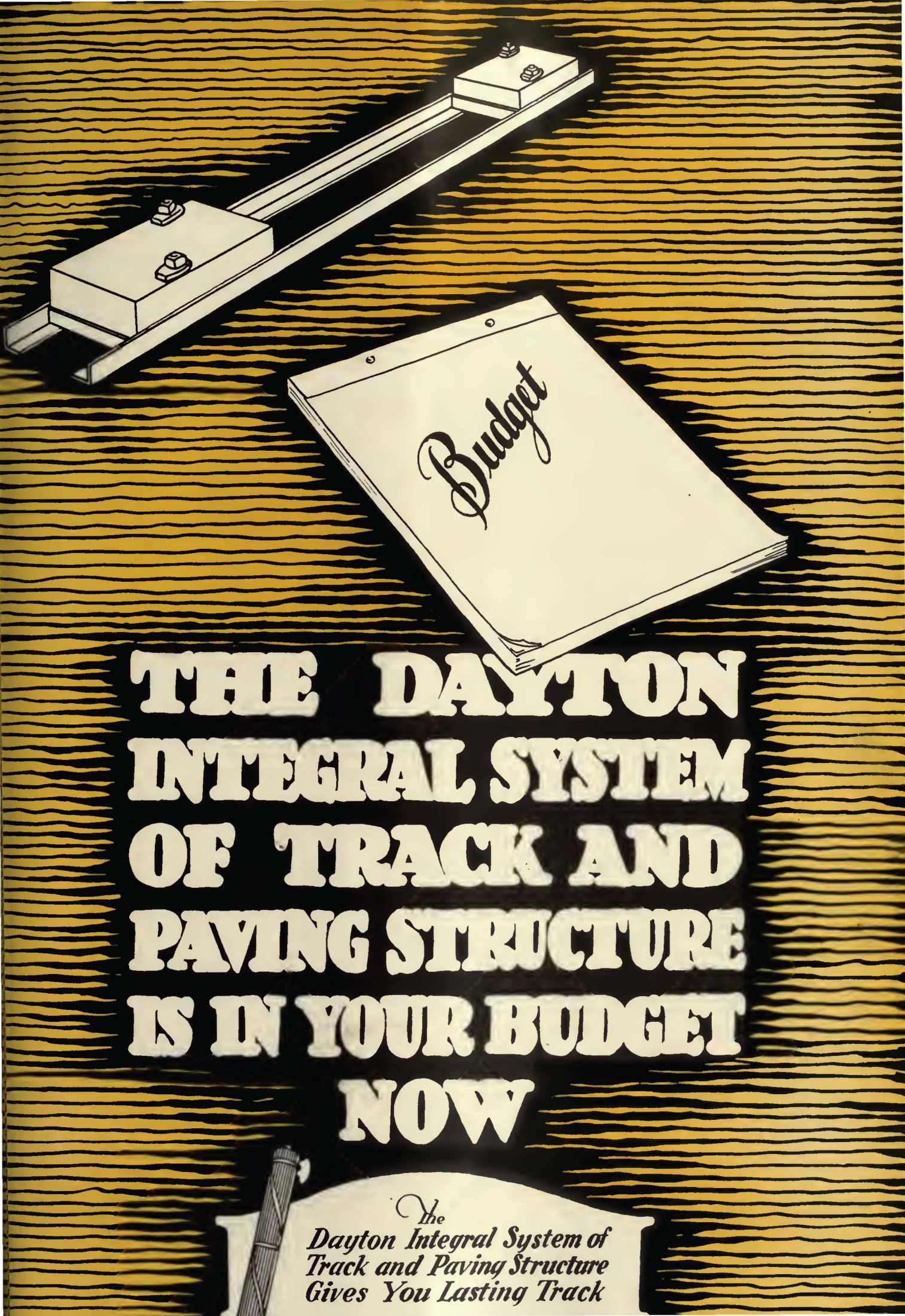




THE DAYTON INTEGRAL SYSTEM OF TRACK AND PAVING STRUCTURE IS IN YOUR BUDGET NOW

The Dayton Integral System of Track and Paving Structure Gives You Lasting Track

The Dayton Integral System of Track and Paving Structure Is in Your Budget Now

Whatever your budget for track renewal or extension —it is adequate for Dayton Integral Track.

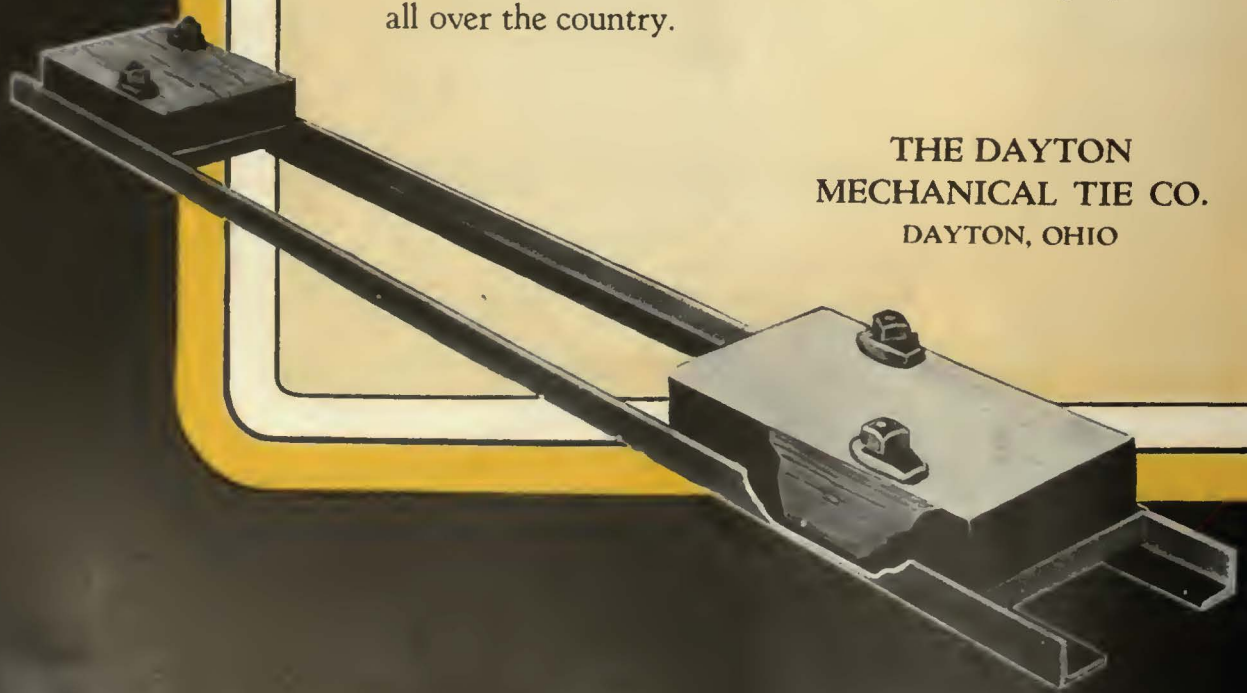
Engineers who have used it will tell you that it is never more expensive than any other good track construction—and often less expensive.

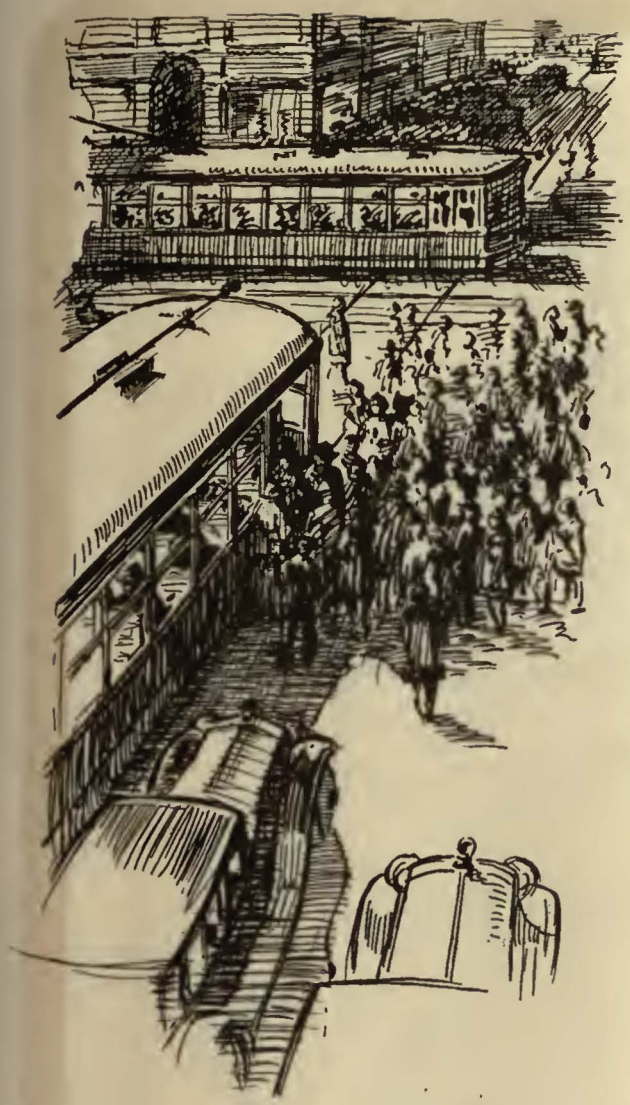
Hence, you can have this lasting track at the same cost as short life track.

The Dayton Integral System unifies track and paving structure into a single, durable whole—one base for track and paving—no trouble or maintenance on either for years.

It will solve your track problem as it has for properties all over the country.

THE DAYTON
MECHANICAL TIE CO.
DAYTON, OHIO





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How about *your* wheels?

Cars in city service stop that often, and stop quickly. Wheels and Axles must give unusual service to prove economical on such lines.

"Standard" Wheels, Springs and Axles are chosen for the nation's leading railway lines. They answer service demands.

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"FOR EVERY TYPE OF CAR

IN EVERY TYPE OF SERVICE"

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PHILADELPHIA, PA.

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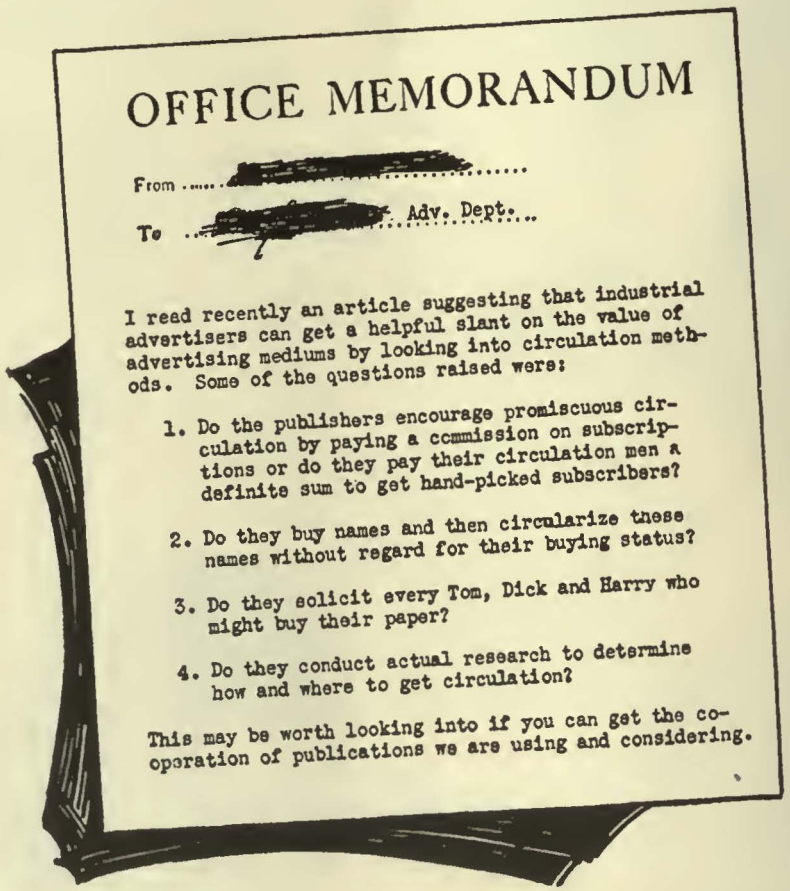

AT McGraw-Hill circulation headquarters in New York there is a large map. On it here and there are colored pegs which show what circulation we do not have—plants, utilities or service organizations whose buying power should be covered by a McGraw-Hill publication.

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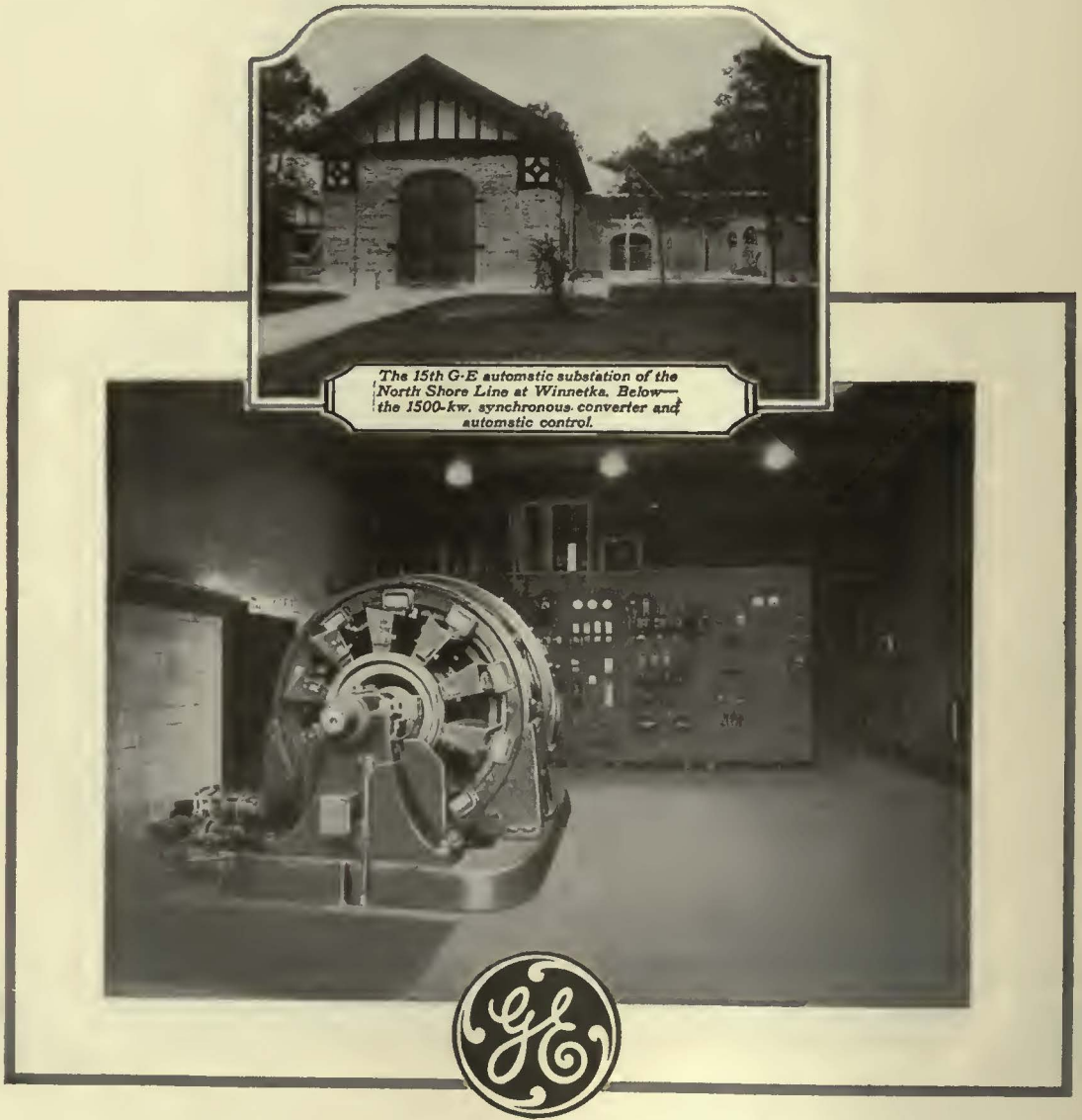
F-9

—The publishers

The 15th G-E Automatic Substation for the North Shore Line

ON the Chicago, North Shore and Milwaukee Railroad, 15 of the 20 substations have been made completely automatic by installing G-E equipment throughout. Coördinated power facilities, greater efficiency and dispatch in maintaining continuous service, unified train control—these are being attained by this progressive road.

The attractive, modern structure at Winnetka houses a G-E 1500-kw. synchronous converter and complete G-E automatic control. The North Shore Line has had extensive experience with automatic substations. This road's choice of G-E automatic equipment is the result of its reliability and economy.



The 15th G-E automatic substation of the North Shore Line at Winnetka. Below—the 1500-kw. synchronous converter and automatic control.

GENERAL ELECTRIC

130-15

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

Electric Railway Journal

Consolidation of
Street Railway Journal and Electric Railway Review

McGRAW-HILL PUBLISHING COMPANY, INC.
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CHARLES GORDON, *Editor*

LOUIS F. STOLL,
Publishing Director

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Unproductive Transportation Charges

FIXED firmly in the minds of many people is the idea that, because their gross revenues are large, the companies rendering public transportation service must be enormously wealthy. It is usually popular with the public, therefore, to demand that transportation agencies make huge expenditures for purposes that do not in any way benefit the companies themselves. At one time this was done largely by taxation of one sort or another. Shining examples of this practice are the park tax paid by the United Railways & Electric Company of Baltimore, Md., and the school tax paid by the steam railroads in New Jersey. Numerous other taxes of a similar nature have been imposed, differing in detail but not in principle.

The energetic campaign carried on by the transportation industry in recent years for relief from unreasonable tax burdens has at least prevented new inroads, although it may not have accomplished much in the way of actual relief. But now the incursions into the treasuries of the transportation companies take new forms. The carriers are subjected to countless demands for "improvements" that neither increase their revenue nor enable them to render better service. For example, the street railways are asked to relocate their tracks for the convenience of the general public, but at the expense of the companies. The steam railroads are asked to build new and enlarged stations when the old ones are entirely adequate. Both steam and interurban electric lines are subjected to constant demands for the elimination of grade crossings, although the conditions which make this necessary are no fault of theirs.

Of course, transportation companies desire to be good citizens in the communities they serve and to co-operate to the fullest possible extent in all public improvements, but they have only one source of income—the passengers and shippers who use their lines. When they undertake costly improvements that neither increase their revenue nor reduce their operating expenses, the costs must eventually be reflected in the price paid by the users of the service. This fact is frequently overlooked by those who clamor loudly for improvements. Absurd as it may seem, it is not unusual to find the same individuals demanding improvements, on the one hand, and encouraging competition on the other.

Earning Public Good Will

PRINTED records often are powerful not so much in what they say as in what they convey. Thus, to those who have been following the course of recent events, the item "Springfield Work Commended" published in the JOURNAL for Feb. 16, perhaps conceals more than it conveys. The Mayor said that Clark V. Wood, president of the Springfield Street Railway, has steadfastly kept every promise made to the city. This most important reference to the street railway he tucked away in a municipal review in which the work of the company was itemized.

It was a gentlemen's agreement into which the New Haven Railroad as the owner of the Springfield system entered for the expenditure of $2,000,000 for rehabilitation in Springfield, under which in 1928 $500,000 alone was spent for new cars, motor coaches and similar equipment. The Mayor is hard headed enough to know that even the expenditure of $2,000,000 within two years has not made the Springfield Street Railway perfect, but it was a real compliment that he paid the management. And it was well deserved. The railway has kept faith with the city. And the city has kept faith with its railway.

Not so long ago the relations between city and company were not so cordial. That was because neither thoroughly understood the other. It needed only the kind of confidence that grew out of the conferences held several years ago over the matter of rehabilitation to iron out many misunderstandings. The Springfield case offers a striking example to this industry. Incidentally it is a testimonial to the efficacy of a municipal management which has recognized that it, too, has obligations to its transportation system, which if ignored must inevitably act unfavorably upon the entire community.

Another Phase of New York's Traffic Problem

LOADING and unloading of commercial vehicles in the city streets cause traffic congestion. This fact is being realized to its fullest extent in the nation's largest city. The merchants of New York have for years looked at the receipt and delivery of goods as a disagreeable detail required in all business, and have been totally blind to the ever-increasing traffic congestion caused by it, and its corresponding bad effect on their business. The realization of this congestion has at last been forced on them by the sheer lack of facilities to deliver and receive goods.

Suggestions and recommendations are now being prepared to improve the situation. Night delivery of certain commodities is being considered. Regulation of end-to-the-curb loading of trucks where side loading is possible has been mentioned. Elimination of street delivery of the major portion of construction material for the erection of new buildings would considerably decrease traffic problems. A change in the building code is suggested, which would require the provision for adequate elevator and off-street shipping and receiving and storage facilities in all new buildings. These suggestions are all good, and will be effective in preventing a growth of traffic congestion. They would have been of inestimable value had they been enforced ten or fifteen years ago.

It is apparent that only drastic regulations, entirely preventing street loading and unloading, will relieve this traffic situation. Such an ordinance would require the construction of a ramp and the establishment of a shipping, receiving and storage plant in the basement of practically every large building in the city. This city's major traffic problem has been created by the erection of large buildings. Why, then, should not the owners of such property be required to relieve the congestion for which they are responsible? However, considering the influence of such a body of property owners and their usual adverse attitude toward enforced expenditures, is it not reasonable to doubt if such an ordinance could be passed? Whether or not this plan can be worked out satisfactorily, does it not behoove other cities of growing importance to consider carefully ways and means of circumventing this mess into which Father Knickerbocker has stepped while looking skyward?

Mixing Fiction With Facts

EDWIN LEFÈVRE has been writing a very interesting series headed "Bulls on America," for the *Saturday Evening Post*. He is a veteran Wall Street commentator. His recent articles have been mostly words of warning, and his predictions presaged the spectacle of liquidation which is apparently now taking place.

It is a needed warning that Mr. Lefèvre has uttered, but it is not so much with that phase of his recent comments that the JOURNAL is concerned.

In discussing the inability to gage accurately the full effect of certain economic changes in the Feb. 16 issue of the *Saturday Evening Post,* he says "just as the trolley has been superseded by the bus and no one yet knows exactly what will happen to our passenger transportation business," etc. Incidentally, this is a statement only slightly different from one made by Mr. Hughes, another financial writer, and repeated in the *Literary Digest*.

How men like Mr. Lefèvre come to say that the trolley has been superseded by the bus when even the most radical bus enthusiast would scarcely make that charge, is difficult to understand except as an evidence of sheer ignorance of the subject. The electric railway business is a $6,000,000,000 industry. It has gone through many difficulties, but the trolley has not been superseded by the bus. Where are the eyes of the writers of these statements? They can't be expected to know the history of all industry, but the facts contradictory of what they write are so apparent that charity toward them becomes difficult to maintain.

To recapitulate the facts of this industry for the benefit of this industry is not necessary, but for the benefit of Mr. Lefèvre and other commentators it would be well to repeat that more than 300 electric railways in the United States and Canada are now operating approximately 10,700 buses in conjunction with their rail services, and that some 50 additional companies have entirely replaced their rail service by substituting more than 500 buses. Buses owned by these electric railways operated 300,000 miles during the past year and carried more than 1,000,000,000 passengers. Electric railway cars in the United States last year carried more than 15,000,000,000 passengers. These facts are all on public record. Mr. Lefèvre and others who venture to cite experiences of the transportation industry as the basis for their conclusion owe it to the publications to which they contribute to distinguish between fact and fiction.

Austrian Commission Disagrees on Intangible Values in Electrification

RESULTS on the electrically equipped lines of the Austrian State Railways have been so good that one may be astonished at the opposition offered to extensions eastward to Vienna. However, there is a very good reason in the cost of capital in Austria. It is still so high there that the government has to allow 8.3 per cent for interest, plus a 30-year amortization reserve. It takes strong arguments, indeed, to leap this high barrier.

The pros and cons are set forth in an article published elsewhere in this issue. From this it will be seen that Austria already has 366 km. (227 miles) of electrified trunk line, extending from the Swiss border to Saalfelden, with another 112 km. (69 miles) to Salzburg for completion in mid-1929. Plans have been made for continuing 312 km. (193 miles) on to Vienna. Because of the great outlay required, the Minister of Commerce and Traffic put the estimates of the State Railways and of the manufacturers before a commission for report.

As with most commissions, there is a majority and minority report. The majority favors electrification; the minority does not. While the members are in agreement on costs and the unprofitableness of electrification as regards direct benefits, they differ widely on the indirect benefits. An analysis of the arguments used develops another example of what the philosophers call "the will to believe."

The electric men figure more mileage per vehicle to be a great advantage, but the steam men see only that the brakeshoes will wear out faster. The electric men see airplanes as real competitors for long-haul business, and say: "We must move faster and more pleasantly." The steam men see in this advance of transportation a reason for assuming that everything will be different 30 years hence—so why invest money in electrification? The electric men point out that removal of smoke and dirt increases patronage and raises property values for taxation. The steam men clutch at some still mythical smokeless locomotive and assert that electrification isn't needed after all.

The electric men see that the electrifications of neighbor states will keep down Austria's pro rata of through business unless that country electrifies its lines, but the steam men see only the situation within their own country.

The electric men see greater safety with an electrified track, particularly in signal visibility, but the steam men grasp the opportunity to point out that wires and poles do not help visibility in any respect. The steam men also score in discussing the hazards from high-tension wires.

Neither side, however, quotes figures. The electric men make a strong point in stressing the value of greater capacity of tracks and yards due to higher-speed operation. The steam men ignore this but argue that manufacturers will not pay the higher cost of electrified sidings. Preconceptions rather than figures are also allowed to govern when the steam men assert greater reliability for individually powered trains than those dependent upon outside power supply. Why could not the commission have made a comparison of delays before and after electrification on one of its own electrified divisions? The steam men are blind to the fire hazard from sparks and burning coal but see very clearly that high-tension wiring is a pyromaniac.

It is rather amusing that electric railway extension

should be asked to wait until locomotive standardization has been obtained, when the very same report suggests the purchase of steam locomotives much better than the present type! The steam men argue that electrification would produce greater stresses in track and draft gear, and then go on to suggest more powerful steam locomotives that would do the same thing. After all, the real objection to extension of electrification is the high cost of capital. It is to be hoped that some reasonable refunding plan will be acceptable to the financiers, but amelioration in this respect can come only with the continuance of domestic peace. It may be that another year will produce that ½ per cent to 1 per cent drop in interest that means so much to this project.

The Place of Rapid Transit in City Planning

WELL-DESERVED criticism has been directed at the city of New York in connection with its transit planning, by Daniel L. Turner, consulting engineer for the New York Transit Commission. His main thesis is that transit facilities must be furnished in advance of population and in the way it is desired to develop the city.

On the whole, Mr. Turner is right. Transportation is an inherent and a most important part of the general problem of city planning. Best of all, it appears now that New York will so regard it in the future, as Edward M. Bassett, authority on zoning and city planning, has submitted to Mayor Walker recommendations for a permanent city planning board of three members to supervise all improvements providing for the city's rapid growth.

Of course, it would be foolish to imply that the routes of the rapid transit lines already built were not carefully planned. That is not the fact, but it is a fact that they were not planned in accordance with the ideas behind the more inclusive program proposed for the future under the master plan which would provide for the city's growth until a population of 18,000,000 is reached. To this proposed planning board would be submitted all proposals for streets, highways, street grades, bridges, tunnels, viaducts, parks, parkways, playgrounds, sites for public piers, routes for railroads, ferries and other public utilities.

Similar master plans are in existence in 300 cities. Only as the planning of transit facilities is made a part of this work are these programs really complete. In the past too often, far too often, as Mr. Turner indicates, the construction of transportation facilities and their expansion have been spasmodic. In consequence much waste, duplication and unwise construction have resulted.

As ELECTRIC RAILWAY JOURNAL has pointed out repeatedly, development of comprehensive transportation plans as a part of the general city plan would permit each step in construction to be made as a part of a broad program. Construction budgets could thus be anticipated and the conditions of financing improved. Of course, the larger the city the greater the need for the most systematic planning, but no city sufficient in size to sustain an organized transportation system can afford not to consider that system as one of the most important factors affecting its welfare. Cities need to plan, but to plan only on a basis that takes into account a program shaped to the best interests of the city as a whole. Certainly they will continue to suffer in a civic way in direct proportion to the extent that they ignore transit requirements.

Potential Possibilities of Steam

STEAM is inherently suitable for the propulsion of transportation vehicles. It has been said that if the same degree of research and developmental effort had been put behind the steam engine for vehicle propulsion that have been applied to the internal combustion engine, automobile drive today would be far in advance of its present state. The abundance of power and flexibility that are available with steam, high torque of the steam engine at low speeds, its mechanical simplicity and small number of moving parts make it superior where these requirements are of major importance.

With the introduction of the gasoline engine as a drive for the automobile it became necessary for the owner who drove his car to become familiar with its construction. As the use of the automobile grew, machinists, blacksmiths and tinkers soon were doing a large business in the upkeep of the early models. Thus the future success of this type of motive power was assured by the growing attention given it by its users. Steam drive, on the other hand, was confined to a relatively small number of high-priced cars, and while its development was attended with certain technical difficulties, not the least of its handicaps was that the American public had become so well acquainted with the principles and the methods of maintenance of the gasoline automobile engine.

The potential possibilities of steam for the propulsion of buses, however, have continued to attract the interest of engineers ever since this type of transportation vehicle began to assume a position of major importance. More than any other free-wheeled vehicle, the bus demands a reliable source of power. It is also necessary to have the engine of sufficient size to provide rates of acceleration comparable to the lighter constructed, less continuously operated automobile. Steam provides these features and in addition offers the prospect of cheaper fuel and reduced maintenance because of comparatively simple construction.

These features, combined with the acute demand for faster schedules on buses, put steam in the position of a potential contender in the field of bus operation, and its successful development in this field will be an important factor in expanding the use of the bus in community transportation. True, there have been numerous unsuccessful attempts to develop steam drive for this purpose, and it will require considerable research to make it compete actively with the internal combustion engine backed as the latter is by seemingly endless resources. In fact, it is doubtful if the bus industry alone could support such an extensive development program as seems necessary.

But another incentive to the development of steam drive that is coming rapidly to the forefront is aviation, imposing still more severe power requirements than any other form of transportation. Here there must be not only high output per pound of weight, but high continuous output as well, and, above all, reliability. Self-starting and non-stalling characteristics of the steam engine would eliminate one of the greatest hazards of air travel, i.e., a stalled motor, particularly just after taking off the ground.

Thus in the background of steam drive development for buses loom the almost limitless possibilities of aircraft. Undoubtedly here is an incentive which is growing greater almost daily. Under the stimulus of such a field of application, steam may again come back into its own as a serious contender with the internal combustion engine.

Passenger train on the Salzkammergut branch line electrification, Austrian State Railways

Austro-Swiss Electrification

Progressing Rapidly

Service already being given from Geneva to Saalfelden, a distance of 472 miles. A total of 542 miles will be completed by summer of 1929. Salzburg-Vienna line, 193 miles long, being considered

IN 1919, or within a year after the disastrous war which disrupted the Austro-Hungarian Empire, the new-born Austrian Republic took up the task of electrifying the State Railways. Rich only in water power, the republic was anxious to exploit it for the two-fold end of reducing costs and of enhancing the attractiveness of travel in Austria.

Despite the harrowing years of fiat money, usurious loans and economic readjustment, electrification has gone forward in accord with the program set forth in the electrification act passed July 23, 1920. As a matter of fact, work was actually started during 1919. By the summer of 1929, or in practically a decade, Austria will be operating 296 miles of electrified main line route from the Swiss border at Buchs to the city of Salzburg, famous for its music and drama festivals.

This additional electrification will place the Paris-Zurich-Salzburg route to Vienna on a parity with the competitive Paris - Stuttgart - Munich - Salzburg route which required only 27 hours traveling time instead of the 28½ hours of the first route when steam-operated. The electrification to Salzburg was made all the more imperative because the planned electrification between Salzburg and Stuttgart will cut the running time to 25½ hours or less.

Before the end of 1928, the Austrian State Railways also expect to complete the 38-km (24 miles) Innsbruck-Brenner connection with the Italian State Railways. Besides these lines, there is the pioneer Salzkammergut branch line, totaling 107 km. (66.3 miles) of single track in operation since 1925. By the summer of 1929, the Austrian State Railway's electrified lines will total

366 route miles. The Schwarzach-St. Veit and Spittal-Millstättersee lines also have been chosen for electrification, but so far only the hydro-electric supply has been taken in hand.

Capital and Amortization Charges 10 per Cent

The capital charges, including amortization, on the electrifications already undertaken, have approximated 10 per cent. Officials of the State Railways estimate that the future charges will be about 8.3 per cent. The principal question to be decided by the Austrian Parliament, which has the final say, is whether it would be economically justifiable to electrify from Salzburg to Vienna for 312 km. (193 miles) and also from Vienna to the important industrial city of Graz, 211 km. (132 miles).

Like the Swiss electrification, the Austrian State Railways standard is single-phase, $16\frac{2}{3}$ cycles, with an average line potential of 15,000 volts and a maximum of 16,500 volts.

The first main line work was begun in 1923, covering 20 km. (12.4 miles) west of Innsbruck. Thereafter, 60 to 70 km. (37.2 to 43.4 miles) were electrified per annum. An extended account of the situation up to the end of 1925 was published in the issue of this paper for June 5, 1926. In the summer of 1928, 366 km. of track were in operation and 112 km. more were to be completed by the summer of 1929.

Through coaches over the line from Buchs to Saalfelden, 70 miles west of Salzburg, are now operated from the electrified divisions of the Swiss Federal Railways. Later this year the traveler can make an all-electric trip from Geneva to Salzburg, a distance of 874 km. (542 miles) without changing cars.

Various types of overhead construction have been installed on the different divisions. Experience has indicated that the Austrian-Bergmann design of gas-pipe bracket construction, as applied between Feldkirch and Bludenz and on the Salzkammergut line will be most satisfactory for general use. These brackets have two double-petticoat insulators with flashover ratings of 85,000 volts dry and 53,000—81,000 volts wet. The insulator for the upper horizontal member of the bracket can rotate in its fixture. The insulator for the diagonal or strut member has a pipe sleeving fixture to permit vertical movement of the diagonal.

On tangents, the poles are set at intervals of 60 m. (197 ft.) The contact wire over the running track is of 100 sq.mm. cross-section and over the switching tracks is 65 sq.mm. with tensions of 600 kg. and 390 kg. respectively.

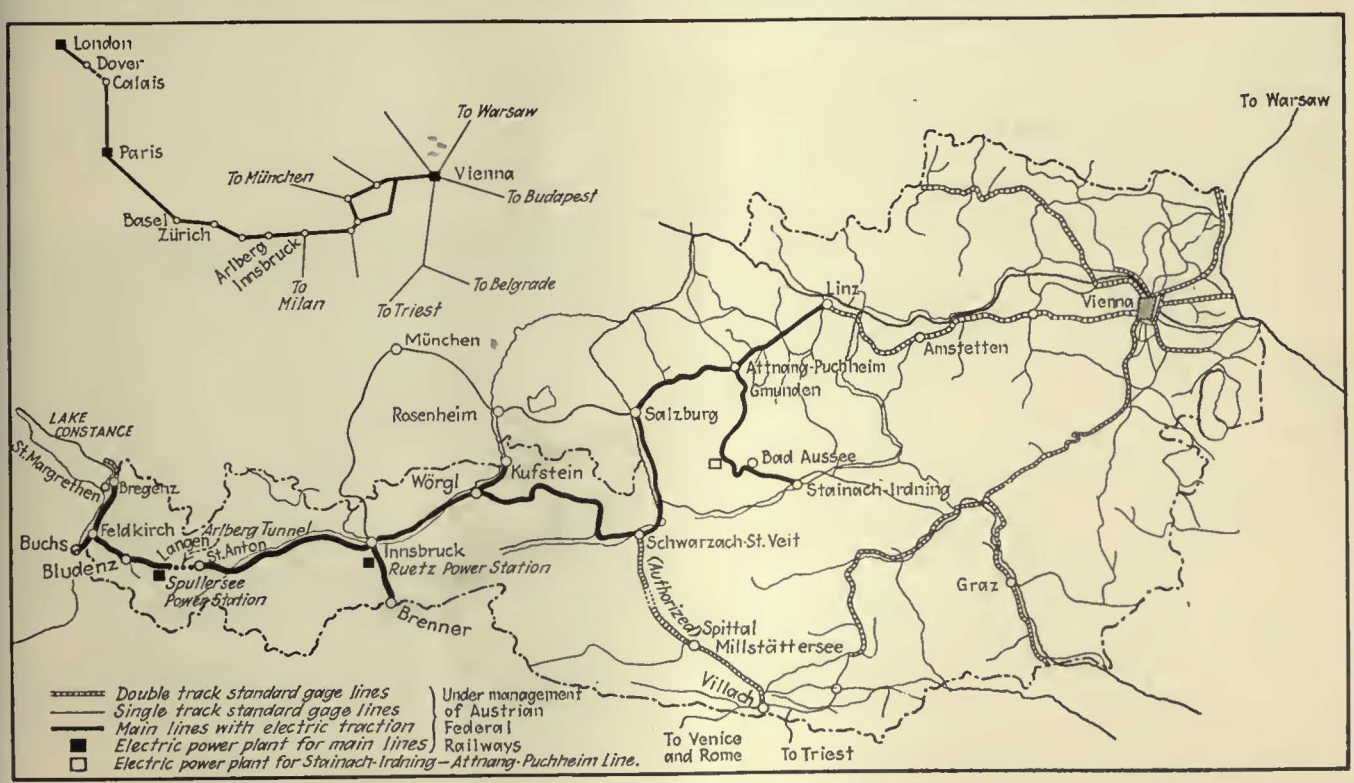
The steel catenary is 35 sq.mm. except for 50 sq.mm. at stations. It is usually under a tension of 600 kg. (1,320 lb.), but at stations it is rigidly anchored.

Electrification Speeds Up the Freight Service to Steam Passenger Speeds

The steepest grades on the main line are on the Arlberg division (Innsbruck-Bludenz) over a stretch of 136 km. (84.3 miles). This portion was opened in May, 1925. After electric locomotives were put in service on this division, freight trains were speeded up from 15 to 30 km. per hour (9.3 to 18.6 m.p.h.). This new maximum is greater than the speed of the former passenger train when operated by steam. The improvement on this stretch alone has been of noticeable help in competing for traffic between Paris and Vienna, with the South German lines via Salzburg, Munich, Stuttgart and Strasburg.

Another important advantage developed in electric operation is the greater effective capacity of train yards, which had grown to be inadequate with steam. In some districts, the expansion of such yards would be a very costly matter.

By 1928, the Austrian State Railways had in use or on order some 124 locomotives of eleven different types,



Electrified lines from the Swiss border into Austria

Austrian State Railway's freight locomotive of design shown in use on the Mittenwald Railway

two of which were Kando single-phase, multi-phase design for experiment. The service weights of locomotives varied from 55.4 to 118 metric tons; and their tractive effort from 55.4 to 89 tons. Hourly ratings ranged from 950 to 3,000 hp.; continuous ratings from 775 to 2,000 hp.

The earlier locomotives weighed only 14 metric tons per driving axle, then 15.2 tons and now up to 18 tons on rebuilt locomotives. Normal schedule speeds are on the order of 45 to 50 km. an hour (27.9 to 31 m.p.h.), but passenger trains attain a maximum speed of 80 km. an hour (49.6 m.p.h.) on level track.

All power is derived from hydro-electric plants as follows:

	Kilowatt Units in Use		Kilowatt Units Eventually	
Stubach	4	5,300	6	5,300
Mallnitz	2	3,300	4	3,300
Achensee	3	5,300	4	5,300
Ruez	2	2,200	2	2,200
	1	5,300	1	5,300
Spullersee	4	5,300	6	5,300
Total	16	74,600	23	107,700

Experts Differ With Regard to Salzburg-Vienna Change

In February, 1928, the Minister of Commerce and Traffic appointed a commission of eight steam, electric and financial experts to report on the feasibility of electrifying the Salzburg-Vienna continuation of the main line on the assumption of 20 per cent more traffic than was carried in 1926.

The cost of money was placed at 8.26 per cent, of which 7.3 per cent was for interest and 0.96 per cent for amortization on a 30-year basis.

As matters stand today, the Austrian State Railways have almost no fixed charges exclusive of the investment in electrification. As of Jan. 1, 1925, the railways were valued at 2,818,782,000 schillings (14 cents to the schilling) of which all but 87,790,000 schillings steam investment had been written off. Extensive electrification would change this picture, especially in regard to amortization.

Comparison with electric operation was made more difficult by the fact that the State Railways had not been making any regular allowance for depreciation but had made renewals on a more or less arbitrary basis.

If further electrification were put through, said the commission, the track structure should be strengthened to take locomotives weighing 18 tons per axle and making speeds up to 110 km. an hour (68.2 m.p.h.). The 42 kg. per m. (84 lb. per yd.) rail used over most of the Salzburg-Vienna section should eventually be replaced by the type of rail used by the German State Railways, that is, 49 kg. per m. (98 lb. per yd.).

How Cost Estimates Vary from Manufacturers' Figures

The cost estimate of the State Railways was 200,000,000 schillings ($28,000,000) on the basis of 2,890,000,000 gross ton-kilometer traffic or 20 per cent more than was moved in 1926. The estimate of the electrical manufacturers was 150,000,000 to 151,000,000 schillings ($21,000,000 to $21,140,000) on the basis of 2,240,000,000 gross ton-kilometer. The difference in traffic was due to the State Railways' assumption that at least five years would elapse before electrification was complete. The commission accepted the manufacturers' estimate

Mountain type high-speed passenger locomotive of 1100 series used by the Austrian State Railways

that five instead of six substations would do. The manufacturers estimate of investment for 110,000-volt tie-in lines was 1,800,000 schillings ($252,000) less than the State Railway's figures.

The cost of changing and conducting weak-current (telephone, telegraph, signal, etc.) circuits was set at 21,000,000 schillings ($2,940,000) by the State Railways but at only 11,400,000 schillings ($1,596,000) by the manufacturers. The State Railways also included 7,000,000 schillings ($980,000) rolling stock supplies.

Perhaps the greatest discrepancy was in the allowance for "contingencies." The manufacturers thought 2¾ per cent or 4,000,000 schillings ($560,000) was enough; the State Railways figured 9 per cent or 18,000,000 schillings ($2,520,000). The argument of the State Railways was that there might be a considerable upward move in material and wages over the five-year construction period.

As regards weak-current circuits, the commission concluded that because of the need for placing such wiring in conduit, the cost assessed against the railways after allowing for the benefit to the State Telegraph and Telephone Department should be closer to the State Railways' estimate than the manufacturers, viz., 16,800,000 schillings ($2,352,000).

Since telegraph-telephone disturbance would be avoided by the radical but costly cure of conduiting the spacing of substations could be made to depend entirely on the factor of line drop. The specifications called for a contact line range of 10,500 volts minimum to 16,500 volts maximum, with the proviso that the equipment must be capable of giving full output at 12,000 volts line potential. This condition favored long intervals between stations.

Section breakers as installed to date prevented the equalization of potential, but this could be remedied with special relays. Since the line voltage would not fall below 12,000 volts even with four stations, except for a rare congestion of trains, the commission agreed that five stations spaced an average distance of 79 km. (49 miles) would be adequate. The estimated transformer peak per station was placed at 11,000—12,000 kva. The total cost of the five substations was figured at 5,500,000 schillings ($620,000).

The commission decided that the initial supplies should be charged to capital account but that replenishments ought to be charged to operating account. The State Railways' allowance of 9 per cent for "contingencies" was accepted as correct, but owing to reductions in estimated investment, etc. the amount was placed at 15,000,000 schillings ($2,100,000) instead of 18,000,000 schillings ($2,520,000).

The commission refigured the total investment on the State Railways' assumption of 20 per cent more business (2,890,000,000 gross ton-kilometer). It calculated a cost of 174,500,000 schillings ($24,430,000) less a credit of 30,500,000 schillings ($4,270,000) for release of all steam equipment except switchers. This gave a total of 144,000,000 schillings ($20,160,000) as follows:

ESTIMATE FOR ELECTRIFICATION OF AUSTRIAN STATE RAILWAYS DIVISION BETWEEN SALZBURG AND VIENNA

	Schillings	
Overhead (850 track-km.)	25,200,000	
Substations (five)	5,500,000	
Rolling stock and supplies	76,300,000	
Electric heating	6,000,000	
Tower and service cars, etc.	800,000	
Dwellings for employes	900,000	
Changes in railway's low voltage circuits, incl. signals	9,000,000	
Changes in state telephone and telegraph circuits	7,800,000	
Changes in dispatching and maintenance layouts	5,000,000	
Changes in bridges, tunnels, and other clearance measures	3,000,000	
Changes in lighting	500,000	
Management, supervision, etc.	4,000,000	
Interest	15,500,000	
Contingencies	15,000,000	
Total	174,500,000	
Less credit for steam equipment transferred	30,500,000	
Total investment	144,000,000	$20,160,000

The rolling stock covers 127 locomotives totaling 10,358 tons with 5 per cent allowance for renewals totaling 60,905,000 schillings ($8,526,000); also 26 motor-car outfits of single and double units in equal number with 4 per cent allowance for renewals for 15,395,000 schillings ($2,154,000).

Perforated concrete poles used by the Austrian State Railways for transmission line betwen Hopfgarten and Soll-Lenkental on the Wörgl-Saalfelden route

The steam credit item included an allowance for new steam investment that would be required to handle 20 per cent more business.

Power requirements for the Salzburg-Vienna division were placed at 100,000,000 kw.-hr. per annum of which 35,000,000 kw.-hr. would come at 4.05 groschen (0.567 cents per kw.-hr.) and 65,000,000 kw.-hr. would come at 6.3 groschen (0.882 cents per kw.-hr).

Electrification was expected to increase the schedule speed of expresses from 68 to 83 km. per hr. (42.2 to 51.5 m.p.h.) or 22 per cent; and of freights from 27 to 38 km. per hr. (16.7 to 23.6 m.p.h.) or a 40 per cent increase.

The saving in personnel was estimated as 4.6 per cent of the labor cost in 1926 for 20 per cent more traffic and without regard to possible one-man operation of locomotives. It is observed that permission to run one-man locomotives in certain classes of service had already been granted. Furthermore, the German State Railways had introduced one-man operation on lines under 70 km. (43.2 miles) per hour maximum speed. In Switzerland, most of the Loetschberg and Rhaetian trains were driven by one man; and the Federal Railways had lately tried some one-man locomotive operation.

In maintenance, the State Railways figured that electric would cost 78 per cent of comparable steam equipment, while the manufacturers figured only 55 per cent. The commission's estimate is 55 per cent. One factor in the commission's calculation was that the later electric locomotives would be maintained for 15 to 20 per cent less than the first electrics, which were rather light for the service.

Would Electrification Pay?

In answering the question: "Would this electrification pay?" the commission was unanimous in declaring that, disregarding the direct merits and demerits of electrification, it would not pay within the 30-year period allowed for amortization. Beyond this point, the members disagreed.

It was estimated that with overhead charges of 8.26 per cent included, the annual cost of electrified service would be 2,425,000 schillings ($339,500) greater than steam.

Five of the commissioners believed that after the loan charges of 11,894,000 schillings ($1,665,160) had been wiped out and the rolling stock renewal allowance doubled, there would be a gain of 8,100,000 schillings ($1,134,000) in favor of electrification.

The three minority commissioners hold that the charges on the cumulative deficit would not be met by the surplus obtaining after the 30-year period. They ask: "Who can tell what the cost of fuel or electricity will be 30 years hence; or what the transportation requirements will be at that time?" Electrical equipment might also be very different after a period of 30 years.

Indirect Factors in Favor of Electrification

The five who favored electrification set forth the following factors:

More milage per vehicle; also less rent for freight cars after modern, through brakes are adopted.

Fewer special or extra trains.

More flexible operation of suburban service with motor-car trains.

More effective competition with aeroplanes for long-haul, high-speed travel, and more effective competition with motorbuses for short-haul travel on short headways.

Removal of the smoke and dirt nuisance would greatly increase patronage.

Note type of concrete tower used to carry high-tension transmission line over contact line at Kitzbühel between Wörgl and Saalfelden, Austrian State Railways

More effective competition with foreign lines for greater prorata of mileage because of improvements in speed and cleanliness.

Lower painting and cleaning cost of cars, upholstery, stations, bridges, etc., due to elimination of smoke and dirt.

Less cost for uniforms (which are paid for by the railways—Editor.)

Decrease in maintenance of weak-current circuits because of enclosure in conduit.

One-man operation of locomotives on an increasing scale.

Postponement of third and fourth track construction because of higher schedule speeds.

Lower fixed charges at some future date in converting assumed 7.3 per cent loan to lower rate when financing conditions become more favorable.

Increased safety: First, clearer view of track and signals; second, fewer non-scheduled train movements; third, greater ease in making up time because of better rates of acceleration and higher speeds than steam; fourth, better control because conduiting permits longer-distance telephoning and better tie-up of signal towers, booths, etc.

Standard steel pole with tension take-up weights between Leogang and Hochfilzen on the Wörgl-Saalfelden route, Austrian State Railways

Elimination of dependence on foreign countries for coal.

More healthful working conditions for train and shop personnel.

Smoke and dust relief for cities along the railway.

Recapture of valuable yard space now needed for coal storage and tanks.

More effective use of track when freed from tenders and water cranes.

No more freezing troubles, especially of heating lines.

Favorable opportunity afforded for modernizing schedules and maintenance facilities.

Stimulation of home material and labor markets.

The minority members saw things differently as the following summary shows:

The money in the renewal fund of non-

electrified divisions would not be available for some years because of the transfer of steam equipment from the electrified section to keep down investment cost. These steam divisions would therefore be compelled to operate with old, inefficient locomotives instead of buying better ones out of the renewal fund.

Less efficient use of personnel because of taking over surplus men from the electrified division.

Operating reliability would be decreased because interruptions of power affects whole divisions instead of single trains.

High-tension wires would increase employee hazards.

High tension would bring new fire hazards.

Greater hazard in crossing the right-of-way.

Visibility of signals decreased because of overhead wire and pole lines.

Greater difficulty in reaching the scene of an accident because a section may be dead.

Lack of locomotive construction designs based on long tradition.

Lack of flexibility on account of type of current, voltage and periodicity. (This ignores present Austro-Swiss operation—Editor.)

Greater stresses in draft gear because of heavier trains and greater acceleration.

Greater stresses in brake-rigging and wear of brakeshoes.

Factory owners would object to paying the higher cost of all-electric sidings. Such sidings would also interfere with existing cranes, derricks, etc., and increase hazards because of high tension.

The unfavorable financial balance with foreign countries would be increased from the present 7,000,000 schillings ($980,000) a year for foreign coal to 11,890,000 schillings ($1,664,600) for interest payments. There was hope, also, for more efficient use of Austrian brown coal in future.

Cost of capital would be excessive.

Modern steam locomotives with superheaters and smoke-consuming devices would do all that was expected of electricity, producing a saving of 5,155,000 schilling ($721,700) over electricity.

Indirect Advantages Justify Electrification Says Majority

In the opinion of the five majority commissioners, the indirect advantages of electricity are worth 1,500,000 schillings ($210,000) a year. This would reduce the electrical excess cost to approximately 900,000 schillings ($126,000) a year. After the 30-year amortization period, the gain from electrical operation would rise to approximately 9,600,000 schillings ($1,044,000) a year.

The initial extra electrical cost of $126,000 a year is held to be relatively small in comparison to the total gross of the Austrian State Railways. This was 566,000,000 schillings ($79,240,000) in 1926. Furthermore, increased traffic, and avoidance of higher wage and coal cost may be expected to change this deficit into a gain in a short time. A 10 per cent rise in coal would make steam operation cost 400,000 schillings ($56,000) more. On the other hand, a ½ per cent cut in interest return on conversion of securities would reduce the cost of the loan by 720,000 schillings ($100,800) a year.

A brief delay in electrification progress would not bring any important advantage but would disturb the labor and material market. A long delay would not be desirable in view of the electrification work of neighboring states.

The interim remaining until the completion of the electrification west of Salzburg gave ample time for the development of standards in maintenance and equipment. Delay, finally, would mean that any new steam locomotives ordered for the easy-grade Salzburg-Vienna division could not be advantageously adapted to the other, mountainous divisions.

While no interruption in electrification was desirable, the work could will be spread over a period of five years. This would make it easier to raise money, train men and shift steam equipment and personnel with less confusion. It would be most helpful to split the electrification as follows:

First year	Salzburg-Attnang-Puchheim
Second year	Attnang-Puchheim-Linz
Third year	Linz-Amstetten
Fourth year	Amstetten-St. Polten
Fifth year	St. Polten-Vienna

Comparison with Swiss conditions would not be fair, because the latter covered a network with a variety of lines. The traffic density of the electrified Swiss lines at the end of 1927 was only 60 per cent of the Vienna-Salzburg route, reckoning 20 per cent increase in the 1926 business of the latter.

Moreover, the Swiss lines were electrified during the highly expensive period of the war and just after. The same work would be cheaper today.

The minority suggestion of modernizing the steam equipment was so unlikely of fulfillment that no comment is made on the calculations offered.

The majority holds that the determining factors in electrification, aside from the fuel versus power cost, are the price of capital and the cost of meeting a given traffic density. In general, it paid to electrify busy trunk lines, and it did not pay to electrify lines of weak traffic. This explained the break in the Swiss and Swedish electrification program after the main-line work had been done.

Austria really was only at the start of electrification. Even so, only the following sections were under consideration:

Vienna-Salzburg	Vienna-Strass-Sommerein
Wels-Passau	Vienna-Graz
Bruck-an-der-Mur-Klagenfurt-Villach	

This totaled 900 km. (558 miles) or 30 per cent of the trunk line mileage. A decade had been required to electrify the 526 km. (327 miles) west of Salzburg and the 107 km. (66 miles) Salzkammergut area. The 558 miles suggested would therefore be likely to require fifteen to twenty years at the same rate of progress.

In view of the need for taking a perspective view, current financing and fuel conditions should not delay the electrification of the Salzburg-Vienna section.

Hungary had already decided to electrify its trunk lines, beginning with the section between Budapest and the Austrian border at Strass-Sommerein. This would certainly spur electrification of the Austrian trunk line east of Vienna. Mid-Europe would then have an all-electric operation of 1,400 km. (992 miles).

It is finally declared that electrification means a great increase in the value of property, and this will produce more revenue from taxes. This would also relieve the government from paying a considerable amount in unemployment doles. Such benefits justify following the lead of Switzerland, which had promoted electrification with the aid of a subsidy.

Indirect Disadvantages of Electricity Forbid Electrification, Says Minority

The minority report asserts that the disadvantages of electricity outweigh the advantages. Therefore, the estimated excess cost of electrification remains unaltered. While repeating the allegation that smoke-consuming devices are available, the minority admits that electrification is generally regarded as modernization and that the traveling public demands it.

If the non-electrified sections were supplied with 183 new instead of transferred locomotives, 11 per cent fuel or 1,200,000 schillings (168,000) would be saved in a year.

They also asserted that the 30 per cent higher speed of electric operation would increase brakeshoe costs 50

per cent or 75,000 schillings ($10,500) a year. In Austria, the cost of money was very high while coal was particularly low.

Swiss figures for 1927 did show a saving of 1,750,000 francs ($337,750) for electrification, but this was based on a 5½ per cent cost of capital, not 7.3 to 8.26 per cent. Furthermore, the Swiss coal figure was 38 francs ($7.33) per metric ton of 7,500 calories, while the Austrian figure was 23.86 schillings ($3.34) for ton of 4,300 calories.

Traffic density per kilometer was 5,500,000 gross ton-kilometer compared with 9,200,000 gross ton-kilometer on the Salzburg-Vienna division.

The minority said that endorsement of electrification would no doubt be more agreeable to the public and perhaps to the government, but it could not be recommended from the economic viewpoint.

Excluding Switzerland, whose 60 per cent electrification was due to total absence of coal, Austria was well ahead in proportion of electrified track as shown by the following tabulation for conditions in 1927:

	Per Cent		Per Cent
England	2.1	Italy	6.6
Germany	2.2	Sweden	7.5
France	2.3	Austria	8.7

On conclusion of the electrification eastward to Salzburg in 1929, Austria's ratio of electrification would be 12 per cent.

Full-Time Man Substitutes for Safety Committees

ON THE system of the Northern Ohio Traction & Light Company, a departure has been made from the usual plan of safety committees. The latter was followed for a year, but was abandoned in favor of a full-time safety superintendent, known as superintendent of accident prevention, with safety committees making investigations on special days and submitting reports. This plan has been found more efficient.

To maintain interest among the employees, the company has an honor roll with emblems which are presented to employees operating without accidents for periods of one, two and three years. These honor rolls are posted at division headquarters and the emblems are presented annually to the winners by the general manager of the company.

The left-hand or northbound track was raised 14 in. to eliminate double bump in highway crossing

North Shore Line Builds Model Grade Crossing

RECENTLY the Chicago, North Shore & Milwaukee Railroad completed a double-grade crossing over the tracks at Kinzie Avenue and Osborne Road, Racine, Wis., transforming a former "rough spot" into a safe and satisfactory rail-highway junction. To eliminate the double bump caused by the banking of the two tracks for the same-level curve, the northbound track was raised 14 in., starting 400 ft. north of Osborne Road and continuing to a point 250 ft., south of Kinzie Avenue. The vertical curve on the surface of the crossing with the crest just east of the tracks created by the new work is so gradual as not to be noticed. Creosoted planks, 4 in. thick, were spiked to the track ties and surfaced with 2 in. of elastite. New concrete and asphalt paving extending 28 ft. to the east and 4 ft. to the west of the tracks was laid on the crossing approaches. This was the only part of the job not handled by the North Shore Line's own maintenance forces. With the permission of city officials a drainage system installed to carry off all surface water was connected with the municipal sewer and three drains placed along the right-of-way. Estimated cost of the whole job of crossing reconstruction is placed at $6,000.

Looking east in Kinzie Avenue, Racine, across revamped rail-highway crossing of North Shore Line

C., H. & D. Railway
Modernizes Power Supply

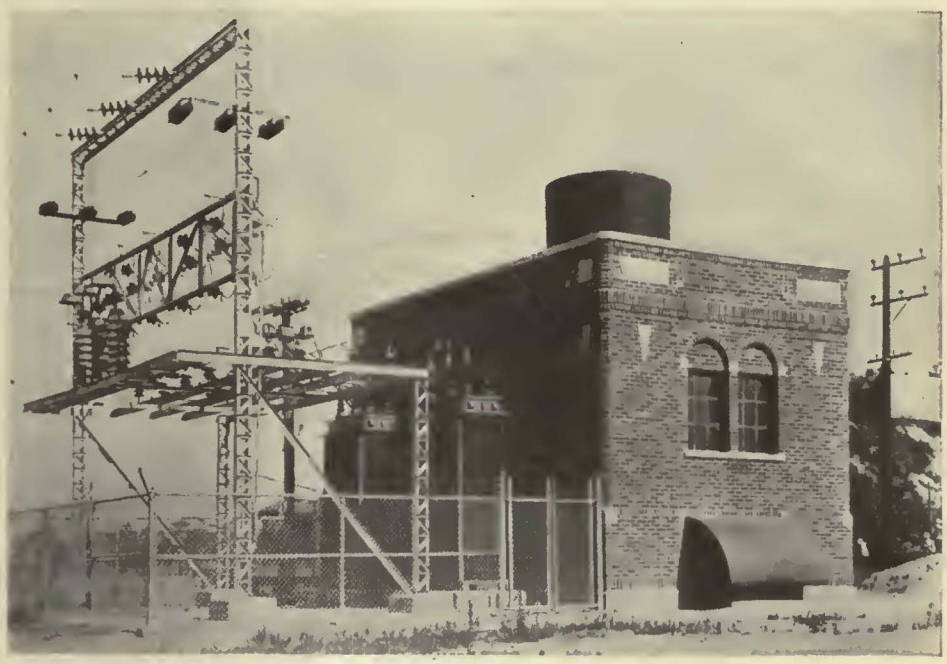
Automatic substations replace obsolete manually-operated stations, and purchased power is used instead of power generated in the railway's old steam-driven power plant

By H. A. Rose
General Engineering Department, Westinghouse Electric and Manufacturing Company

POWER for traction purposes on the Cincinnati, Hamilton & Dayton Railway formerly was generated in the company's power plant near Hamilton, Ohio, by reciprocating engine-driven generators of obsolete design, at 390 volts, three phase, 25 cycles. This was stepped up by transformers to 33,000 volts for transmission purposes. Naturally, power costs were high, particularly as the load had outgrown the power system. It was found that a substantial saving could be made by scrapping this plant and purchasing 60-cycle energy.

The six old manual substations had 25-cycle, 600-volt, compound-wound synchronous converters, with total capacity of 3,900 kw.

With insufficient feeder copper the average trolley voltage was low. Passenger schedule speeds were at times curtailed and power for freight haulage was insufficient.



One of the substations, showing the high-tension equipment and the hood for protecting the air inlet

In order to determine the proper locations and capacities for substations, a graphic study was made of power demands of each train, from which the heaviest daily loading for each 5-mile section was indicated. An economic study was made to determine the direct-current distribution losses and the average voltage conditions for different substation spacings. The losses were compared with the investment required to finance a new substation of proper rating. With slight modifications, the arrangement best suited to meet the requirements was found to be that given in the map. The total conversion capacity of the new substations is 3,800 kw.

The average substation spacing under the new system is 7.64 miles, as compared with 10.7 miles for the old system.

Since the capacity of each substation was determined on the basis of sufficient nominal rating to handle the present maximum load conditions adequate capacity is available for any normal increase in power demand. It follows that any future traffic developments requiring added system capacity would be most economically handled by the addition of substations midway between the existing locations rather than by the installation of a second unit, requiring additional feeder copper. For this reason all except the end stations are of the single-unit type.

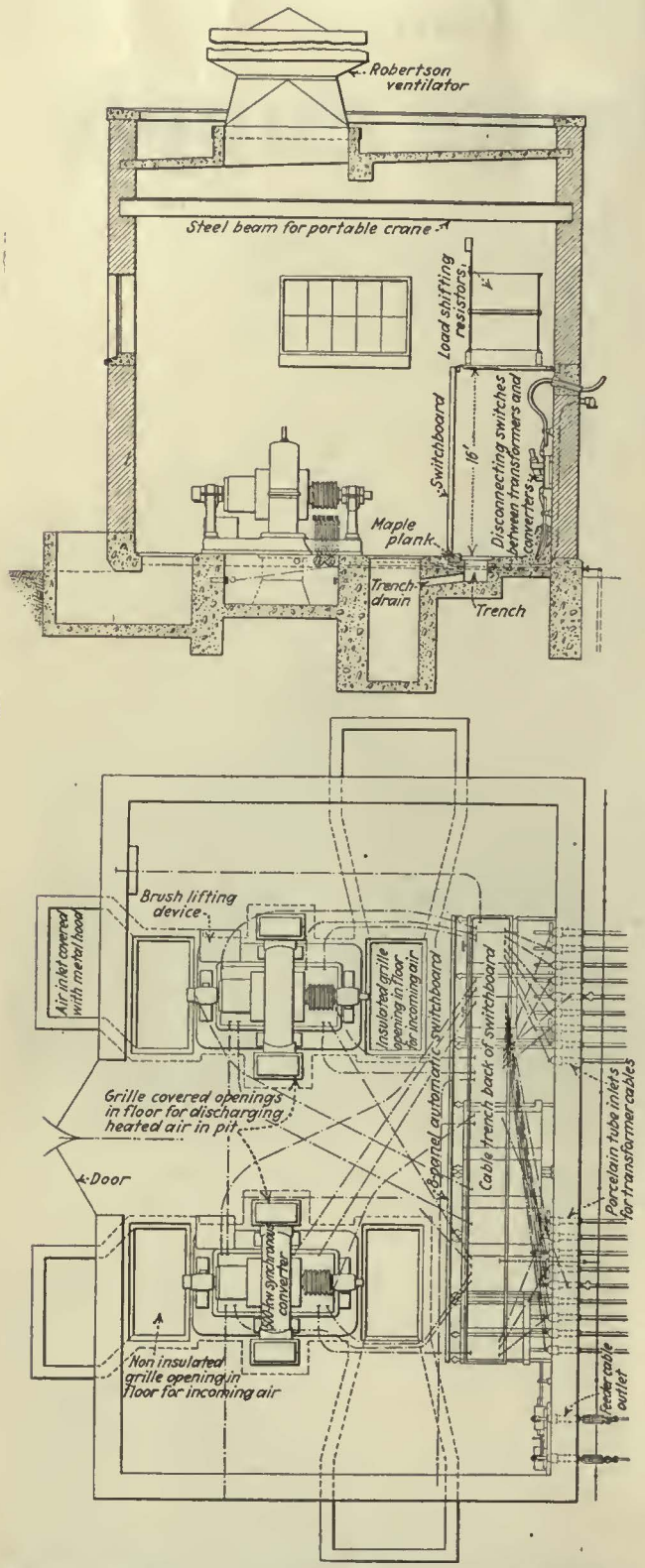
Although the methods used for determining substation capacities indicated that a two-unit 1,000 kw. station was required at Hamilton, it was decided to locate a single-unit 500-kw. station on each side of the city.

Although a single-unit substation would ordinarily be sufficient at each end of the line, a station failure would

COMPARISON OF OLD AND NEW SYNCHRONOUS CONVERTER SUBSTATIONS OF THE CINCINNATI, HAMILTON & DAYTON RAILWAY

Name of Station	Old Stations		New Stations	
	Units	Total Kw.	Units	Total Kw.
O'Neils	3	900	2	1,000
Miamisburg	1*	300	1	300
Franklin	2	600	1	300
Elk Creek	..	...	1	300
Trenton	2	600	..	...
Coke Otto	..	...	1	500
Lindenwald	3	900	1	500
Pleasant Run	..	...	1	300
College Hill	2	600	2	600

*Portable substation.



Plan and elevation of O'Neil's substation, showing ventilating system and arrangement of power ducts

cripple service, since the power required would be fed stub end from the adjacent station. Also, the growing passenger business near Dayton and a particular freight haulage situation near College Hill made advisable the addition of a second unit. O'Neils and College Hill are the only two-unit substations on the property. The O'Neils substation near Dayton has two 500-kw. synchronous converters, while the College Hill substation near Cincinnati has two 300 kw. machines.

New buildings were constructed for all the substations except College Hill, which was remodeled, incorporating the same essential design features used in the others. The structures, which are of red tapestry brick, are well proportioned and pleasing in appearance. The interior dimensions for the 300 and 500-kw. single-unit substations are the same. The following table gives the dimensions for the various types.

STATION INTERIOR DIMENSIONS

Station Capacity	Floor Space, Ft.	Height, Ft
Two-unit 500 kw	17½x28	16
Two-unit 300 kw. (remodeled)	21 x30	25
Single-unit 500 kw	17 x16½	16
Single-unit 300 kw	17 x16½	16

Air for ventilation enters inlets on adjacent sides of the building, is carried downward under the foundation and floor, and enters the interior through a grille-covered opening at each end of the converter bedplate. After passing over each bearing into the armature and field windings it is discharged radially on each side of the field frame. A single Robertson type ventilator in the roof, in line with the pressure belt built up by rotation of the armature, discharges the heated air. For the single-unit substations the ventilator is placed to one side of the converter in line with the direction of rotation. This assures efficient ventilation and at the same time prevents leakage of water on the machine.

Recirculation of air through the machine is reduced by small scavenging ducts which maintain a constant flow of air from the pit to small openings in the floor on each side of the field frame.

A hood covers each inlet at the entrance to the air ducts to prevent the entrance of rain and snow. The ducts are of large cross-section to insure low air velocities, thus aiding in the precipitation of entrained materials. A certain amount of moisture, snow or dirt, which may enter on windy days, is in this way deposited before entering the substation.

One of the illustrations shows the method of terminating a number of large conduits in the pit. All conduits leading to the machine terminate here instead of passing through the floor near the bedplate. This arrangement facilitates cleaning and adds to the appearance of the substation interior.

A trench in the floor at the rear of the switchboard terminates the control and power cables between the machine and transformers. This provides a junction or pull box, which aids in the installation and inspection of the cables.

Power is supplied to the railway's 33-kv. high-tension lines from the Union Gas & Electric Company's Hamilton substation. The high-tension lines are sectionalized at this point, one section feeding the substations located north, and the other those south.

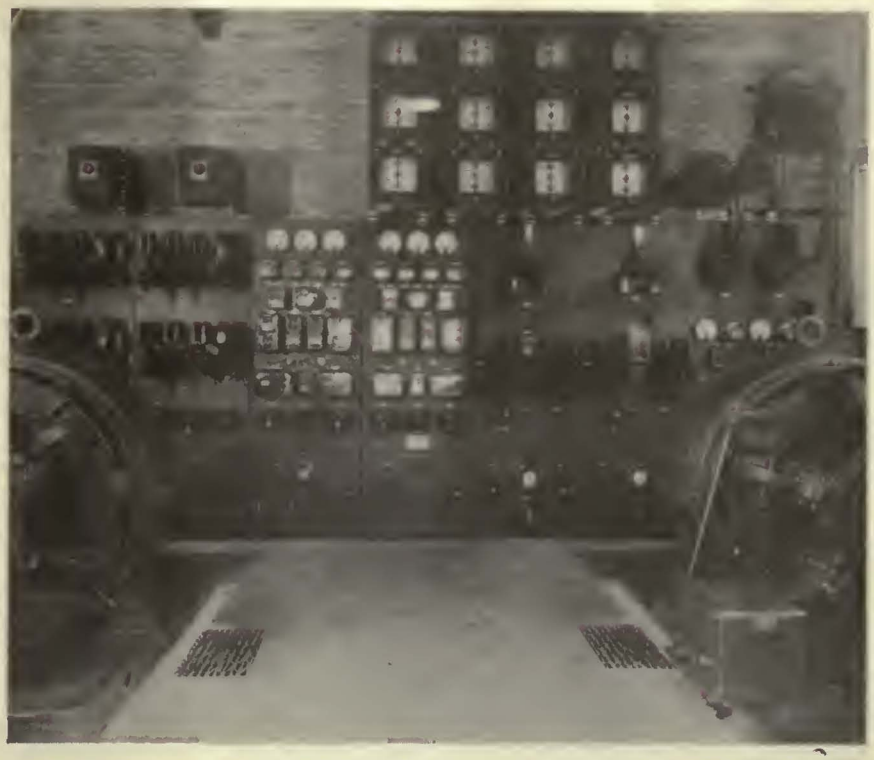
Manually-operated high-tension pole-top switches near each station make it possible to sectionalize at any of these in case of a high-tension line fault.

Inexpensive steel structures are used for mounting the high-tension switching and protective equipment and for making taps to the power line. The high-tension equipment consists of three-phase lightning arresters, three-pole gang-operated disconnecting switches, choke coils and expulsion-type fuses. High-tension oil circuit breakers are not used, since the light-load losses of the transformers are not sufficient to justify them.

Shunt-wound synchronous converters connected to

low-reactance three-phase transformers convert the 33-kv. three-phase power to 600 volts direct current. The many advantages to be obtained through the use of the shunt machine were responsible for its adoption.

The shunt converter with transformers of 7 per cent reactance gives a direct-current voltage regulation of approximately 5 per cent. The effect of this characteristic is to cause a shift in part of the load to adjacent substations, thus automatically providing for greater conversion equipment capacity at times of heavy loads. In automatic substations, resistance must be inserted between the machine and the bus when the load builds up to a value sufficient to endanger the machine. By lowering the bus voltage in proportion to the load, part of the load is shifted to the adjacent substations. Experience has shown that with compound-wound machines, two such steps of load-shifting resistance are desirable. With shunt machines, one step is all that is necessary.



The switchboard and a partial view of the two converters in the O'Neil's substation

The use of shunt or drooping voltage characteristic makes possible savings in the car resistor losses incident to the acceleration of heavy interurban or freight trains. This saving obtains through the lesser time required by the motorman to reach the series or full parallel combinations.

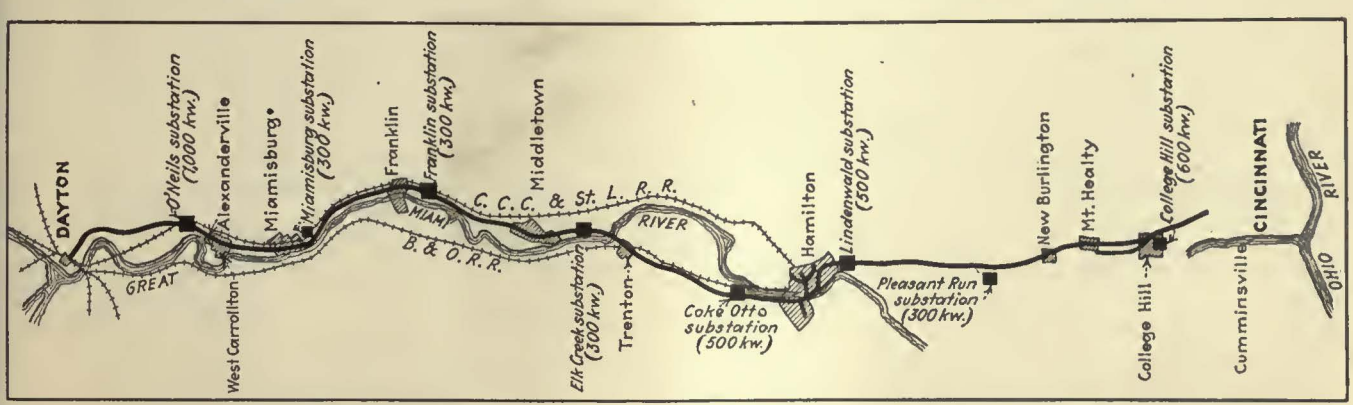
The shunt converter operates at leading power factors above 95 per cent between one-third and full load. From full load to 1½ load the power factor is slightly lagging, being approximately 99 per cent for the higher value. With compound machines and the high reactance transformers required, the deviation from unity is much more pronounced, being approximately 85 per cent lag for one-third load and 97.5 per cent lead for 1½ load. Since the load factor of the railway's substations is necessarily low, it follows that the leading power factor, obtained at light loads through the use of shunt converters, is advantageous.

The kilovolt-ampere rating of the transformers is equal to the nominal kilowatt rating of the synchronous converters. A spare 500-kva. transformer is available in the event of failure of any of those in service. Each transformer has a 10-kva. single-phase, 440/110-volt tertiary control winding.

The substations are arranged for both full and semi-automatic operation and are unattended except for periodic inspections. Full automatic operation provides for starting and stopping of the station in response to load, and stopping if faults develop which might prove detrimental in case of continued operation. Troubles of a serious or permanent nature lock the equipment out of service, and an inspector must restart the station. Troubles of a minor or less permanent nature allow the station to be placed back in service as soon as normal conditions are resumed, providing the load is such as to demand additional machine capacity.

Under semi-automatic operation the station runs continuously until shut down manually or by the functioning of a protective device which either locks or holds the equipment out of service, depending on the nature of the fault. For troubles of a minor or less permanent nature, the equipment in semi-automatic operation functions to hold the unit out only during the fault period, it being returned to service as soon as conditions become normal.

The change from full to semi-automatic operation is made by a double-throw knife switch. It is customary practice to retain at least one station under continuous



Eight substations now supply power to the Cincinnati, Hamilton & Dayton Railway system

or semi-automatic operation as the master station. The others then stop and start in response to load in their immediate vicinities.

In order to sectionalize the feeder system and to protect the machines from damage due to short circuits between the trolley and rail, two automatic short-circuit detecting, service-restoring, contactor-type breakers are installed at each substation. An insulator in the trolley

Converter pit and air inlet construction

circuit in front of the stations sectionalizes this circuit. Power is thus fed each way from the stations through a single feeder.

In event of a short circuit on one section of track, the short-circuit detecting feeder equipments, which supply this section from adjacent stations, open. This removes the faulty section of line while service is allowed to continue on the normal sections. Following the opening of a feeder contactor, a resistor, which is permanently connected across the main contacts, feeds a small current into the circuit presumably at fault. A sensitive relay, connected in such a manner as to measure the resistance of this circuit, automatically recloses the contactor as soon as the circuit resistance has risen sufficiently to indicate that the fault has been removed.

For convenience of inspection and reference, all switchboard devices are marked either by metal plate numbers for devices mounted on the front of the switchboard, or with painted figures for those back of the switchboard. These are in accordance with the latest Power Club device numbers. This indicates the particular purpose for which the device is used. All resistor tubes, fuses, connections and terminal blocks are given wiring numbers. This facilitates inspection and reading of wiring diagrams. It is with the protective device numbers that the annunciator targets of the lockout relay are labeled.

The switchboard and auxiliary equipment are insulated from ground by maple planks in the floor and wall. This arrangement practically eliminates the danger from accidental grounds in the wiring from doing damage.

The electrical equipment for the substations was supplied by the Westinghouse Electric & Manufacturing Company. J. W. Bishop, superintendent of substations for the Detroit Edison System, was consulting engineer, while engineering work in connection with the rehabilitation of the power supply was under the direction of the company's chief engineer, J. E. Dallas.

Milwaukee Devises Test for Substation Operators

SUCCESS in the selection of motormen by means of a standardized test, as worked out by the educational department of the Milwaukee Electric Railway & Light Company, has been so impressive that an investigation into the possibilities of developing a somewhat similar means of forecasting the capabilities of applicants for substation operators' posts was undertaken recently at the urgent request of the electric distribution department of the company. The methods developed in making tests for selection of motormen were discussed in articles in ELECTRIC RAILWAY JOURNAL for April 10, 1926, page 624, and Nov. 10, 1928, page 830. Preliminary to any attempt to prepare a selection test a detailed job analysis was made, the task being delegated to a young engineer who started as a station operator and had worked at the various substations of the company for more than 2½ years. This study took a month, and when completed made it possible to specify the necessary qualifications for the position.

The work of the substation operator consists essentially of the following duties: (1) Daily inspection of substation equipment; (2) putting machines on the line; (3) removing machines from the line; (4) testing relay protection, primary and secondary meters, feeder regulators, etc.; (5) cleaning and charging lightning arresters; (6) clearing rotary converters, rectifiers, transformers, and other station equipment of minor troubles; (7) tracing trouble in station wiring; (8) answering telephone and door.

Qualities Necessary for Station Operator

From careful study of the job analysis, visits to a large number of the stations, observation of operations in each, discussion of the work with supervising engineers, and an analysis of types of errors most frequently made by station attendants, the qualities needed by a successful substation operator were summarized: (1) Ability to understand and carry out written directions; (2) ability to understand and carry out oral directions; (3) ability to distribute attention; (4) ability to act quickly; (5) caution; (6) good emotional control; (7) at least average intelligence; (8) good mental control; (9) good memory for numbers and location.

With the above data at hand a group of tests was devised for experimental purposes, consisting of an apparatus designed to measure reaction time, distribution of attention, learning ability, memory, emotional control, freedom and co-ordination of movement. This apparatus as designed and built consists of three parts, a signal and response board, an automatic signal control and recording machine and a tachistoscope. The last is a small box with a cross slot past which five-digit numbers move at approximately five-second intervals. The switchboard contains seven switches of the various types encountered in an ordinary substation. Five of the switches are numbered; the three-pole, double-throw switch is lettered A; the two-pole, double-throw switch is lettered B. Switches A and B provide master control of the five numbered switches. Whenever one of the numbered switches is operated, switch A or switch B must be closed to right or left to complete the desired circuit.

There are three signals, two audible, one visible. These

are a horn, a buzzer, two small green lights and a large red one.

The individual under test is supplied with typewritten directions, giving him the sequence which must be followed in acknowledging and shutting off each of these three signals and the emergency red light signal. He is allowed to read and reread these instructions until he believes he understands them and is ready to practice the answering of them at the test board. This study of instructions lasts from three to fifteen minutes, according to how quickly the individual assimilates the printed word, and how thoroughly he feels it is necessary for him to understand directions before trying to carry them out. He then goes to the test board for practice and is given the various signals, to which he responds by manipulation of the switches in definite sequence. He is drilled on these responses until he feels satisfied he can go through all of them without error. This practice period may last from six to twenty minutes, depending on the individual. The instructions relating to the answering of the emergency signal appear on the instruction sheet, but are not unduly emphasized.

The test is commenced with the individual seated at a convenient distance and angle from the test board. He is instructed to copy on a sheet of paper as rapidly and accurately as possible the five-digit numbers which commence to appear in the illuminated slot in the tachistoscope. This work is to be interrupted when signals sound or flash on the board, but is to be resumed as quickly as possible, however, following the answering of the latter. There are 25 signals in all during the test, with two emergency signals. Correctness of responses, errors, and reaction time, as well as the operator's method of handling the switches, are recorded graphically on a tape paralleling the signal sequence tape in the automatic control unit. Reaction time to all signals is measured in hundredths of a second by means of a stop watch which starts and stops with the start and stop of the signals.

The test results of 50 regularly-employed station operators of the company were checked against ratings given the men by two engineers directly responsible for their work and in constant touch with it. Each man was rated with respect to speed in carrying out orders, behavior under emergencies, caution, attention, and mental capacity. The ratings were repeated three separate times at one-month intervals to improve the reliability of the findings. The form used in the ratings is reproduced.

Agreement between the ratings given by the two engineers and that determined from the combination of selection test and accompanying interview, given each of the 50 men tested, has been so close that it has been decided no further experimentation is necessary before utilizing the test as a selective measure. That the investigation has already paid for itself is freely admitted. The test has disclosed one man who was in a serious nervous condition unfitting him for service, and several others were found whose temporary removal from the job for treatment was considered advisable. Transfers and promotions have already been made on the basis of the selection and interview results. It is expected that the test will prove immensely valuable, not only in the reclassification and treatment of the remaining 50 station operators yet to be checked, but also in the selection of new men.

The test board was designed to measure an individual's reaction time, distribution of attention, learning ability, memory, emotional control, freedom and co-ordination of movement

E.M.B.A. Educational Department

Rating of Station Operators

Date.....

Name .....Location.....Date Employed.....

Check one item, under each heading, which best describes the above station operator.

Speed in Carrying out Orders

—Very rapid.
—Rapid.
—Fair.
—Slow.
—Very slow.

Caution

—Very careful even to minor details.
—Usually careful, occasionally slips on minor matters.
—Occasionally cautioned.
—Careless, often cautioned.
—Reckless.

Mental Ability

—Superior intelligence. Thinks things out for himself.
—Good. Quickly grasps directions.
—Average. Follows orders, but needs specific instruction.
—Fair. Needs considerable supervision. Difficult to teach.
—Poor. Untrainable.

Behavior Under Emergency Conditions

—Excellent control under difficult conditions.
—Good control—never loses his head, but noticeably disturbed.
—Upset under unusual conditions, but sufficient control to regain composure quickly to carry out instructions.
—Rather easily upset. Becomes confused but can carry out direct instruction.
—Nervous, very easily confused, cannot be depended upon.

Attention

—Always alert and on the job. Puts self into job.
—Attentive. Carefully watches job. Passively rather than actively.
—Carries out routine but attention is somewhat divided.
—Mind wanders. Often not alert.
—Inattentive, negligent.

.....
Rater

This form facilitates rating individual substation operators in Milwaukee

Pullman Car on South Shore Line

ON FEB. 16, the Chicago, South Shore & South Bend Railroad used its first regular Pullman sleeping car, when it carried 35 members of the University of Illinois track team from South Bend, Ind., to Chicago in a special car attached to one of the hourly South Bend limited trains. At the conclusion of the meet, the sixteen-section sleeping car was ready at the terminal for the athletes to retire. It left South Bend at 4 a.m., attached to a Chicago limited train for Roosevelt Road, Chicago. According to officials of the company, this is one of the few instances in which a Pullman sleeper has been used in service on an electric railroad.

Large Car Yard

Designed for Dorchester Extension

Storage space now provided for 60 rapid transit cars. Additional tracks may be installed later. Complete yard signal system facilitates handling of large number of trains which end runs at this point

Aerial view of the terminus of the Dorchester Rapid Transit Extension, showing the Codman Street yard in the foreground and the Ashmont Street station beyond the yard

SOUTH of the Ashmont Station on the Dorchester Rapid Transit Extension of the Boston Elevated Railway is the new Codman Street yard. After trains terminate their runs at this station they continue south, either going to the by-pass track between Ashmont station and the Southern Artery, Codman Street, or continuing over the bridge spanning the Southern Artery to the Codman Street yard. If a train is to go back into service immediately the by-pass track only is used. If it is to be laid up, if additional cars are to be attached to the train, if the length of the train is to be reduced, or if inspection or other work is to be done in connection with it, the train goes to the yard.

The relay track south of Ashmont station is parallel to the two main-line tracks. Between the northbound and southbound track is a raised wooden platform installed for the purpose of allowing the train crew to change ends quickly and to facilitate the cleaning of the train that is to go back into service immediately. It is shown in the bottom illustration on page 364.

All of the switches and signals between Ashmont station and the entrance to the Codman Street yard are controlled from a tower, indicated as *Q* in the accompanying diagram of the yard. This section is well lighted by overhead illumination, and suitable plank walks have been provided so that the trainmen, inspec-

The yardmen's building, at the entrance to the yard, is used by the yardmen of the transportation department, the department of rolling stock and shops, and the trackwalkers, signal men and others of the maintenance department

tors and others can safely and readily walk between the yard and the station.

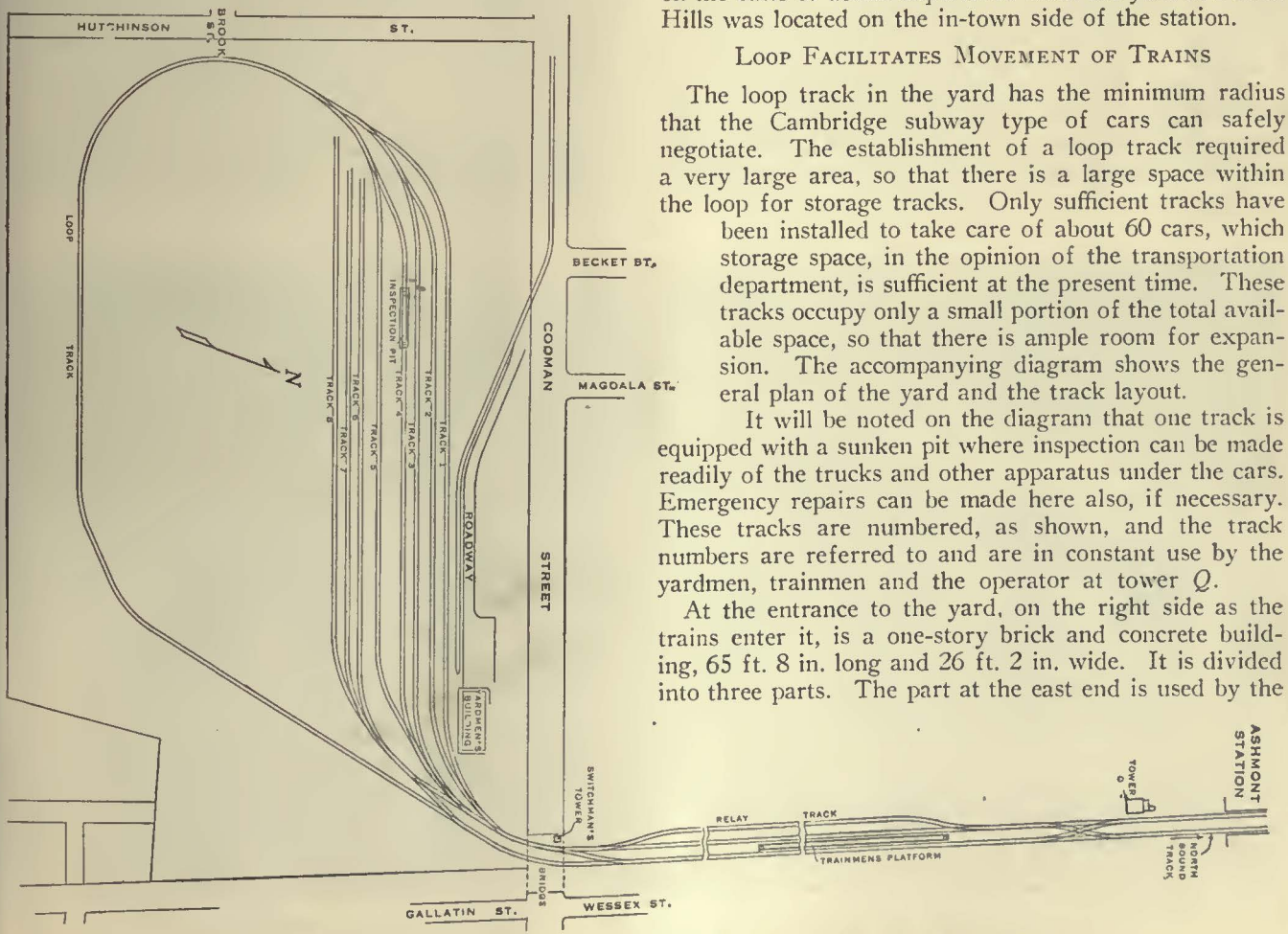
The Codman Street yard is located on a large tract of land containing about 1½ acres, just south of the new Southern Artery and west of the high-speed trolley tracks that will later lead to Mattapan. The yard was located here for three reasons: First, because the area available was sufficient; second, because practically all of the land was already owned by the city of Boston, this area having been used formerly as a stone quarry from which broken stone for the repair of the streets was obtained; third, it was located in the proper position south of, or beyond, the terminal station, which corresponds to the location of all storage yards on the rapid transit lines of the Boston Elevated Railway system. The company has found that for economical and efficient operation of rapid transit trains or cars the yard must be located beyond the terminal station. In recent studies for rapid transit facilities, suggestions have been made that terminal yards be located on the in-town side of the terminal station. The operating and engineering staffs of the Boston Elevated Railway, however, favor the other plan on the basis of actual experience when the yard at Forest Hills was located on the in-town side of the station.

Loop Facilitates Movement of Trains

The loop track in the yard has the minimum radius that the Cambridge subway type of cars can safely negotiate. The establishment of a loop track required a very large area, so that there is a large space within the loop for storage tracks. Only sufficient tracks have been installed to take care of about 60 cars, which storage space, in the opinion of the transportation department, is sufficient at the present time. These tracks occupy only a small portion of the total available space, so that there is ample room for expansion. The accompanying diagram shows the general plan of the yard and the track layout.

It will be noted on the diagram that one track is equipped with a sunken pit where inspection can be made readily of the trucks and other apparatus under the cars. Emergency repairs can be made here also, if necessary. These tracks are numbered, as shown, and the track numbers are referred to and are in constant use by the yardmen, trainmen and the operator at tower *Q*.

At the entrance to the yard, on the right side as the trains enter it, is a one-story brick and concrete building, 65 ft. 8 in. long and 26 ft. 2 in. wide. It is divided into three parts. The part at the east end is used by the



General plan of the Codman Street Yard and the tracks leading to the Ashmont Station

The interlocking tower of the complete yard signal system installed is shown at the right of this view

yardmen of the transportation department; the middle section is used by the department of rolling stock and shops, which will keep here certain material and tools for inspecting and making repairs to cars; and the west portion has been turned over to the maintenance department for the use of trackwalkers, signal men and others. The maintenance section will be used in winter for the use of additional men sent to the yard to remove snow and keep the switches open during snowstorms. The building is equipped with ample toilets and washing facilities. It is heated by steam, the heating plant being located in the basement at the west end.

From Dorchester Avenue to the Codman Street yard, a track has been installed in the center of the Southern Artery, leading into the yard, parallel to track No. 1, and terminating near the yardmen's building. Alongside this track is a driveway which is used for hauling material to, or taking it away from, the yard or the yardmen's building.

There is a system of inter-communication connecting tower *Q*, the yardmen's building and a small switchman's booth located near the Southern Artery Bridge. This is complete in every detail, the three locations being connected with both main line and inter-communicating telephones, call bells and a special annunciator system. The bell signals are used by the towerman in calling upon the yard force to put a relay train into road service, in notifying them when a road train is to be removed from service, etc. The annunciator is used by the yard-

Looking north from the yard. The track at the extreme left is the relay track, used for trains which are to go back into service immediately. Note the wooden platforms for the trainmen and trackwalkers

men to notify the towerman of required routes to be set up for train movements through the interlocking. Telephones are, of course, for securing and transmitting a variety of information, where greater detail is necessary than can be given by bell code or annunciators.

The annunciator in use was especially designed. It consists of push-button controls and miniature lights at both the yard building and switchman's booth, and with miniature indicating lights, cancelling buttons and buzzer at tower *Q*. In calling for a route to be set up, the

Looking south from Ashmont Station, showing the Codman Street yard in the background. The platform, shown in the center of this view, allows the trainmen to change ends quickly and facilitates the cleaning of cars

yardman pushes the button at either the yardmen's building or the switchman's booth. This call is indicated at tower *Q* by both the light and audible signal. The corresponding light is also displayed at the originating point and continues to show until the route has been set and train movement made, after which it is cancelled by the towerman. By this method, accuracy on the part of both men is required. As both men have the indication of what was called for, disputes are avoided.

New Englanders Express Faith in Rail Transportation

Discussion at Providence meeting centered on problem of making transportation salable and importance of modern cars

THAT the electric railway is certain to be a permanent form of transportation and that steps should be taken to improve the equipment and make it more attractive to the public were the opinions advanced by members of the New England Street Railway Club who met at the Narragansett Hotel, Providence, R. I., on Feb. 21. The sessions were presided over by Walter C. Slade, president of the club and vice-president United Electric Railways, Providence, R. I.

The afternoon session was devoted entirely to the presentation and discussion of a paper by Henry S. Day, superintendent of equipment United Electric Railways, on the subject of modern electric cars for city service. Mr. Day pointed out that it is the job of the railway to hold the present patrons by giving good service and, as congestion increases, to sell the transportation product to as many automobile drivers as possible. "To hold the present riders," he said, "we must change the appearance and riding qualities of our trolley cars because the present-day rider is thinking in terms of the automobile." He discussed the newer types of cars that have been introduced and then concentrated on the present types of standard cars and what could be done to improve them. Mr. Day spoke of the desirability of reducing the weight of railway cars and pointed out that with aluminum it is possible to reduce the weight very materially without sacrificing durability or strength.

Mr. Day then reported the results of an extensive investigation that he and Mr. Webber of his company have made of the use of the lighter metal in cars. A tentative set of specifications for the construction of a car with body and trucks of aluminum has been prepared, the car being essentially a duplicate of the present lightweight cars in service in Providence. The standard steel car with a quadruple equipment of 35-hp. motors and K-control weighs 31,500 lb., according to Mr. Day. The same car, made of aluminum with leather upholstered seats and linoleum covered floors, equipped with four 25-hp. motors and K-control, he said, weighs approximately 23,000 lb. He stated further that stress diagrams indicate that the aluminum car is as strong as the steel car, and it does not appear that the maintenance of aluminum would differ materially from that of steel.

He also pointed out that the use of aluminum would allow the installation of heavier seats and flooring, thereby increasing riding comfort and decreasing noise, due to the changes in the floor construction. At the same time the total weight would be decreased by some 8,500 lb. which would result in a lower power consumption and lower cost of maintenance of the equipment.

In discussing Mr. Day's paper, W. J. McKee, president Osgood Bradley Car Company, brought out that 8,500 lb. can be saved in the frame of the car by substituting aluminum, 1,500 lb. in the trimmings and 1,700 lb. in the motor, making a total saving of approximately 11,700 lb. on a standard 40- to 44-passenger double-truck car.

A. H. Woollen, representing the Aluminum Company of America, spoke on the maintenance of cars made of aluminum, discussing it from all angles. He emphasized that holes and tears in side sheets could be effectively welded, if not too large, and that many parts could be straightened cold and most of them with a little application of heat. As advantages for aluminum in maintenance work, he named the lower total cost of maintenance, the lower cost for paint, the high corrosion resistance of the metal, the high scrap value of aluminum, being 20 to 25 per cent of the original cost, and the lightness of the metal for handling. He mentioned that the same maintenance equipment now installed in the shops could be used for aluminum and that with a little added expenditure for an electric furnace and a two-point pyrometer a shop could be completely equipped for handling the lighter metal.

Others who contributed in the afternoon discussion were Charles S. Johnson, Wason Manufacturing Company, Col. Alonzo R. Williams, United Electric Railways, and A. J. Manson, Westinghouse Electric & Manufacturing Company.

Dinner and Speaking Program at Evening Session

At the dinner held in the evening, Col. Alonzo R. Williams presided as toastmaster. The first speaker was Miles B. Lambert, sales manager transportation department, Westinghouse Electric & Manufacturing Company, who spoke on transportation problems and opportunities. He named five big problems with which the industry is now confronted: Traffic congestion, rate making, modernizing equipment, railway income and undermanning. He pointed out that opportunities exist for doing real service in solving many of the problems. "Although the electric railway industry is a basic one it is not thriving as the other utilities are," he stated, "and the railways should study their problems more intensively and consult outside help." Speaking of the traffic problem, Mr. Lambert suggested that the transportation companies take the lead in calling in outside help in studying the city problems and that they use their own organization, in public relations work, to gather facts and present them to the city officials. To solve the rate problem he suggested that the railways make a scientific study of the many factors that affect rates, rather than to continue with the usual cut-and-try method. Speaking on the modernization of equipment, he mentioned that car manufacturers have spent enormous sums to develop new cars, but that the operators were still hesitating in buying them. He mentioned that this delay possibly was due to a lack of confidence and suggested that a committee be appointed to study the car problem and to make definite recommendations.

"Weathering the Storm" was the subject of a lively paper by William B. Spencer, executive assistant to the vice-president and general manager United Electric Railways. Mr. Spencer answered the question "Have We

Faith in the Trolley Car?" very emphatically in the affirmative. He referred to the trying period through which the trolley car has come and chided the would-be obituary writers of the electric railway industry. To use his own words, "As the storms of attempted competition, huge increased costs and gigantic economic obstacles rage on, the good old trolley car still remains, faithfully serving the community, virtually as its throbbing heart—its pulse of existence—a tribute to the courage, stamina and efficiency of the red-blooded street railway men who strive to carry on."

Mr. Spencer spoke at some length on the present-day traffic problem and urged that a thorough analysis be made of all vehicles using the streets to determine which are essential and which are non-essential. "It will easily be determined," he stated, "that the street car is the most economical in the use of street space, costs relatively nothing for the city to supervise, owing to its fixed location, and does bring to the central business district much of its money and is, therefore, responsible in a great degree for the city's prosperity. Common sense solving of the parking problem," he continued, "will do much to silence the unfair criticisms hurled at the street car as a means of blocking traffic and to establish clearly its priceless value to the community. The ballyhoo about street cars causing congestion must disappear."

Mr. Spencer also spoke of the place of the bus in the electric railway industry and outlined his company's policies with regard to the use of this vehicle. He also touched on other important factors that require attention, including a guaranteed seat service, faster speeds and public relations work. He spoke of the necessity of educating the public of the place of the street car in present-day transportation and pointed out that the attitude of the public actually is changing. In conclusion, he said, "The poor, much-abused street car has weathered the storms and is increasing in favor again every day."

The evening program was concluded by a highly interesting, instructive lecture and demonstration on "Making Light Audible," by John B. Taylor, consulting engineer General Electric Company.

Reducing Accidents by Organization

Trainmen on Capital Traction System in Washington hold meetings monthly to discuss best methods to promote safety work. Competition is encouraged for best records

ACCORDING to the belief of the Capital Traction Company, one of the best ways to interest and educate trainmen in the reduction of street accidents is to gather them together frequently, present accident statistics to them, show how accidents can be prevented and get them to tell each other of their experiences and to make suggestions for improvements that may occur to them. This point is brought out in the brief submitted in the Anthony N. Brady safety contest.

Safety conferences are held monthly at each of the five divisions of the company, with usually three in one day, so timed as to reach as many men as possible. The topics are selected to be of a practical nature. Recent topics include the following: "Collisions—where and how they occur," "Passenger accidents—how they happen and what they cost," "Safety devices and their limitations," "Safety means—their purpose and value," "A typical hearing on a collision."

No matter how well the times for these meetings may be arranged, they cannot reach more than half of the total number of men on the division, so other ways are employed to get the information to them. One is to make a hundred or more copies of the talk and distribute them among those not present. Another is to leave the charts at places where they can be explained by the superintendent or others who have attended. A third is to arrange personal interviews with those men who were not in attendance. Still another and perhaps the best way, in the opinion of the company, is to print a digest of the talk in the company publication, so that every trainman may get a copy.

Divisions Divided Into Groups of Ten

The method of organizing the safety teams is to divide the men of each division into crews of about ten car or coach operators each. The men in each division select a suitable number of men for captains, and they choose their teams from men in the division so that everyone is included. Score sheets are then prepared on which the names of these members appear with the daily total of points scored by each team. The basis of monthly comparison is 100,000 car-miles, with two points for accidents or complaints and ten points for each unreported accident. The company gives to each man at the end of each month a mimeographed sheet with the scores of all the teams, comment on the month's performance, a review of matters discussed at the previous safety conference and such general safety suggestions as will help to interest the men in the safety program.

In addition, since July 1, 1927, record cards have been kept for each individual trainman, and show all accidents with which he has been concerned during the year. On the top of each card removable green tabs were so placed to indicate by position the number of accidents recorded on the card. The records on file of each division were then put in the hands of the superintendent of that division and the men were advised to study their records and note the location of their tab on the card compared with those on the other cards.

To maintain keen rivalry between the divisions, President Hanna offered a neat safety banner to be awarded each month to the division (cars only) having the best safety record per 1,000 car-miles operated. Although this banner has twice been won by the Seventh Street division, the margin was narrow and the interest aroused in all divisions has been very helpful in keeping the idea of safety permanently in the minds of the trainmen.

To enable the various safety captains to get acquainted with each other and with the officials of the company, monthly meetings are held in the assembly room of one of the carhouses, and two men from each safety team are invited to attend. Thus, in the course of ten months all of the trainmen have an opportunity to meet the company officials. Through these meetings the company officials are kept in closer touch with the safety work, the men have another point of contact with the safety campaign, they are encouraged to express themselves, and every month they have another helpful topic for discussion with their fellow workmen.

Practical Ideas *for the* Maintenance Man

Testing Insulation to Prevent Equipment Failures

INSULATION tests are now made at regular intervals on cars of the Des Moines City Railway, Des Moines, Iowa. The company operates cars from two carhouses, the larger one with approximately 100, and the smaller one with about 40. Test instruments are installed only in the larger carhouse, and cars from the smaller car division are tested as they come to the general shop for maintenance repairs. The equipment used in making these tests includes a Weston 600-volt direct-current voltmeter of 80,000 ohms internal resistance. This has been calibrated to read in megohms so that the insulation values are read directly for the electrical circuits. The procedure used in making routine insulation tests consists of placing a piece of fiber under the ground finger of the K-35 controller of four-motor equipments. The circuit breaker on the car is opened and the voltmeter leads are attached across from the trolley to the various controller terminals. If the voltmeter needle registers less than 25 volts on the 600-volt scale a further investigation of car circuits is considered necessary, inasmuch as this reading indicates an insulation resistance of 2 megohms or better. However, if a voltmeter reading of more than 25 volts is obtained; the individual car circuits are checked to locate the one having the low insulation resistance.

Form 291—11-1-28—1M

Car No._____

Insulation Test

Date_____, 19____

Over All

Resistance No. 1_____
" No. 2_____
" No. 3_____

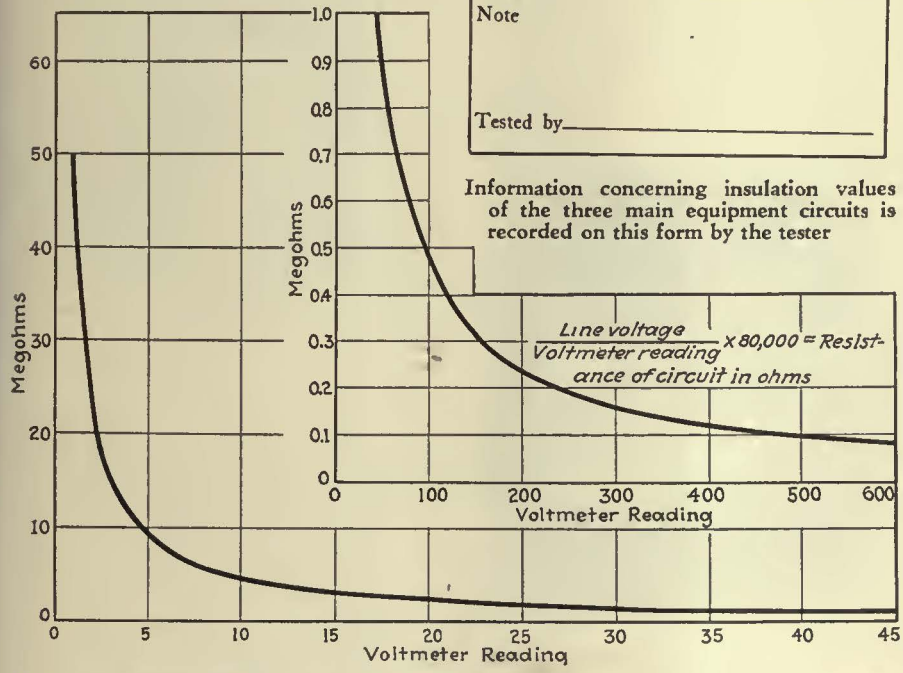
Armature No. 1_____
" No. 2_____
" No. 3_____
" No. 4_____

Field No. 1_____
" No. 2_____
" No. 3_____
" No. 4_____

Note

Tested by_____

Information concerning insulation values of the three main equipment circuits is recorded on this form by the tester



Voltmeter readings are translated into megohms by means of the calibration curves shown. The larger of these is simply an expansion of the low scale portion

Form 291 11 8 28 300

Insulation Test Car No. 154

Date	Over All	Resistance 1	2	3	Armature 1	2	3	4	Field 1	2	3	4	NOTES

A complete history of insulation tests and equipment repairs for each car on the system is kept in permanent file form on this card record

In the varied testing experience of the Des Moines Railway, the trouble is located most frequently in the car resistors, especially if the tests are being made during the wet seasons of the year. Motor fields, armatures and cables also come in for their share of the faults found by the insulation test and many that would cause serious trouble in service are weeded out and so are prevented from giving trouble.

Where segregation of the individual circuits for further tests is necessary, the tester works from the reverse points of the controller to secure readings for each motor, armature and field separately. If the weak point still remains unlocated brushes are lifted from the brush-holders and voltmeter leads are applied directly across the armatures of the motors and fields so as to test each part separately.

So far, 125 cars have been tested by this method. Half of these readings on the voltmeter indicated a condition that required correction. Four armatures with weak insulation were located and repaired. Three of these were repaired by simply redipping and baking.

Tow Rope With Compression Spring

NO MATTER how carefully a fleet of buses is maintained or what precautions are taken to avoid accidents, some will need towing. The Surface Transportation Company, a subsidiary of the Third Avenue Railway, New York, N. Y., experienced towing trouble, due to the breakage of tow lines when the towing machine took up the slack too rapidly. The tow line shown in the accompanying illustration was designed to prevent this destruction. It is a rope 2½ in. in diameter with a 2½x6-in. eye spliced on either end. One eye is fitted with a ring 5 in. in diameter, made of ⅞-in. round iron together with a hook made of 1½-in. material. The other end is provided with a compression spring with the necessary supporting links and a hook. The link fastened to the splicing eye is elliptical in shape and is 6 in. wide at its widest point. It is made of ⅞-in. round iron and is about 7 in. long. The link to which the hook is fastened is made of the same material and has inside dimensions of 2½x7 in. The hook is made from 1½-in. material and has an opening of 2½x5¼ in. The compression spring is 8½ in. long, 4½ in. outside diameter and is made from ¾-in. material. It is designed with seven turns and the spacing between turns is $\frac{9}{16}$ in. The spring seats consists of two ½-in. plates 4½ in. square. They have, on each corner, a spring guide prong ¾ in. long.

This tow rope has been found very useful for moving disabled buses

These plates are designed with four $1\frac{5}{16}$-in. holes drilled diametrically opposite. Two ⅞-in. U-bolts having an inside diameter of 2¼ in. are passed through the spring and spring supporting plates in opposite directions and the ends riveted to the plates. The spring apparatus is about 16 in. long over the ends of the U-bolts in the full release position. The force of the jerk in taking up the slack of the rope is dissipated in the compressor of the spring, thereby preventing the breaking of the rope.

Bumpers for Cars Reduce Collision Damages*

By E. M. Lunda
Superintendent of Shops and Equipment, Grand Rapids Railroad, Grand Rapids, Mich.

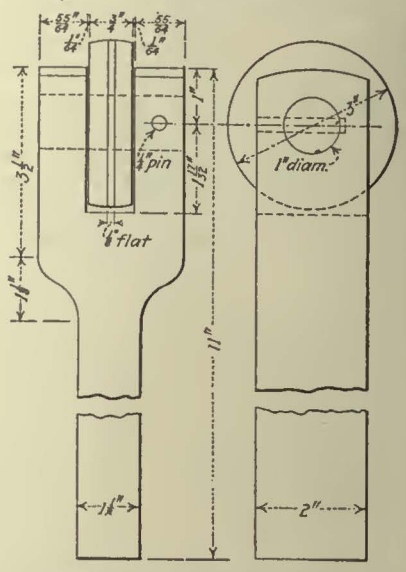
TO PREVENT damages to cars from side-swiping and collisions, the cars of the Grand Rapids Railroad are equipped with front and side bumpers. They have been in use over a year, and serious damage has been prevented on several occasions. The side bumpers run the entire length of the car and are constructed of 2-in. steel pipe. This has tapered ends with 1½-in. offset. They are held out from the car sides with four oak blocks. The front bumpers are made in three sections. The end sections are made of 2-in. pipe curved to conform to the channel bumper and spaced 3½ in. from it. The center section is of cast steel and has an opening to permit the draw bar to pass through it. The cast-steel construction is a safety feature for, in case of an accident, it will break and prevent the frame being distorted. The cost of a new center is only $2.

Pipe bumpers on sides and ends of cars prevent damage

*Submitted in Electric Railway Journal *Prize Contest.*

Polishing Tool for Journals

EVEN though a bearing is packed properly and the correct grade and quantity of oil is used, operation will be unsatisfactory if the bearing surfaces are not perfect. This will cause an increase in maintenance expense and service interruptions.



This polishing tool has been found to be very efficient

Great care is exercised in the shop of the Staten Island Rapid Transit Railway, Staten Island, N. Y., to see that all bearings are in good condition. Not only must all axle and journal-bearing fits be turned accurately but the fits must be polished highly before they are acceptable for service. This polishing is done by a polishing tool designed and constructed by Machinist James A. Collins.

The tool consists of a hardened steel wheel supported by a steel holder. The wheel is made from tool steel and has a diameter of 3 in. It is ¾ in. thick. The polishing surface is rounded except for ⅛ in. in the center. The wheel is mounted on a 1-in. shaft which is fastened to the jaws by a ¼-in. pin. The holder is made of 2½x2-in. stock and is 11 in. long.

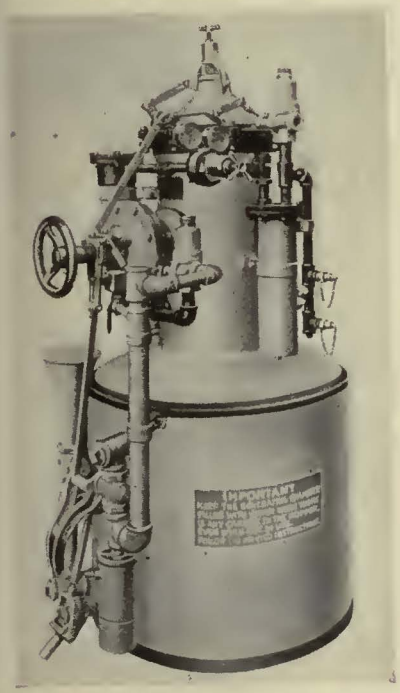
The 2½-in. side is narrowed to 1⅛-in. at a point 3½ in. from the end of the jaw. The axle supports are $\frac{5}{64}$ in. wide, and the wheel slot $\frac{3}{32}$ in., leaving $\frac{1}{64}$-in. clearance on either side of the wheel. This tool is mounted in the lathe tool rest so that the wheel comes in contact with the revolving axle fits. The wheel rolling on the oiled surface of the axle fit produces a highly polished surface which reduces lubricating expense.

New Offerings of

Useful Equipment

Medium Pressure-Type Acetylene Generators

THREE medium pressure-type acetylene generators for welding and cutting have been placed on the market by the Oxweld Acetylene Company, New York, N. Y. The type MP-2 is built in two sizes having 50 and 100 lb. carbide capacity, respectively. The type MP-3 is of 300 lb. capacity.



Improved type of acetylene generator

The type MP-2 generator is similar to a previous design in construction and operation. The feed mechanism has been redesigned to make the carbide shut-off more positive. A new method is used to stop the carbide feed positively, in case the diaphragm breaks or zero pressure exists in the generator due to any other cause. A new regulator, the type R-40, is furnished instead of the line regulator formerly used. This regulator is of the stem type, having a large stem and seat to provide ample capacity, and is equipped with two gages. One of these indicates the pressure in the generator and the other the pressure in the delivery line.

The hydraulic back pressure valve, which has been simplified, and the filter are of seamless steel tubing assembled by bronze-welding and then galvanized. This construction is more sturdy than that previously employed. The vertical pipe, leading downward to the back pressure valve and extending below the surface of the water, is fitted with an angle check valve. In case back pressure is exerted, water will be forced up the vertical pipe causing the check valve to close and preventing the possibility of back pressure or flash reaching the interior of the generator.

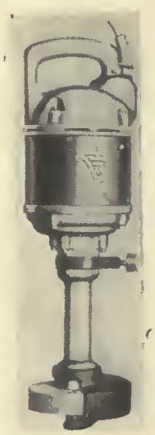
The two relief valves, one mounted on the hydraulic back pressure valve and the other directly connected to the generator, are of new design, have larger capacity and are less liable to leak than the older devices. A desirable feature consists of interference levers which unseat the relief valves every time the generator is recharged. This arrangement automatically prevents the relief valves from sticking, should they be called upon to function. Since the relief valve on the hydraulic back pressure valve opens only momentarily, no acetylene from the line is lost during recharging. A conveniently placed clean-out door renders the feed mechanism parts accessible and easy to clean without dismantling the generator.

The type MP-3 generator has been placed on the market to meet the demand for a pressure-type generator of large capacity that will supply gas with a minimum pressure fluctuation and with minimum expense for maintenance. The feed is driven by a motor actuated by a weight. A diaphragm pressure control is used in connection with the motor to regulate the feed and maintain proper pressure in the generator. The feed shaft bearing is protected by a dust-proof cover which protects it from carbide dust. Two charging doors facilitate filling the hopper. For maximum durability, some gears are made of bronze and Monel metal and certain shafts are of special alloys. The brake control on the motor is positive in action and does not require frequent adjustment once it is set.

A clean-out door is provided which permits cleaning the carbide feed disk without removing the generator top. The filter can be repacked, if necessary, without breaking any adjustment of interference or relief valves. This operation is performed by removal of the top plate. The hydraulic back pressure valve is arranged so that it is always filled with water before the generator itself is entirely filled. An overflow-level check plug has been provided in order that the operator may check the water level at any time.

The feed motor is rendered inoperative, if zero pressure exists in the generator because of a pronounced leak or any other contingency. The operating pressure can be changed by turning the adjusting nut on the feed control. During normal operation the set pressure will not vary more than about 1 lb. The type MP-3 generator consists essentially of two sections, the lower being a cylindrical shell, the upper a shell in the shape of a truncated cone. The bottom is dished for maximum strength. All seams are bronze welded, both inside and out. The overall height is slightly over 120 in. and the height to the top of the generator shell is 104 in. The diameter of the shell is 42½ in. The shipping weight is 2,300 lb.

Portable Grinder and Buffer



New type of grinder and buffer

CONVENIENCE of control is made possible in a new ½-hp. portable grinder and buffer, announced by the Hisey-Wolf Machine Company, Cincinnati, Ohio, by a two-pole switch located at the grip handle. A specially designed compound wound motor for direct current is provided. The cast steel wheel guard is adjustable and can be placed at an angle most convenient for the operator. The end cover is readily removable and affords quick renewal of grinding wheels, when these become worn out.

News *of the* Industry

New Rapid Transit Measure for Boston

A new Boston Elevated bill, based on the so-called Harriman $50,000,000 rapid transit extension measure but containing several changes intended to meet objections raised by Mayor Nichols, was placed before the legislative committee on metropolitan affairs on Feb. 25. The new bill seems likely to reopen the entire question and according to the Boston News Bureau additional hearings may be necessary. It was drafted under the direction of Frank S. Deland, corporation counsel for Boston.

Unlike the old bill, two parts of which would have become effective even if stockholders of the road had rejected a third part, the new bill stands or falls in its entirety. The most important change is that while the old bill set up a metropolitan transit council which was a factor in name only the new bill makes this council the all-important agency in carrying out rapid transit extensions provided in the measure.

Another entirely new provision is that every ten years there shall be a readjustment of the proportioning of the cost between the car-rider and the taxpayer. If trustees and members of the council fail to agree, either party may then apply to the Supreme Judicial Court for the appointment of three suitable persons as arbitrators.

The new bill contains a section, to which Mr. Harriman is reported as being strongly opposed, whereby depreciation shall be set aside by trustees only as approved by the State Department of Public Utilities.

Ten-Cent Cash Fare in Columbus

C. C. Slater, general manager Columbus Railway, Power & Light Company, Columbus, Ohio, has notified Columbus Council that cash fare will be 10 cents. Tickets will be 35 cents for five. The fare has been 6 cents or five tickets for 25 cents.

These advances, according to Mr. Slater, will increase the revenue of the railway lines by $1,039,487 a year. Counterbalancing the fare increase, rates for electric current will be cut to 6 cents a kilowatt hour starting March 10. The present rate is 7 cents.

This, Mr. Slater said, would reduce revenues from this source $312,360 a year. Another cut made recently, he said, reduced revenue from sale of current $780,070 a year, making a total reduction of $1,092,430 a year.

Cars have been operated for three years without a franchise. Unless some legal course not apparent on the surface is discovered, it appeared the city can choose between two courses:

Accept the fare increase and open negotiations for a new franchise, making the best possible deal for fares.

Order the cars from the street and make other arrangements for transportation service.

Councilman Worley, a member of the public utilities committee of the Council, said:

> If it is possible for the rail-light company to fix fares to suit itself the company has a great deal more power than it should have, and I am in favor of putting in a complete bus system.

This expression of opinion is, however, regarded as the extreme view. More reasonable counsel is expected to prevail.

One-Man Car Inquiry in Indiana

An investigation to determine whether one-man street cars are less safe than the two-man crew types will be held by the Indiana Public Service Commission. The complaint was made by an Indianapolis resident. James P. Tretton, superintendent, Indianapolis Street Railway, said the experience of the company had been that the one-man type of car was as safe, if not safer, than the two-man type.

Buffalo Report Completed

Experts employed by the Buffalo municipal authorities to make an exhaustive survey of service, operations and costs of the International Railway, Buffalo, within the city, have completed their report which will be used in opposition to the application of the railway company for a 10-cent local fare now pending in United States District Court at Buffalo before Judge John R. Hazel. The corps of experts were under the personal supervision of Col. Harold U. Wallace, former manager of the Detroit Municipal Railway.

The report lays particular stress upon the operation of one-man cars on all local lines of the International Railway. According to it an adequate fare to be charged in Buffalo can be fairly determined only from a consideration of the properties used in the local service contrasted with receipts and expenditures. Interurban and other services, the report says, have no bearing on the proper Buffalo rate.

The reports have been filed with Federal Judge John R. Hazel as part of the city's application for a United States District Court order demanding segregation of the railway company's properties before the suit is brought to trial.

New York's Transit Policy Produces Congestion

Daniel L. Turner, consulting engineer for the New York Transit Commission, told 200 members of the Municipal Art Society of New York, at their annual luncheon recently that only one-third of the metropolitan area was served by rapid transit facilities.

He said the experience of the last 40 years showed that population always followed development of transit facilities, instead of the reverse. He expressed amazement that this principle was not fully understood after almost 100 years of street railway transit.

Mr. Turner said transit facilities must be furnished in advance of population and in the way that it is desired to develop the city. Unless that were done, he said, city planning would be largely futile. He added that despite the large amount of automobile traffic, the transit lines carried 75 per cent of the passengers and were consequently the controlling factor in city development. He is reported to have said:

> New York has not made the best use of its rapid transit facilities. There has been too much concentration of the lines, with consequent overlapping in the service area, particularly in the outlying boroughs. In 1925 new subway and elevated lines increased the net area served only about 41 square miles, through 111 route-miles have been constructed since 1904. One square mile of new area required nearly 3 miles of new rapid transit line. This is an extravagant use of rapid transit facilities.
>
> For this reason and because of the possibility of unlimited land use, the city's rapid transit policy produces congestion instead of relieving it. This results in a vicious circle. The city has been concentrating its new rapid transit lines too much in already overdeveloped areas.
>
> In 1925 there were 210 route-miles of track traversing the city, yet direct and convenient service is afforded to only about 97 square miles. The remaining 202 square miles has no direct facilities accessible to it. After building lines for 55 years, New York even now is serving only about one-third of the entire city area. Eighty-six per cent of the city population is concentrated in the 97 square miles and 14 per cent are spread over 202 square miles, all because population will follow rapid transit and the land can be developed in response to any population demand. The used area of New York City is no larger than Little Rock, Ark,
>
> According to Mr. Turner the distributive influence of transit should be utilized to the utmost in these communities and thereby relieve congestion along rapid transit lines already overcrowded. If rapid transit is not furnished to New York's entire city area, the population cannot be distributed through the city's 200 square miles of unpopulated area.

Terminable Permit Bill Advanced

The judiciary committee of the Missouri House of Representatives on Feb. 22 reported out favorably the terminable permit bill for common carriers, sponsored by the St. Louis Transportation Survey Commission as part of the program for obtaining a rapid transit system in St. Louis. It is the last of four bills sought by the St. Louis commission to be reported out favorably by the House committee. Three of the bills have been engrossed and are now on the calendar for third reading and passage.

Under an amendment suggested by the attorney for the People's Motorbus Company, St. Louis, the permit bill allows street railways, bus lines and other common carriers, operating prior to Jan. 1, 1929, to obtain a terminable permit for an unlimited period subject to cancellation for misuse and non-use without a public hearing on the merits of the application, once the carrier obtains the consent of the municipality affected for the surrender of franchise for the new permit.

Transportation and Engineering Topics on Illinois Program

Six addresses on specialized topics are announced on the tentative program for the railways division of the ninth annual joint convention of the Illinois State Electric, Illinois Electric Railways, and Illinois Gas Associations to be held in Springfield on March 14-15. Joint meetings will be held in the mornings and group meetings of the individual divisions in the afternoons.

Members of the Illinois Electric Railways Association will hear an address, "One-Man Operation in East St. Louis," by G. W. Welsh, vice-president East St. Louis & Suburban Railway, East St. Louis, Ill., after which there will be general discussion.

W. C. Wheeler, engineer of equipment Chicago Surface Lines, will discuss "Late Trends in Car Equipment," and A. W. Baumgarten, Chicago & Joliet Electric Railway, will talk on "Mercury Arc Rectifiers as Applied to Electric Railway Service."

"Co-Ordination of Rail and Bus Service" will be the topic of Emil A. Roehry, general manager St. Louis Electric Terminal Railway. H. O. Crews, supervisor of public relations Chicago Surface Lines, will talk on "Visualizing Transportation Problems." As an added feature "Safe Highways," a film release of the Chicago Surface Lines, will be shown.

Parking—A Serious Menace in Baltimore

An active part is being taken by the United Railways & Electric Company, Baltimore, in an effort to prohibit parking on some of the downtown streets of the city. The movement was started when two fires reached serious proportions because parked automobiles prevented the firemen from getting their apparatus into position for service immediately. An ordinance prohibiting the parking has been introduced in the City Council at the request of the fire department officials and the railway as well as other interests is backing the measure.

Unification in Grand Rapids

Move advanced under which railway, bus and taxi services would be brought together

ANOTHER step has been taken toward the consolidation of street railway, bus and taxicab services in Grand Rapids, Mich., under the control of the Grand Rapids Railroad for the purpose of reducing congestion and meeting new demands for additional transportation. Through L. J. DeLamarter, vice-president and general manager, the railway has formally and favorably replied to the recent recommendations of G. J. Wagner, city consulting engineer, that the company be authorized to carry out his suggestions to augment the present rail system with bus and taxicab service.

Mr. DeLamarter says that he realizes the congestion in the downtown districts and that extensions to service must be made in the future, but that increased revenues must be assured or the city government will face a problem of subsidy to maintain mass transportation facilities. He believes, however, that with the continuation of co-operation from the city that has existed, and with protection to the railway as long as the service is rendered satisfactorily, the railway would be justified in investing in a taxicab line and extending its bus systems.

The proposed taxicab service would be created to supplement the regular rail service, as suggested in the Wagner report. Mr. DeLamarter said:

> It is obvious, however, that the interest of the public would be ill served if the proposed special service should be exposed to loss from future ruinous competition from other taxicab companies. This company should be in a position substantially to cover this whole field of transportation or it should not be entered.

When the City Commission adopted the Wagner recommendations in December that body assured the railway a broad policy of operation and if this were carried through there would be no difficulty from more cab companies than exist now. In commenting on this phase of the situation, Mr. DeLamarter's reply states:

> Rights of present operating taxicab companies, of course, should be essentially preserved.

Mr. DeLamarter's reply stated that, if the railway is authorized to operate a taxicab system, it should not be legislated against as to such reasonable maximum or minimum fare as may be required to meet conditons now unforeseen but that may arise. Peak load services of the railway will be covered well by the additional buses, while heavy capital investments will be required by the new units of bus and taxicab services. Mr. DeLamarter states that he believes both will prove great aids to the present rail system.

In dealing with the tax situation, the reply states that it is recognized throughout the country that having the railways furnish capital for tracks and paving and also requiring them to pay taxes on both track and equipment have militated against their successful operation. Relief from having to invest in pavement between rails is asked by the railway. Since this change can be effected only by charter amendment, the company asked that the question be placed before the voters.

The commission has announced that it will take time to study the general manager's suggestions and recommendations.

Interurban Will Supply Service in Springfield

Organization of an entirely new company to operate street cars and buses in Springfield, Ohio, is contemplated by the Cincinnati, Hamilton & Dayton Railway, which plans to acquire the Springfield Railway.

Should the plan go through, it is intended to have the Springfield Railway permit the new organization to operate cars over a portion of the narrow gage track now used by the city street cars, in addition to giving city service over the standard gage trackage of the Indiana, Columbus & Eastern system within the corporation limits.

These plans were divulged in the reply of Thomas Conway, Jr., president of the interurban line, to a telegram sent him by Springfield officials asking whether the plans of the Cincinnati, Hamilton & Dayton in regard to the local transportation system would necessarily hold up the improvement of E. High Street, proposed to be carried out by this year. Mr. Conway stated that his plans would not interfere with the proposed improvements.

The city of Springfield has advertised for proposals to furnish a transportation system for the city. Among the bidders who have submitted proposals are the Twin Coach Corporation, Kent, Ohio; The City Rapid Transit Lines, Newark, Ohio; Alexander S. Drescher, Brooklyn, N. Y.; and Cincinnati, Hamilton & Dayton Railway.

Reduced Rates for Sacramento School Children

As the result of informal negotiations conducted by the Railroad Commission, the Pacific Gas & Electric Company, which operates the railway lines in Sacramento, will place in effect on March 20, 1929, school children's reduced rate tickets on the basis of eight rides for 25 cents, applying to *bona-fide* school children under 18 years of age, and attending schools of grade no more advanced than the high school. At the present time this privilege is extended only to children of thirteen years or under.

Oldest Aircraft Paper Acquired

Aviation, weekly founded twelve years ago by Major Lester D. Gardner, bought by McGraw-Hill

AVIATION, the oldest aeronautical magazine in the United States, published weekly, has been acquired from the Aviation Publishing Company, New York, by the McGraw-Hill Publishing Company, Inc. Devoted to the field of aviation in all its phases, the weekly was established twelve years ago by Major Lester D. Gardner, until recently president of the Aeronautical Chamber of Commerce and now president of Aeronautical Industries, Inc. Under the new owners, who now publish 25 engineering, industrial and business papers, the field of the publication will continue to include aircraft manufacturers, engine and parts makers, airports, distributors and others who are professionally engaged in aeronautics.

Aviation fits in well with the other papers of the McGraw-Hill group, which covers the five major branches of engineering—civil, electrical, mechanical, mining and chemical. Several of these papers have long been closely concerned with various aspects of the progress of aviation. ELECTRIC RAILWAY JOURNAL and *Bus Transportation* have been recording the development of this new agency of commercial transportation. *American Machinist* and *Factory and Industrial Management* have been encouraging high efficiency in manufacturing production. *Engineering News-Record* has given much attention to the civil engineering problems of airports, runways and structures. *Electrical World* has discussed the lighting of airways and airports, and also signal systems. *Chemical and Metallurgical Engineering* has contributed to the solving of many problems of weight, corrosion and wing surfacing. The *Magazine of Business* recently conducted a year's practical experiment in "Flying for Business," operating its own plane.

James H. McGraw, chairman of the board of the McGraw-Hill Publishing Company, said:

> Aviation is now becoming a vital tool of modern business, and a new basic industry is in process of development. McGraw-Hill desires to contribute to the progress of aviation a publishing service that will provide every facility of modern industrial journalism to aid in the solution of its inherent problems.
>
> We assume the publishing direction of *Aviation* with the conviction that the resources of the McGraw-Hill organization will bring new strength to this paper and practical benefits to the industry beyond the reach of a single publication. We enter this field only because it is clear that there is an opportunity to render a service that will advance the art of flying and its economic development. We are glad to welcome into our organization a group of men of the type responsible for the splendid record and fine prestige that *Aviation* now enjoys.

Publishing headquarters of *Aviation* will continue in New York. Earl D. Osborn, who has been publisher of the periodical for several years, will join the McGraw-Hill organization.

Eastern Massachusetts Would Amend Agreement

A subcommittee of the general conference board of unions, the members of which are employed by the Eastern Massachusetts Street Railway, Boston, Mass., have been told by the trustees of that company that the company cannot operate at a profit and pay the existing wage scale. The committee was asked to take a cut which would affect 1,500 employees. They were also asked to relinquish their rights to the arbitration of discipline cases.

The result of this conference between trustees and the committee leaves an understanding that it will be impossible for the Eastern Massachusetts to renew the present agreement. Further agreements then must be only under the condition that the men be willing to meet the company half way in revising wages.

COMING MEETINGS OF *Electric Railway and Allied Associations*

March 12-14—**Oklahoma Utilities Association, annual meeting, Oklahoma City, Okla.**

March 14-15—**Illinois Electric Railway Association, Hotel Abraham Lincoln, Springfield, Ill.**

March 20—**Central Electric Traffic Association, Keenan Hotel, Fort Wayne, Ind.**

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

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

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

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

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

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

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

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

Court Dismisses Suit Against Seattle Municipal

Superior Judge J. F. Ronald on Feb. 15 rendered a decision giving the Seattle Municipal Railway a clean bill of health financially, and freeing it from threatened insolvency and default in its bonded obligations. The ruling is regarded as a complete victory for the sponsors of the Municipal Railway in the J. G. Von Herberg suit. Attorneys for Mr. Von Herberg, however, immediately served notice of appeal.

A few minutes after the decision of Judge Ronald, the city wired $1,062,225 to New York to meet principal and interest payments due on street railway purchase bonds. The payments had been held up by a temporary restraining order, which was dissolved by Judge Ronald's decision.

In dismissing the two-year old suit of Von Herberg as "without merit," Judge Ronald took the plaintiff to task for harassing the city by litigation, and praised the City Council and management of the system for efficient management, at the same time expressing confidence that the street railway, if unhampered by further litigation, would be able to pay off its debts and operate efficiently out of its revenues.

Judge Ronald held that the railway system is solvent; that the City Council has a right to loan it money from other utility funds; that the system is now in better condition than when purchased from the Puget Sound Power & Light Company ten years ago.

He pointed out that since the trial of a similar suit brought by S. B. Asia in January, 1922, the railway has reduced to $183,313 an operating deficit which at that time amounted to $1,500,000, besides meeting all installment payments when due and adding much to the system's value. Purchase payments, since the acquisition of the railway, he enumerated at $12,977,413 up to Dec. 31, 1928, in addition to $2,162,477 paid out for extensions and betterments, and $1,977,500 on other utility bonds and warrants, notwithstanding that the system has been compelled to charge off $1,479,356 for retirements and abandonments in the meantime. Furthermore, the court found, the railway fund, with the $800,000 loan from the Water Department, had on hand $1,200,000, and operating receipts amounting to about $16,000 a day, with which to meet obligations of $1,576,600 due this year.

In the course of the trial, testimony was introduced by the city to show that an annual saving of $440,000 in operating costs of the railway system will be made by an economy program already under way. Railway officials declared that the present equipment, while obsolete in design, can be continued in service indefinitely without excessive costs for repairs. An expert, who testified for Mr. Von Herberg, had represented the railway as rapidly approaching a physical collapse which could be averted only by excessive expenditures for rolling stock and track replacement.

Interurban to Give Local Service in Newcastle

Abandonment of railway service in Newcastle, Ind., by the Terre Haute, Indianapolis & Eastern Traction Company, has been authorized by the Indiana Public Service Commission. The company was ordered, however, to give local service on the interurban line it operates into Newcastle at a fare of 5 cents within the city.

Reply Brief Filed in St. Louis Fare Case

The city of St. Louis, Mo., in a brief filed with the Cole County Circuit Court at Jefferson City on Feb. 21, renewed its attack on the decision of the Missouri Public Service Commission fixing a straight 8-cent fare in St. Louis effective last July 1.

The case was carried into the Circuit Court when the city asked for a review of the commission's decision. It was argued on Jan. 31, last. The attack in the brief centered on the $63,500,000 valuation allowed the company. The city contends that on a proper valuation the 8-cent fare is excessive.

Evidence on Chicago "L's" Plea for Permanent Injunction

Charles E. Thompson, vice-president Chicago Rapid Transit Company, testified recently before Roswell B. Mason, master in chancery, that he did not consider that the present 10-cent fare on the elevated system in Chicago is adequate to provide a fair return on the company's investment. Evidence is being heard by the master on a petition of the Rapid Transit Lines for a permanent injunction restraining the Illinois Commerce Commission from interfering with the 10-cent rate of fare established last fall.

Mr. Thompson pointed out that since the higher fare was put into effect 1928 revenues had fallen slightly below those of 1927, but that operating expenses also had decreased. On the basis of the state commission's valuation of $92,588,000 on the company's properties, he added, the company earned a return of only 3.33 per cent last year. He declared, however, that more seats were available now in proportion to passengers carried than under the former 8½-cent fare.

Suburban Towns Accept New Twin City Fare

Another step in settling the fare question for all divisions of the Twin City Rapid Transit Company, Minneapolis, Minn., is a stipulation ordered by the Councils of Stillwater, Minn., and Bayport, Minn., both on the Stillwater division of the Minneapolis & St. Paul Suburban Railroad, to be filed with the Minnesota Railroad & Warehouse Commission, providing for a cash fare of 10 cents and a token rate of 7½ cents. The question has already been settled for the Twin City divisions and a petition was pending before the commission for increased rates of fare in these two cities which have just ordered stipulations accepting the increased fare.

Ticket Rate Reduced in Ottawa

A reduction in fares has been announced by the Ottawa Electric Railway, Ottawa, Ont. The new schedule provides for seventeen tickets for $1, against sixteen under the old rate. The reduction does not affect the four-ticket strips, now sold at 25 cents, and single fares will continue on a basis of 7 cents. The 7-cent fare went into operation last August.

Preparing to Consider Louisville Plea

The increase in railway and bus fares in Louisville, Ky., asked by the Louisville Railway, is expected to be handled by the Board of Public Works soon. The company seeks a 10-cent cash fare, but has left the matter of a possible bulk sale rate open for the purpose of experiment. Meanwhile the Public Utilities Bureau has reported on the appraisal of the property of the company.

Among business and financial men the feeling is that the company will get an increase. In fact, the impression prevails that the company proposal will receive a measure of consideration fully in keeping with the spirit in which the company's plea was advanced.

Rehearing of Elgin Fares Asked

A petition asking a rehearing of the Illinois Commerce Commission order, authorizing an increase in commutation rates on the Chicago, Aurora & Elgin Railroad, has been filed with the commission by a group of the company's patrons residing in Wheaton, Ill. The new rates became effective on Jan. 23. They are slightly higher than those of competing steam railroads between Chicago and west suburban points.

Approval by the commission of the railroad's application for an increase in fares was based upon the estimate of commission engineers that the railroad had earned a return of only 3.4 per cent for the year ended July 31, 1928. The commission also found that the company had expended $1,800,000 for improvements which had not been financed through the issuance of securities and "which under proper earning conditions it is entitled to capitalize."

In view of this situation and the fact that wages of all trainmen had recently been advanced, the commission held that an increase in rates was necessary to give the public the service to which it is entitled, permitting the company to earn sufficient return to attract new capital.

Wage Increase Granted in Indianapolis

A wage increase of 4 cents an hour to all motormen and conductors has been announced by officials of the Indianapolis Street Railway, Indianapolis, Ind., effective from Feb. 24. The increase was granted voluntarily and will add approximately $120,000 to the 1929 payroll. Increases will be granted in other departments.

A minimum wage for beginners of 44 cents an hour, increasing 1 cent an hour a year to a maximum of 49 cents an hour for operators of two-man cars is provided. A minimum of 49 cents an hour for beginners, increasing 1 cent a year to a maximum of 54 cents is provided for operators of one-man cars. The last wage increase was 3 cents an hour in 1927.

James P. Tretton, general superintendent, said that with a net decrease in operating expenses during 1928 of $120,000, the company was able to raise the wages of its men as it had promised. A further saving in 1929 is desired for needed repairs and the cordial co-operation of employees has been asked to make this possible, since the company would regret a circumstance that might require it to file a petition for increased fares.

An increase of 5 cents an hour to drivers of buses of the People's Motor Coach Company, a subsidiary of the Indianapolis Street Railway, has been announced. The increase was effective on Feb. 24. It will make the scale for coach drivers the same as that of drivers for the Indianapolis Street Railway buses.

The present scale of the coach company drivers is from 40 to 45 cents an hour. Under the terms of the announcement it will be increased to 45 to 50 cents an hour. The wage scale of drivers of the buses for the railway will remain the same.

Fare Increase Ahead in Portland

With two more community clubs petitioning for additional bus service, W. H. Lines, vice-president Portland Electric Power Company, Portland, Ore., has told the City Commissioners and the Council that not only can the company not grant this request, but that it is possible an increase in fare may be necessary to care for lines already running unless returns become more satisfactory. Mr. Lines pointed out that the buses are losing $125,000 a year now, and that for some time the company had been considering an appeal to the Public Service Commission which would relieve the situation. Mayor Baker told the community clubs that the Council would do what it could to assist in arranging for service by a private operator, but he indicated that he would do so only if an arrangement could be worked out that would not interfere with service already being given in the vicinity by the Portland Electric Power Company.

Recent Bus Developments

Interstate Bill Not Likely to Pass

Adjournment of Congress without action on the Parker bill to regulate interstate bus traffic was regarded as likely on Feb. 27. Uncertainty on the part of the interstate commerce committee of the House, to which the bill was referred, and the crowded state of the legislative calendar made it seem useless to try to bring the measure up on the floor in the few remaining days of the session. Whether there will be an opportunity of getting a vote on the bill during the extra session is still undetermined. There is an element in the committee that believes that the measure goes too far in its regulation.

Further Delay in Equitable Proceeding

The Equitable Coach Company, New York, is expected by city transit experts to let its franchise lapse on April 1, the time limit set by the Board of Estimate early this month. On Feb. 27 the company asked the Board of Estimate for permission to withdraw applications to amend its franchise in such manner as to make possible the B. M. T. merger and the operation of Manhattan buses by a new corporation. This request, which probably would be granted as a matter of course, would result in a delay of at least eighteen months in putting buses on the city streets, even if the Equitable succeeds in getting Transit Commission approval within the time limit set.

The New York *Times* sees the company forced with a demand for legislative inquiry into the circumstances under which it obtained its bus franchise nearly two years ago, threatened by a suit by the B. M. T. for breach of its contract to merge Brooklyn and Queens bus routes with trolley lines, and confronted with stubborn resistance from traction groups when it again seeks the Transit Commission approval, without which bus operation is impossible.

Line in St. Louis Suspended Temporarily

The St. Louis Public Service Company on Jan. 7 received from the Circuit Court for Cole County an order directing it temporarily to suspend operations of its bus line between Maplewood and Kirkwood, Mo., via the Manchester and Big Bend roads. This line was opened by the railway a few months ago after residents of the districts served had complained to the Missouri Public Service Commission regarding the character of service being offered by the De Luxe Bus Line which had been operating over the same routes.

At the time a state permit for the bus line was granted to the St. Louis Public Service Company, the De Luxe Line was ordered to suspend operations. This it refused to do, appealing to the Circuit Court for relief. In the meanwhile the De Luxe company readjusted its schedules.

Taxi War in Louisville

Wild-cat operation of twenty-five cents cabs brings drastic regulation. Ordinance contested

A NEW ordinance has gone into effect at Louisville, Ky., regulating cabs, and forcing them to carry insurance or bond to protect the public and property, operate with meters and regulate the employment of drivers. The measure stipulates the maximum fare that may be charged. The ordinance will materially increase operating costs for all cab companies. The Louisville Taxicab Company will carry a bond, but will write its own insurance. Some of the small companies will not be able to secure bond, and insurance rates are very high. Many that have been buying cabs on time are expected to drop out.

Situation Had Become Intolerable

All in all, however, it seems very likely now that a situation which had grown to be intolerable will soon be corrected. For years Louisville had a taxicab company which operated good equipment at rates comparing favorably with rates of well conducted companies in other large cities. In the fall of last year, however, Columbus, Ohio, interests came in with a 25-cent cab company, offering to haul at the rate of 25 cents for 2 miles, with additional mileage at the rate of 12½ cents a mile. Another company came in from Ohio with a rate of anywhere within the city for 25 cents, but later changed this to three miles for 25 cents, or 8⅓ cents a mile, with additional mileage at 10 cents a mile. Then some small companies formed. The Louisville Taxicab & Transfer Company met the competition and added more than 100 light cars. From a total of about 200 cabs in use, some part time, the number jumped to about 400 or 450 cabs, all carrying four passengers for one fare, and at rates of 8⅓ to 12 cents a mile.

A few days ago the Dodds Twenty-five Cent Cab Company filed a voluntary petition in bankruptcy with 57 claims pending against it for accidents. None of the other companies, with the exception of the Louisville Taxicab & Transfer Company, the old line company, has been able to comply with the law. About the time the cabs were to be ordered off the streets, an injunction was asked, pending investigation of the legality of the new ordinance. Enforcement of the law is held up pending decision in this suit.

Passes for Maryland Interurban Buses House to House Canvass

Use of the weekly pass in six varieties was started on Monday, Dec. 31, 1928, by the Cumberland & Westernport Transit Company. Most of the passes replace a reduced-rate ticket book which consisted of twelve (two a day) tickets and a Sunday pass. These tickets were good only over one of three routes terminating respectively at Cumberland, at the Kelly-Springfield tire plant and at the Celanese plant, both of which are just outside of Cumberland but on different highways.

The passes sell for $1.50 up to $5, according to distance, and are also available on all three routes. In some cases they cost even less than the former ticket books.

The company has decided to try the pass in an effort to combat more successfully the practice of auto-owning workmen selling rides to their comrades. As this competition is between their homes and the two plants as a rule, the passes include riding privileges to Cumberland as well. An intensive house-to-house canvass is being made under the direction of D. D. Price, general manager. Fifty-six passes were sold in the first week, which contained a holiday. At the expiration of the third week the sale had been more than doubled despite the handicap of the influenza epidemic.

Would Incorporate South Side Motor Coach

Petition of the Beech Grove Traction Company, Indianapolis, Ind., for authority to buy the South Side Motor Coach Company, a competing bus line, for $22,500 has been filed with the Indiana Public Service Commission. In the petition the company states its plan to incorporate the bus company as the South Side Motor Coach Corporation. Eight buses, which originally cost about $40,000, constitute the principal equipment of the company. The railway plans to spend $17,500 for new equipment and $10,000 for new buildings.

New Regulatory Measure Likely for Rochester Taxis

City Manager Stephen B. Story, Rochester, N. Y., on investigation of the complaint by James F. Hamilton, president of the New York State Railways, that the 25- and 35-cent taxis are violating city ordinances, said that doubtless a new ordinance regulating taxi fares would be drafted. He found that the rules of the city safety department fixing fares was not being enforced. The rates fixed by the department call for 30 cents for the first ⅓ mile and 40 cents for the first ⅔ mile, with a charge of 10 cents for each third of a mile thereafter. The city manager classed the 25- and 35-cent taxis as "trippers" within the scope of the

jitney law, but not subject to city regulation at present. Mr. Story said that what will come is a new ordinance that will fix the rates of metered cabs and also "tripper taxis."

Nighthawk Taxis May Cruise in Worcester

The Worcester, Mass., license board has decided to permit taxicabs to cruise without restraint between the hours of midnight and 6 a.m. There had been a rule prohibiting such solicitation on the grounds that it interfered with railway traffic since the Worcester Consolidated Street Railway had established all-night service on a few of its lines.

Nashville-Old Hickory Service by Railway

Service of the Tennessee Transportation Company, subsidiary of the Nashville Railway & Light Company, Nashville, Tenn., and operator throughout Nashville, has just been expanded to take over buses to and from Old Hickory, co-ordinating them with Nashville street cars and motor coaches.

Hourly service is being furnished, reaching Old Hickory now by way of Donelson. It is understood that the Gallatin Pike will also be used when the new river bridge is opened.

Free transfers are issued either from street car or city motor coach to the Old Hickory coach, thus linking Nashville and Old Hickory closer than they have ever been.

The purpose was to make the Old Hickory fare 50 cents per trip, but at the present time, reduced rates are being offered through the use of commutation books. Transfers are acceptable at the Union Bus Terminal on Commerce Street. Twelve rides to Old Hickory or back sell for only $3. Twelve rides from Nashville to Donelson, or from Donelson to Old Hickory, sell for only $2.

Permission for the expansion of this service was granted the Tennessee Transportation Company by the State Railroad & Public Utilities Commission.

New Service on Winsted Run

Buses replaced cars on the Winsted-Torrington, Conn., line of the Connecticut Company on Jan. 13. Seven of the ten trolleys used on the line are to be scrapped. The other three have been sent to Waterbury to be used on that division. The bus line schedule calls for buses to leave Waterbury for Winsted at fifteen minutes after the hour from 7:15 a.m. to 6:15 p.m. and another trip at 8:15 p.m. Buses will leave Torrington for Winsted ten minutes after the hour from 6:10 a.m. until 10:10 p.m. Buses will leave Winsted for Torrington on the hour from 6 a.m. until 10 p.m.

Substitution in Ohio

Thirty-six-mile interurban of Northern Ohio Company to give way to railway's buses and trucks

APPLICATION has been filed by the Northern Ohio Power & Light Company, Akron, Ohio, with the Ohio Public Utility Commission for abandonment of its interurban car line from Massillon to Uhrichsville, Ohio, a distance of 36 miles. A. C. Blinn, vice-president and general manager, signed the plea. The hearing has been set for April 2, and the necessary legal notices have been published. The company plans to substitute bus and truck service for its present rail lines between Massillon and Uhrichsville.

Line in Use Twenty-five Years

Interurban cars have been operated over the line continuously since the road was completed 25 years ago, serving the cities and villages of Navarre, Justus, Beach City, Strasburg, Dover, New Philadelphia, Midvale and Uhrichsville among other places.

In its petition the company declares that the tracks are located for a portion of the distance upon the highway, for a part on private right-of-way and for part upon city streets; that service was pursuant to certain franchises; that all of these franchises have expired except with the village of Navarre and that the tracks are being maintained by sufferance.

In view of this, the right is asked to cease all interurban operation between the entrance to the Massillon State Hospital and the southern terminus in Uhrichsville. In addition the company sets up the plea that the loss from operation of the line has been increasing from year to year; that there is sufficient transportation service for the convenience and necessity of the public between Massillon and Uhrichsville and continuance of interurban service is unnecessary; that there has been proposed, and in process of designing and building, public road improvement which will require removal and replacement of track requiring capital investments so heavy as to make continued operation economically unsound.

History of Company Reviewed

This interurban was built in sections. The companies that went to make it up were known as the Canton-New Philadelphia Railway and the Tuscarawas Traction Company. They, with the Canton-Akron Railway, were united under the name of the Canton-Akron Consolidated Railway. In 1906 this company was taken over by the Northern Ohio Traction Company, which in turn was absorbed by the Northern Ohio Traction & Light Company. Two years ago the name was changed and operation continued by the Northern Ohio Power & Light Company.

Nine months ago the interurban line between Canton and Akron was abandoned and bus service substituted. The Cleveland-Akron-Canton Bus Company, a subsidiary of Northern Ohio Power & Light, has been granted the right to operate an interurban bus line through the cities and towns served by the railway.

Extension of Los Angeles Service

The Los Angeles Railway Corporation and Pacific Electric Railway have filed a joint application for a certificate of public convenience and necessity to operate motor coach service temporarily, under the name of Los Angeles Motor Coach Company, between the terminus at Santa Monica Boulevard and Wilshire Boulevard, and a proposed terminus at the University Drive entrance to the University of California, southern branch, in the city of Los Angeles, as an extension of present motor coach service.

Flat Rate Taxis Opposed in Springfield, Mass.

Petitions for permits to operate taxicabs at flat rates of 35 to 50 cents a ride for any distance within city limits, presented to the municipal transportation board of Springfield, Mass., are opposed by the Springfield Street Railway and also by some of the larger cab concerns.

Rights Sought by Omaha Company

A committee of three has been appointed by Mayor Dahlman of Omaha, Neb., to consider two applications made to the City Council for bus line extensions on the part of the Omaha & Council Bluffs Street Railway. J. N. Shannahan, president of the railway, had 29 similar petitions for bus lines as well as two for rail extensions on file. These petitions have also been turned over to the special committee which will investigate the existing conditions.

If the facts found by the committee warrant an extension or an introduction of rail or bus lines, service will be given in accordance with the policy of the railway to provide the city transportation in the best possible manner. Mr. Shannahan voiced this sentiment when he said:

> You have given us the monopoly of local transportation service and we are bound to serve the city.

It is estimated that the initial cost for the bus lines for which rights are sought would be $274,000 and the initial cost of the rail extensions asked would be $71,000.

Experimental Service by San José

The San José Railroad has applied to the Railroad Commission for authority to abandon its passenger bus service on Morton Avenue to Tillman Avenue and along Tillman Avenue to Park Avenue in Hanchett Park, Cal. Permission is also asked to establish an experimental bus service for one year between the intersection of Martin Avenue and The Alameda, San José, and the intersection of The Alameda and Hedding Street.

Financial *and* Corporate

Smaller Net in Baltimore

United Railways & Electric Company earned only $1.36 a share in 1928, but conditions are improving

SURPLUS earnings of the United Railways & Electric Company, Baltimore, in 1928 equaled $1.36 a share on the outstanding common stock. This compares with $1.66 a share in 1927 and $2.47 a share in 1926. The calculations are based on preliminary figures and do not take into consideration annual adjustments at the closing of books at the end of either year.

The company's gross earnings in December showed a substantial increase in response to the increased fare. This increase, allowed by the Public Service Commission, from a fare rate of three for a quarter to four for 35 cents, represented an increase of only 45/100 of a cent. This, it was thought, and so far has proved, to be insufficient to provide for the increased depreciation ordered at the same time by the commission.

While the company benefited to the extent of putting aside for depreciation $136,555 in 1928 compared with $70,000 in December, 1927, the net result to surplus for December, 1928, was $65,879 as against a surplus of $91,678 in 1927. This surplus represents income over and above all interest charges, including interest on income bonds.

For the twelve months of 1928, before annual adjustments at the closing of books for the year, the statement shows gross passenger revenues of $16,060,894, or an increase of $104,880, over the year 1927. A statement says:

Annual adjustments at the end of the year frequently make a substantial change in the net income from that shown in the preliminary statement. The present statement, however, shows the 1928 net as $558,393 after payment of all interest, including income bond interest. This was about $123,000 less than in 1927.

Increased operating expenses for the year were $249,595. This was due to increased depreciation, the higher wage scale that went into effect this year, and other small items.

STATEMENT OF EARNINGS OF THE UNITED RAILWAYS & ELECTRIC COMPANY, BALTIMORE

	1928	1927	Increase	Decrease	Per Cent
Passenger revenue	$16,060,894	$15,956,013	$104,880	.....	.66
Other revenue	212,912	233,727	.....	$20,815	8.91
Total	$16,273,806	$16,189,741	$84,064	.....	.52
Operating expenses:					
Way and structures	$872,703	$841,535	$31,167	.....	3.70
Equipment	917,315	907,550	9,765	.....	1.08
Power	1,421,823	1,387,832	33,991	.....	2.45
Conducting transportation	5,158,662	5,143,117	15,545	.....	.30
Traffic	25,594	15,474	10,120	.....	65.40
General and miscellaneous	1,606,048	1,535,354	70,693	.....	4.60
Transportation for Investment-Cr	*6,919	*16,025	9,106	.....	56.82
	9,995,228	9,814,839	180,389	.....	1.84
Depreciation	878,693	809,487	69,206	.....	8.55
Total	$10,873,921	$10,624,326	$249,595	.....	2.35
Net operating revenue	5,399,884	5,565,415	.....	165,530	2.97
Taxes	1,578,782	1,593,143	.....	14,361	.90
Operating income	3,821,102	3,972,271	.....	151,169	3.81
Non-operating income	150,823	159,230	.....	8,406	5.28
Gross income	3,971,926	4,131,502	.....	159,575	3.86
Fixed charges	2,853,532	2,889,315	.....	35,782	1.24
Remainder	1,118,393	1,242,187	.....	123,793	9.97
Interest on income bonds	560,000	560,000	.....	.....	.....
Net income	$558,393	$682,187	.....	123,793	18.15
Car-miles	33,013,320	33,979,657	.....	966,337	2.84
Seat-miles	1,561,348,818	1,592,238,132	.....	30,889,314	1.94
Revenue passengers	$200,466,304	$218,714,410	.....	$18,248,106	8.34
Transfer passengers	$82,997,639	$89,039,613	.....	$6,041,974	6.79
Revenue passengers per car-mile	6.0766	6.4440	.....	.3674	.....
Maintenance cost per car-mile	.0554	.0524	.0030	.....	.....
Depreciation cost per car-mile	.0266	.0238	.0028	.....	.....

*Credit.

NOTE:—Increase in rates of fare, effective at midnight Feb. 12, 1928, from 8—7½ cts. for adults and 4 cts. for children to 9—8½ cts. for adults and 5 cts. for children, without change in commutation or school ticket rates. Further increase to 10—8½ cts. for adults became effective Dec. 1, 1928.

For the month of February, revenues and expenses were for 29 days in 1928, as compared with 28 days in 1927. Expenses for 1928 are at increased wage over 1927—2% effective Jan. 1st and additional 2% effective Feb. 12.

NET INCOME OF UNITED RAILWAYS & ELECTRIC COMPANY BY MONTHS

	1928	1927	Increase	Decrease	Per Cent
January	$18,366	$72,128	.....	$53,761	74.54
February	18,769	27,590	.....	8,820	31.97
March	63,255	81,509	.....	18,254	22.40
April	37,535	61,000	.....	23,465	38.47
May	61,738	63,529	.....	1,791	2.82
June	30,009	41,721	.....	11,711	28.07
July	34,506	36,370	.....	1,863	5.12
August	20,453	20,849	.....	395	1.90
September	39,034	38,691	$342.82	.....	.89
October	92,584	72,738	19,845.87	.....	27.28
November	76,260	74,379	1,881.12	.....	2.53
December	65,879	91,678	.....	25,798	28.14
	$558,393	$682,187	.....	$123,793	18.15

Dividends Resumed by Twin City Company

The Twin City Rapid Transit Company, Minneapolis, Minn., has resumed dividends on the common stock by the declaration of a quarterly dividend of $1, payable on April 1 to stock of record March 12. The last previous dividend was $1 quarterly, paid July 2, 1928.

Warren-Jamestown Line May Be Abandoned

Abandonment of the Warren & Jamestown Street Railway line between Warren, Pa., and Jamestown, N. Y., is expected. The line, which is 21 miles long, was opened in 1902 and has maintained hourly service in each direction for the greater part of that time. Of late, however, the opening of bus service between the two towns by the West Ridge Transportation Company has materially cut down the railway's revenue and a meeting of officials, at a hearing for approval of a franchise for the bus company, brought that the railway would surely make application for abandonment shortly.

Increase in Capital Stock of Jamaica Central

Jamaica Central Railways, Long Island City, N. Y., has filed a certificate in the office of the secretary of state increasing the number of shares of its capital stock from 2,000 to 12,000 shares, no par value.

Lower Net Income on Brooklyn-Manhattan

Total operating revenues of the Brooklyn-Manhattan Transit System, Brooklyn, N. Y., for the six months' period ended Dec. 31, 1928, were $24,135,351 against $23,617,381. Operating expenses increased from $15,378,210 to $15,710,730. After the consideration of total income deductions, the net income was $3,106,141 for the six months' period ended Dec. 31, 1928, and $3,123,306 for the 1927 period.

Another Income Bond Payment

Directors of Third Avenue Railway, New York, have declared an interest payment of 1¼ per cent on the adjustment mortgage 50-year 5 per cent income bonds, payable April 1, 1929. Similar payment was made Oct. 1, 1928. Total arrears on the issue is 31½ per cent.

Local Business Men Added to Omaha Board

Seven new directors were elected at the annual meeting of the stockholders of the Omaha & Council Bluffs Street Railway, Omaha, Neb., recently. All are prominent Omaha business men. The new directors are:

William Diesing, vice-president Cudahy Packing Company, and member of its Omaha branch; John W. Robbins, collector of customs for the Port of Omaha, realtor, and real estate investor; Arthur Metz, capitalist; P. F. Petersen, president P. F. Petersen Baking Company; Kirk Griggs, president Occidental Building & Loan Association; W. H. Schellberg, president Union Stockyards Company; and O. H. Barmettler, vice-president and general manager Iten Biscuit Company.

President Shannahan said:

In recommending to the stockholders additional names for the board of directors, I had in mind that settlement of the street railway problem in Omaha is of vital interest to the city as well as to the company.

When I asked the new members for the privilege of nominating them for election to the board, I told them they were being asked to perform a civic service. They agreed on that basis, and I am sure their counsel will be helpful to the city and to the company.

The other seven board members are: John A. Munroe, F. B. Johnson, J. N. Shannahan, Fred Hamilton, Louis C. Nash, W. A. Smith and Emmet Tinley.

Would Abandon Service in Independence

Permission to discontinue its city service in Independence is sought of the Public Service Commission in an application by the Kansas City Public Service Company. The plea says the local service in Independence has been operated at a loss for several years, estimated as ranging from $4,000 to $15,000 a year, because of a general decrease in patronage.

Small Municipal Line Shows Improvement

Gross income of the Athol & Orange Transportation Area, 6-mile municipally-owned railway, decreased in 1928 compared to the previous year, but as expenses were kept down a larger profit was shown than in 1927. The trustees report that the employees went through the year without a single accident to person or property.

Receipts from passengers totaled $41,522. Receipts from other sources brought the gross to $42,823. The largest expense was for power, $12,546. Other expenses included, way and structure, $5,898; equipment, $10,445; conducting transportation, $9,443; general and miscellaneous, $2,806; interest, $720; taxes, $204.

Receipts from passengers in 1927 totaled $43,692, or $2,169 more than in 1928. The 1927 receipts over expenses were $622 and the 1928 receipts over expenses, $750.

On the balance sheet the road and the equipment are listed at $21,318. Cash is shown as $8,490 and total assets are listed at $84,316.

Highest Return in Ten Years in Youngstown

Gross revenue of the Youngstown Municipal Railway, Youngstown, Ohio, increased 4.03 per cent in 1928, compared with 1927, although the total number of passengers carried decreased 1.12 per cent. In the year the mileage of car and bus operation decreased 1.38 per cent.

This reduction and other economies, together with the increase in fare effective on Feb. 27, 1928, brought an increase in the net balance with the result that the return to the company after all charges, including depreciation, was 5.48 per cent upon the agreed capital value under the ordinance, the highest return in the ten years of operation under the service-at-cost plan.

COMPARISON OF RETURNS AT YOUNGSTOWN FOR 1928 AND 1927

	1928	1927
Total passengers carried	30,996,943	31,345,360
Car and bus-miles operated	5,712,471	5,792,898
Gross revenue	$2,022,368	$1,943,897
Balance available, after all charges, for stipulated return	$246,173	$55,706
Agreed valuation under franchise	$4,490,297	$4,487,659
Per cent return on valuation	5.48	1.24

The improved showing of the Youngstown lines is attributable largely to the change in rate of fare which became effective on Feb. 27, 1928. Prior to that time the rate of fare had been 9 cents cash, seven tokens for 50 cents and 1 cent for a transfer. The rate of fare effective throughout the last ten months of the year was 10 cents cash, six tokens for 50 cents, $1.50 weekly pass and free transfers.

The Youngstown service-at-cost franchise went into effect on Jan. 16, 1919. It allows a 7 per cent return to the company upon the basis of the agreed capital value as defined by the ordinance. The actual return earned by years follows:

Year	Per Cent on Investment	Year	Per Cent on Investment
1919	2.73	1924	2.49
1920	3.81	1925	4.27
1921	1.16 loss	1926	4.48
1922	1.76	1927	1.24
1923	2.55	1928	5.48

Record Established in Toledo

January established an all-time record for the Community Traction Company, Toledo, showing total revenue of $370,560, an increase of $70,000 more than the similar month a year ago. After allowing for all reserves provided by the Milner ordinance, there was a net surplus of $20,833 available for the stabilizing fund. The deficit is now reduced to $1,126,375 and the new fare stabilizing fund stands at $85,864.

Passenger revenue in January was $351,802, or a gain of 24 per cent more than the similar month last year. Good employment conditions in Toledo industries, active business, severe weather with icy streets, and extension of the service of the company to provide better transportation facilities are all credited with contributing to the big gains. A total of 3,895,821 passengers was carried on street cars and 1,149,233 passengers on bus lines. The combined showing is nearly 1,000,000 passengers better than that for January last year.

Two of the new bus lines established on Jan. 1 made a profit and two others broke nearly even.

Finances of Eastern Massachusetts in Good Shape

About a fortnight ago the initial ten-year period of public operation of the Eastern Massachusetts Street Railway, Boston, Mass., came to an end. The feeling of the Boston News Bureau was that no account of the stewardship of the trustees would be complete without a reference to their achievements in the important matter of debt reduction. To that end the paper explained:

On Feb. 1, next, some $331,000 South Shore & Boston Street Railway 6s, extended, come due and will be paid off from treasury cash. Including this maturity, there will have been retired during the decade of public operation a total of $7,225,150 of bonds and equipment trust notes. This has all been done without recourse to new financing of any kind.

On Dec. 1, next, there will fall due an issue of $3,352,000 Lynn & Boston Railroad extended 6 per cent bonds. The road holds in its treasury 1,088,000 of these bonds, leaving the amount outstanding in the hands of the public $2,264,000. This maturity likewise will be taken care of without the necessity of refunding. At present, Eastern Massachusetts has $1,250,000 cash and has free, marketable securities or securities in reserve accounts in excess of the net amount of the Dec. 1 maturity. In other words, the road could pay off the bondholders today without touching its cash, and this makes no allowance of course for the reserves that will be accumulated between now and next Dec. 1 from operation of the property.

After the Lynn & Boston issue has disappeared from the balance sheet, Eastern Massachusetts will have outstanding bonds aggregating a principal amount of $19,936,447. There reposes in its own treasury $855,550 of these bonds, so that the net funded indebtedness in the hands of the public will be $19,080,897, all maturing on Jan. 1, 1948, or nearly nineteen years hence. Furthermore, it is a fact to be remarked upon that some $14,303,000 of this $19,000,000 odd total bears 4½ per cent interest. In other words, Eastern Massachusetts will have the use of a substantial bulk of capital for the next nineteen years at a rate that will make a favorable comparison with almost any other street railway.

The number of Eastern Massachusetts Street Railway common shares outstanding is 82,664. Earnings available for the common stock for 1928 were $1.55 a share.

Legal Notes

KENTUCKY—*Depot May Be Abandoned Where No Longer Required by Public Needs, Provided No Contract Required Its Maintenance Forever.*

A railroad constructing a depot pursuant to a contract with an adjoining landowner which did not require the depot to be maintained for any particular time could abandon the depot when public interest no longer required it, regardless of the enhanced value of the land of the adjoining owner. [Johnson's Adm'x vs. Louisville & N. Ry., 11 S.W. (2d) 96.]

LOUISIANA—*A Girl Eleven Years and Nine Months of Age, Intelligent, Robust and Bright, Is Capable of Negligence.*

Plaintiff claimed $20,000 damages for the loss of love and society of his child and for the pain and suffering he had endured because of her early death, and for the loss of support in his old age which he could have expected from his child. A jury awarded $12,000, a judgment which the court affirmed. On appeal the Court of Appeals ruled that recovery cannot be had against a street railway for injury to a pedestrian unless the railway was at fault. The court could perceive no negligence on the part of the company, rejecting the contention that the brakes of the car were not in good order and holding that fenders used on street cars for years would be considered to comply with the law unless proved inefficient. [Hargus vs. New Orleans Public Service, 118 So. 847.]

MICHIGAN—*Owner Must Be Compensated for Damages to Remaining Land Where Part of Land Is Taken for Highway.*

Michigan wanted to build a new highway. To do so it was deemed essential to acquire a part of the right-of-way of the Detroit, Grand Haven & Milwaukee Railway. Johnstone, Pohlmeyer and others sought to enjoin the defendants, claiming among other things that the relocation would seriously affect private residential estates. The principal question was whether, because of the proposed violation of the restrictions, the state must pay compensation to the owners of other lots in the subdivision, whose land is not actually and physically taken under the Constitution which prohibits private property being taken for public use without just compensation. The court ruled that although condemnation proceedings are conducted under Highway Law, Pub. Acts 1925, No. 352, and Pub. Acts 1927, No. 340, it is duty of commissioners to compensate the owner for what his landed interest will suffer from use proposed to be made of it by the railroad. [Johnstone vs. D., G. H. & M. Ry., 222 N.W., Rep. 325.]

NEW JERSEY—*Town Council May Not Revoke Bus Consent by Resolution Without Notice, Hearing and Approval of Service Commission.*

The Town Council of Secaucus had previously passed a resolution revoking and rescinding municipal consent authorizing the Public Service Transportation Company to operate buses through the town. The Board of Public Utility Commissioners held this revocation to be unlawful and the court sustained this contention since the revocation had been brought about without notice and hearing and without the approval of the board. The position of the board was that the consents granted were necessary and proper for the public convenience and conserved the public interest. The Hudson County Bus Owners Association and others sought a writ of certiorari to review the order of the commission approving the application of the transportation company for a permit to operate between certain towns. The court held the plea to be without legal merit. [Hudson County Bus Owners Association vs. Board of Public Utility Commissioners, 143 Atl. Rep., 755.]

NEW JERSEY—*Negligence for Car to Hit Man Dismounting from Truck Standing Near Track.*

Where a motorman knew, or should have known, that a truck had stopped in front of his car close to the track, and with the mechanical arm out, he should have slowed his car down almost to a standstill, and should have anticipated that someone on the truck might get off on side nearest track. [Markowski vs. Public Service Ry., 143 A., 740.]

NEW YORK—*Power of Eminent Domain Is Inherent In Every Sovereign.*

This was a proceeding brought indirectly by the state to acquire title to, and possession of, certain property of the Fonda, Johnstown & Gloversville Railroad, a combined electric and steam railroad in Fulton County, the stated purpose being the construction of a dam and reservoir for the regulation of the flow of the waters of Sacandaga River, which lie within the territory of the Hudson River regulating district. Commissioners appointed to ascertain the compensation to be paid for the property taken rendered a report which was confirmed. After an informal oral discussion between representatives of the board and of the railroad, the board made a written offer of $550,000. The award in this proceeding was $1,442,130 for property which the railroad and the trustee under the mortgage securing an issue of bonds claimed to be worth more than $4,000,000. The board's offer was far less than the amount awarded, but in the opinion of the court was so much closer to the actual value than to the defendants' demand that no justification could be found in the charge that the board did not act in good faith. The trier of the facts found that the offer was bona fide, and that finding was fully supported. After the board's attempt to agree with the railroad ended unsuccessfully, any effort to agree with the holder of the mortgage would have been futile, and, therefore, was not required. When the state takes this property and makes adequate provision for its location elsewhere, it does nothing to regulate or to cause an abandonment. With the questions of abandonment and possible direct interference with interstate commerce eliminated from the case, the court held that the right to acquire and take possession of the property is clear. [Board of Hudson River District vs. Fonda, Johnstown & Gloversville R.R., 164 N.E. 541.]

NEW YORK—*Affirmation by Court of Appeals of a Judgment in Favor of the Plaintiff in an Action for Personal Injuries.*

Plaintiff, while driving a wagon on Military Road, Buffalo, was injured in a collision with one of defendant's street cars. The issue on appeal was whether payments advanced to an injured party by an insurance carrier, after formal written notice that the injured party had elected to sue the negligent third party, are to be regarded as payments of compensation where no award of compensation had ever been made nor a hearing had before the State Industrial Commission. [Sifkowitz vs. the International Railway, 164 N. E. 585.]

OHIO—*Interstate Certificate to Operate Buses Was Properly Revoked Where Violations of Commission's Rule Continued After the Owner Had Been Warned.*

The court found it difficult to see upon what theory the commission revoked the certificate in the interstate operation, and refused to revoke the certificate relating to the intrastate operations, except on the theory that it was inclined to be lenient with the operator in the first instance and only decided to be firm with him upon proof of his later violations. It was the opinion of the court that the commission did not err in revoking the interstate certificate, since on Dec. 12, 1928 (Detroit-Cincinnati Coach Line, Inc., vs. Public Utilities Commission, 119 Ohio St. 324, 164 N.E. 356), it ruled that the commission has the power to revoke an interstate certificate for flagrant violations of valid rules and conditions. The court felt, however, that it would be an anomalous situation if it should hold that the commission might revoke an interstate certificate while at the same time leaving in full force and effect an intrastate certificate covering the same route and involving substantially the same violations. In consequence it reversed the commission's ruling on this order. [Wheeling Traction Co. vs. Public Utility Commission, 164 N.E. 523.]

Personal Items

A. Clint Spurr Honored in Wheeling

A. Clint Spurr, general manager of the Wheeling Traction Company, Wheeling, W. Va., was elected vice-president as well as general manager of the company and its subsidiary companies at a recent meeting of the board of directors. He was also given charge of the Wheeling Bridge Company. Mr. Spurr went to Wheeling as general manager in 1925 when he succeeded G. S. Wills, who left to take a similar post with another property in the East Liverpool district.

Early in his career Mr. Spurr entered the services of the Baltimore & Ohio Railroad with headquarters in Baltimore in the office of A. W. Thompson, vice-president. He remained with this outfit until the outbreak of the war. After his discharge from the Army, he became associated with Thomas Fitzgerald in consulting electric railway engineering work in Pittsburgh and remained with him for four years. When Mr. Fitzgerald became general manager and later vice-president of the Pittsburgh Railways, Mr. Spurr accepted the position of research manager for that company and worked indefatigably until his appointment as general manager at Wheeling.

Mr. Spurr was born in Valley City, N. D., in 1885. Later the family moved to Moundsville where he received his early education. Later he attended Linsly Institute for two years. He then entered Yale University where he received the degree of B.A. and LL.B.

C. J. Darrah Succeeds W. C. Shuck at Toledo

C. J. Darrah, who has been in the transfer department of the Community Traction Company, Toledo, Ohio, for nearly two years, has been named chief clerk of the transportation department to succeed the late William C. Shuck, according to an announcement by C. H. Forsgard, general superintendent.

J. E. Zimmermann Elected U.G.I. President

John E. Zimmermann was elected president of the United Gas Imrovement Company at a meeting of the board of directors on Feb. 27. Mr. Zimmermann has been chairman of the company's executive committee. He has agreed to assume the additional duties of the presidency "without obligation to continue the same for an indefinite period." Mr. Zimmermann will retain the chairmanship of the executive committee of the United Gas Improvement Company. He succeeds Arthur W. Thompson, to whom a six months' leave of absence was granted early in December and whose resignation was accepted last month. Mr. Thompson is now in Europe.

C. J. Curtaz Advanced

Made active manager of the Boston, Revere Beach & Lynn Railroad, the service of which he entered as a boy

FULL recognition came to Charles J. Curtaz for his long period of able and faithful service with the Boston, Revere Beach & Lynn Railroad, when he was recently designated acting manager of the company, effective on March 1. In addition to that office he will serve as assistant treasurer and clerk of the corporation, the latter office, under Massachusetts laws, corresponding to that of secretary.

C. J. Curtaz

Mr. Curtaz went to work for the railway as a mere lad. To be exact he was only fourteen years of age. He had attended the Boston public schools, but the fact that circumstance dictated that he seek work did not whet for a moment his desire for formal schooling more extended than it had been possible for him to obtain. So he attended the evening high schools, meanwhile and ever since adding to the meager equipment with which he started out to make his own way.

From that time in July, 1898, when he entered the service of the railroad, Mr. Curtaz unassumingly carried not only one Message to Garcia, but literally hundreds of them, as he served successively as clerk, cashier and accountant until Aug. 16, 1920, at which time he was made clerk of the corporation and assistant to the treasurer. Three and a half years later, on Jan. 24, 1923, he was appointed treasurer, in which capacity he served until Nov. 15, 1927. This was the date on which Hemphill & Wells arranged to take over the line and began to mature plans for equipping the road for electric operation, work that was completed in very fast time, the installation being fully described in the JOURNAL for Dec. 8, 1928.

At the time the road passed to the new owners, Mr. Curtaz was appointed assistant treasurer, retaining the office of clerk of the corporation. The new management soon found that this "old-timer" was in full accord with its up-to-date ideas. Like others in similar cases, Mr. Curtaz simply had not had the opportunity to prove his larger worth. In an age in which it seems at times that the showy, spectacular individual too often succeeds in having himself accepted on the basis of what he appears to be rather than what he is, it is the instances of recognition of men like Mr. Curtaz, who perform their work modestly but with real facility and dispatch, that hearten men in all walks of life who have achieved a real celerity in performing their duties that at times seems to becloud their capacity.

H. C. Truesdall Reappointed to Toledo Board

Henry C. Truesdall, vice-president Toledo Trust Company, has been reappointed by Mayor W. T. Jackson, of Toledo, Ohio, to the Board of Street Railway Control for the third term. He will serve six years.

Following Mr. Truesdall's appointment, the board reorganized and named W. W. Knight, chairman, and David H. Goodwillie, secretary. These three members have served together for the eight years that the Milner ordinance has been in effect and reappointment of Mr. Truesdall indicates that they will continue together for two more years. The problem of extension of the Milner grant will come up for settlement within the next two years, and it was deemed important to keep the original board intact.

Woman Executive at Alton Resigns

Miss Katherine Wilson, assistant to the vice-president Illinois Terminal Railway, a position which carries the duties and responsibilities of a general manager, has resigned. She was stationed at Alton, Ill., and for many years had concealed her sex in her correspondence by using the initials K.E., instead of her full name.

Born in Alton, Miss Wilson joined the railway as a stenographer in 1899, and worked under H. H. Ferguson, vice-president. At that time the 6-mile railroad served only one industry. Successively she became chief clerk and car accountant, the highest position the small road could then offer her. As years passed Mr. Ferguson came more and more to pass operating responsibilities to Miss Wilson and she was recognized as the manager. The road expanded to Formosa and Edwardsville and Miss Wilson's duties increased.

Eight months ago the Illinois Power & Light Corporation purchased the 50-mile railroad and it was consolidated with the Illinois Traction System controlled by the same interests.

Both Vice-President Ferguson and Miss Wilson have announced their intention to retire from the organization.

Walter C. Loy Takes on New Duties in Chicago

Walter C. Loy, assistant general manager Shore Line Motor Coach Company, Hammond, Ind., has resigned to become associated with the Union Motor Coach Terminal Company, Chicago, as assistant general manager. Mr. Loy has been identified with traffic work in steam, electric railroad and motor coach enterprises for more than 25 years, the last three of which have been with the Shore Line Motor Coach Company.

Alba H. Warren With Houston Gas

Announcement has been made from the office of O. R. Seagraves, president, United Gas Company, parent company of the Houston Gas & Fuel Company, Houston, Tex., of the appointment of Alba H. Warren as vice-president and general manager of the latter company, succeeding W. A. Raymond.

Mr. Warren is leaving his present position as district manager of the Stone & Webster properties in Georgia and Florida, with headquarters at Savannah, Ga. He has been in the public utility business for 21 years. Among the positions he has held are the following: Manager Pensacola Electric Company at Pensacola, Fla., 1908-1913; manager Galveston Electric Company, 1913-1918; manager El Paso Electric Company, which did the lighting and railway business in El Paso, Juarez, Mexico, and surrounding communities, 1918-1925. In February, 1925, Mr. Warren was transferred to Savannah as manager for Stone & Webster of the Southeastern district.

J. J. Pelley Heads New Haven

John J. Pelley, president of the Central of Georgia Railway, was elected president of the New York, New Haven & Hartford Railroad, succeeding the late E. J. Pearson. He assumed his new duties on March 1 with that road and its subsidiaries. After serving in many capacities in the railroad field, Mr. Pelley in 1917 was appointed general superintendent to the Illinois Central, Southern lines, and general superintendent of the northern lines in 1919.

He was promoted to be general manager of the Illinois Central in 1923 and the next year he was made vice-president in charge of operation. In the fall of 1926 Mr. Pelley was elected president of the Central of Georgia. Mr. Pelley was born at Anna, Ill., in 1878. He attended the University of Illinois.

C. H. Copley Leaves Missouri Road

C. H. Copley has moved to New Haven, Conn., but has not decided on any new assignment. He resigned his position as general superintendent Springfield Traction Company, Springfield, Mo., some months ago. Since 1894 Mr. Copley has been engaged in electric railway work, first as motorman for the Winchester Avenue Railroad, West Haven, Conn. Later he was general superintendent of the Bellows Falls & Saxtons River Street Railway in Vermont. Before his affiliation with the Springfield Traction Company in 1917 he had served as construction foreman for C. W. Blakeslee & Sons, New Haven, and as superintendent of the Norwalk and the Stamford divisions of the Connecticut Company in Norwalk.

H. K. Bennett, formerly identified with safety work on the United Electric Railways, Providence, R. I., is serving as manager of the Providence council of the National Safety Council. Mr. Bennett resigned some months ago from the United Electric Railways, relinquishing the position as manager of the department of safety and publication.

W. H. Wright, secretary of the Georgia Power Company, Atlanta, Ga., has been appointed assistant to the president, according to an announcement made by Preston S. Arkwright, president. A native of Georgia, Mr. Wright entered the employ of the company in 1906 as secretary to H. M. Atkinson, chairman of the board of directors of the Georgia Railway & Power Company. These duties he held until 1916, when he was elected secretary of the company, the position he retained up to the present time.

Major Ewing E. Towles has resigned as assistant chief engineer for the Missouri Public Service Commission at Jefferson City, effective on March 1, to enter the operating end of the public utility field. He is a graduate of the Missouri University School of Engineering. He became assistant chief engineer for the commission in 1914, and was later granted a leave of absence to serve in the signal corps of the army during the World War.

W. Forbes, general manager of the Aberdeen Corporation Tramways, Scotland, has been unanimously recommended for appointment as general manager of the Cardiff Corporation Tramways in Wales. Mr. Forbes succeeds R. L. Horsfield, recently made general manager of the Leeds City Tramways. In his early years Mr. Forbes served with the once prominent firm of Westinghouse, Church, Kerr & Company, consulting and constructing engineers. This experience naturally has led to Mr. Forbes' maintaining a keen interest in American transportation practices.

J. P. Pulliam, vice-president of the Wisconsin Public Service Corporation, Milwaukee, has been elected a vice-president of the Wisconsin Securities Company. In addition to his new position he retains his former position as treasurer of the Wisconsin Securities Company.

OBITUARY

Harry O. Butler

Harry O. Butler, superintendent of transportation, St. Louis Public Service Company and for 40 years an employee of the company and its predecessors, died on Feb. 11. He started his railway career as a conductor on the old Olive Street cable line in 1889 and in 1896 was made a supervisor for the old Union Depot Railroad, which was later merged with other companies to form the St. Louis Transit Company, the predecessor of the United Railways, and its successor, the present St. Louis Public Service Company. The Union Depot Railroad was operated by John Scullin and associates. In 1897 Mr. Butler was made superintendent of the Grand Avenue line and in 1903 was placed in charge of the Grand and Bellefontaine lines. He continued in that capacity until 1913 when he was promoted to assistant superintendent of transportation. He was made superintendent of transportation in 1923.

R. E. Gallaher

Raphael Eccleton Gallaher, president of the New York Insulated Wire Company, died on Feb. 10. Mr. Gallaher was a pioneer in the wire and cable industry. In 1884 he organized the New York Insulated Wire Company, which is now a member of the Wire and Cable Section of the National Electrical Manufacturers Association. He held the position of secretary of his company from the time it was organized until 1927, when he became president. Mr. Gallaher was 78 years of age.

W. C. Shuck

William C. Shuck, who had served as chief clerk of the transportation department of the Community Traction Company, Toledo, Ohio, since 1919, died at Mercy Hospital there on Feb. 18, following a stroke of apoplexy suffered two days before. He was prominent in Masonic affairs in Toledo. He had formerly been employed for 22 years at the Toledo State Hospital. Mr. Shuck was born in Cumberland, Md., in 1875.

Jonas J. Burns, who aided in promoting the first electric railway in Goshen, Ind., and also the railway line, now part of the New York Central system between Goshen and Battle Creek, Mich., died recently. He was 78 years old.

J. W. Weitnauer, master mechanic Springfield Traction Company, Springfield, Mo., died recently. He had been with the company for 30 years, advancing from the position of motorman. Mr. Weitnauer was 54 years old.

Equipment Orders Pending

Detroit may order 100 additional cars. $5,492,173 railway improvements to be made in Milwaukee. Montreal may place large car order. Public Service orders 288 buses

WITH THE delivery of 100 new street cars now commencing, the general manager of the Detroit Street Railway, Detroit, Mich., has been instructed to make a survey to determine whether 100 additional cars should not be ordered at once. This action was taken so that the department may not find itself with insufficient equipment when the employment conditions show further improvement during the summer months.

Delivery of the cars ordered last November from the Perley Thomas Car Company, High Point, N. C., has commenced and will continue at the rate of six or eight per week until the contract has expired. It is believed that if new cars are ordered they should be equipped with three doors in the center instead of two, thus facilitating loading and unloading.

Milwaukee Improvements

The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., and its associated utilities in Winconsin and upper Michigan are planning to invest $17,339,211 in expanding and improving its public service facilities this year. The program is the most extensive the company has ever undertaken, the total budget exceeding that of 1928 by $3,356,567. Substantially the largest part of the expansion is planned for the Milwaukee area. The budget is divided among the various properties as follows: the Milwaukee Electric Railway & Light Company and the Wisconsin Electric Power Company, $12,668,486; The Wisconsin Gas & Electric Company $2,999,800; and the Wisconsin-Michigan Power Company, $1,670,938.

A total of $5,492,193 is provided for the improvement of the Milwaukee Electric Railway & Light Company's railway system. The provision of $1,250,000 for the prosecution of work on the west side rapid transit and subway projects are major single items in the program. Other items include $150,000 for the company's apportionment of the cost of the west side steam railroad grade separations and $127,000 for the construction of tracks on the new Sixteenth Street viaduct. Expansion of the boiler capacity, and auxiliary equipment at the Lakeside plant is to cost approximately $1,500,000. The Wisconsin Gas & Electric Company plans further expansion of its gas manufacturing and distributing system at a total cost of $1,678,191. The Wisconsin-Michigan Power Company will undertake extensive plant improvements and expansion of its transmission line facilities.

Borough President Byrne, of Brooklyn, has proposed that the Board of Estimate seek an agreement with the South Brooklyn Railway, Brooklyn, N. Y., for the transfer of its tracks from the private right-of-way along Shell Road to the middle of the street. By laying the tracks on both sides of the row of elevated pillars, which now fall in the middle of Shell Road, it is pointed out that the tracks across Shell Road from Gravesend Avenue would be less dangerous to traffic, and by using the Mall for the tracks, the city will not have to attempt the difficult task of compelling the railway to construct its present right-of-way to the legal grade at the intersections of the eastbound streets that have been mapped out.

The South Brooklyn Railway's private right-of-way crosses a number of eastbound streets which have been mapped out but which have not as yet been acquired by the city of New York. Where this right-of-way crosses these various streets, it is below grade and it is believed it will be a very difficult matter for the city to compel the railroad to conform its right-of-way to the legal grade at these intersections. It is believed that it cannot be done without the action of both the Board of Estimate and the State Transit Commission. A ruling by the latter body is said probably to result in a number of dangerous street crossings.

It is pointed out that the way to avoid such grade crossings is to transfer the railroad out of its private right-of-way to the center of Shell Road and to improve the highway with roadways on each side of the central Mall. A public hearing on the measure was set for March 12 by the Assembly judiciary committee.

Public Service Buys Buses

The Public Service Co-ordinated Transport, Newark, N. J., has just placed an order for 288 additional Yellow chassis and complete coaches, it was announced here today by H E. Listman, vice-president General Motors Truck Company. The order calls for 33 type Y, 29-passenger coaches; 93 Z-240 gas-mechanical chassis; 161 Z-240 gas-electric chasis and 1 type W.

Public Service Co-ordinated Transport is the largest operator of motor coaches in the United States.

The order just reported brings its total fleet to more than 2,000 coaches.

Montreal to Order Cars

It is understood that Montreal Tramways, Montreal, Que., will shortly place an order for 50 cars of modern design to replace equipment of an inferior type. The management also is said to be considering the placing of an additional order for a like number.

At an average cost per car of $20,000, this will mean an expenditure of about $1,000,000 by Montreal Tramways and possibly twice that amount if the management decides to go ahead with the larger program.

It has not been decided what manufacturer will get the initial order. In the last two or three years Montreal Tramways has spent large sums of money in maintaining its rolling stock in a high degree of efficiency and has been active in adopting the latest designs.

Construction in Oakland

Preparatory work for the widening of Foothill Boulevard is under way by the Key System Transit Company, Oakland, Cal. The company is setting back all the trolley guide wire poles on Foothill Boulevard from 35th Avenue to 42nd Avenue. This work precedes the paving work to be undertaken by the city and track reconstruction and paving work to be done by the railway.

The Key System Transit Company is also developing a number of more comfortable noiseless cars. A total of six cars have already been reconstructed and are now in operation for experimental purposes. Noise deadening, shock absorbing shims have been placed between the trucks of the cars and the car bodies and at the base of the air compressors. Deep cushioned individual seats have been installed and a new window sash arrangement affords spacious windows and greater vision for the passengers. A new carpet, buzzer system, and modern illumination are features on these cars.

There was a total of 105,705 lineal feet of track rebuilt during the year 1928 by the Kansas City Public Service Company, Kansas City, Mo. This exceeded the construction during the previous year which amounted to 102,231 lineal feet. During the year special work was installed at 30 different locations. In the rehabilitation of tangent track there was $303,373.75 expended for labor; for material, $557,065.35; making a total of $860,439.10. The installation of special work called for labor amounting to $88,608.71 and material charges of $237,974.08. the total expenditure for rehabilitation of tangent track and special work was $1,187,021.89.

The Chicago & Joliet Electric Railway, Joliet, Ill., will relocate a number of its car tracks and make several extensions to its lines during the coming spring. Bond elections are proposed in San Francisco to provide $1,000,000

for the electrification of the old California cable line in that city. The British Columbia Electric Railway Vancouver, B. C., has let a contract for a $40,000 power distribution plant, having a capacity of 20,000 kw. The Ottawa Electric Railway, Ottawa, Ont., has ordered one 5/8-in. electric valve refacer.

The Louisville Railway, Louisville, Ky., has recently ordered 10,000 white oak ties; 15 miles of No. 00 copper trolley wire; 50,000 ft. of soft steel strand and 500 clinch ears. This company has also ordered miscellaneous car equipment and supplies amounting to approximately $10,000.

Britain Completing Large Suburban Electrification

The electrification on the central section of the Southern Railway of England is now nearly complete. On March 3 and 4, new electric train service will be brought into operation for the first time, and trains previously worked on the overhead wire system will be worked on the third-rail or direct current system, the standard method of Southern Railway electrification.

From this time the whole of the railway's electrified tracks will be worked by the third-rail system. "Overhead" trains will continue to run for a while on certain of these routes, but those will gradually disappear as the new rolling stock becomes available. With the opening of this, therefore, the whole of the railway's suburban electrification scheme of 875 miles, as authorized by its board of directors, will be complete.

The first stage under Southern Railway administration was opened in 1925, and each year there have been extensions and conversions, until the installation has reached a cost of £11,000,000. The service has been entirely rearranged and increased in some cases to as much as 200 per cent more than that previously given by steam. New signalling has been installed; stations have been rebuilt and platforms remodelled on a large scale, and further extensions of the electrified area are being considered by the company's experts.

Apart from the electrification of steam lines and the conversion to third-rail working, London business people will benefit by the opening of the railway's new through services from Wimbledon, Tooting, Beckenham, etc., to the city.

The introduction of these new and converted services has necessitated provision of 42 three-coach units and 22 two-coach trailer units, with seating accommodation for 2,352 first-class and 11,740 third-class passengers.

The electrification and conversion of the lines has necessitated many structural alterations and the lengthening of platforms at several stations. The new station at Epsom will be brought into use to serve both the Waterloo and Victoria trains.

New permanent way connections have been provided at the terminus at Victoria. The lines between Kent House Junction and Beckenham Junction have been widened to enable the new services from Beckenham Junction to Victoria to work into the new bay platform at Beckenham Junction without interfering with the main lines.

METAL, COAL AND MATERIAL PRICES F. O. B. REFINERY

	Feb. 26, 1929
Metals—New York	
Copper electrolytic, cents per lb	18.45
Copper wire, cents per lb	20 875
Lead, cents per lb	7.10
Zinc, cents per lb	6.7
Tin, Straits, cents per lb	49.
Bituminous Coal, f.o.b. Mines	
Smokeless mine run, f.o.b. vessel, Hampton Roads, gross tons	$4.425
Somerset mine run, f.o.b. mines, net tons	1.875
Pittsburgh mine run, Pittsburgh, net tons	1.80
Franklin, Ill., screenings, Chicago, net tons	1.35
Central, Ill., screenings, Chicago, net tons	1.05
Kansas screenings, Kansas City, net tons	1 70
Materials	
Rubber-covered wire, N. Y., No. 14, per 1,000 ft	$5 90
Weatherproof wire base, N.Y., cents per lb.	21.375
Cement, Chicago net prices, without bags	2 05
Linseed oil (5-bbl. lots) N. Y., cents per lb.	10 6
White lead in oil (100-lb. keg), N. Y., cents per lb	13.5
Turpentine (bbl. lots), N. Y., per gal	.6225

Booklet Issued on Simplified Coated Abrasives

Instead of 8,000 varieties of coated abrasive products, spot stocks will now be limited to 1,976, corresponding to an elimination of 75.3 per cent, the Department of Commerce announces through its division of simplified practice. According to the department, the printed government pamphlet is now available for purchase, through the Superintendent of Documents, Government Printing Office, Washington, D. C.

For years the quantity of sizes and varieties of coated abrasive products has been increasing at a rapid rate. Many thousands of varieties have been stocked and cataloged by the industry when actually only a certain portion of them have enjoyed a satisfactory turnover. This becomes a matter of considerable importance in view of the fact that the estimated annual output of the industry amounts to about $16,000,000. This over-diversification in manufacture led to the development of Simplified Practice Recommendation No. 89, Coated Abrasive Products. The industry fixed Jan. 1, 1929, for absorption of the obsolete varieties. A standing committee of the industry has been appointed which will have in its charge the periodical revision of this simplified practice program.

Mazda Lamp Prices Reduced

Mazda lamp prices were again reduced on March 1, 1929, on the 50 and 60-watt lamps of the standard line of inside frosted lamps, Gerard Swope, president General Electric Company, has announced. Price reductions were also made on all colored lamps except flame tints.

This is the twelfth time that Mazda lamp prices have been reduced since 1920. Present reduction of approximately 10 per cent brings the prices of these lamps to almost one-half of their 1914 prices.

The March 1 price reductions are as follows:

Lamp Size	Old Price Cents	New Price Cents
50-watt (A)	22	20
60-watt (A)	22	20
25-watt (colored)	30	25
40-watt (colored)	30	25

Building Construction Declines

After the value of construction contracts had reached a new high record for all time during 1928 at $6,628,286,000, which is 5 per cent above the total for 1927 and 10 per cent above that for 1925, the January building reports were received with mild disappointment in some circles. Construction contracts awarded in that month in 37 states east of the Rocky Mountains, according to the F. W. Dodge Corporation, amounted to $409,967,900, which is 4 per cent below the value of those awarded in January, 1928. The heaviest decline in contracts awarded in January was in the district composed of New York State and northern New Jersey, where there was a drop of 22 per cent from contracts awarded in the corresponding month in 1928. The total for the Pittsburgh district, on the other hand, was double that of January last year; while the Northwest district reported the second largest total for any January on record.

ADVERTISING LITERATURE

Wagner Electric Corporation, St. Louis, Mo., has issued a new bulletin No. 158 on small vertical motors, covering all types, in ratings of ⅛ to 1½ hp. As illustrated by diagrams in this bulletin, a unique feature of these motors is that they all have the same flange or lug dimensions, making it possible for manufacturers and users of small motor-driven machinery to interchange motors of different types and ratings on the same mounting dimension.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a booklet giving a photographic presentation of "Modern Metal Handling Methods" by using "Red Top" lifting magnets. Photographs are used almost entirely to show the application of magnets to the varied kinds of work in foundries, junk yards, steel plants and miscellaneous industries.

Waukesha Motor Company, Waukesha, Wis., has issued a new book entitled "What's New With Waukesha," which describes new engines developed during the past year by that company. A large stationary engine, several sizes of transportation engines, and a number of completely equipped power plants are described.

It's not the design that makes a modern car— *it's the equipment*

—Especially the safety equipment. That is why so many of the new cars are equipped with hand-brakes that operate on the most modern principle of—

"Peacock" Staffless

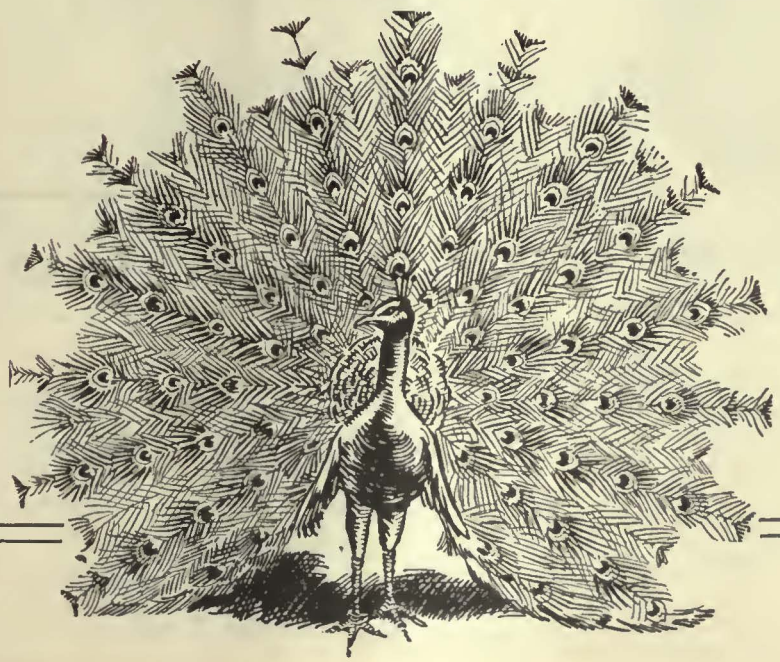
Reg. U. S. Pat. Off.

It is this modern principle that enables Peacock Staffless Brakes to wind up any amount of chain without clogging—a most important feature, when rigging is slack or brake shoes worn. It is the same modern principle that makes Peacocks so fast and powerful in braking. And besides these features, Peacock Staffless also claims its place on modern cars because of its light weight and small platform space requirements. Not to overlook their exceedingly low maintenance, a truly modern requisite.

NATIONAL BRAKE COMPANY

890 Ellicott Square Buffalo, N. Y.

Canadian Representative: Lyman Tube & Supply Co., Ltd., Montreal, Can.
The Ellcon Co., General Sales Rpresentative: 50 Church St., New York



LONG RADIATORS HELP REPEAT SALES *for* FEDERAL

It's the user's satisfaction that makes repeat sales. 72% of all Federal sales represent those to previous owners. Long radiators are built to give that satisfaction that makes repeat sales and our production has gone on with increased volume until it is now the greatest in our history.

LONG MANUFACTURING CO., DETROIT, MICHIGAN

LONG

LONG PRODUCTS—AUTOMOTIVE CLUTCHES AND RADIATORS

Our Aim

Safety:

C.E.M.F. RELAYS: Prevent doors from opening while the car is in motion
CONTROL RELAYS: Prevent the car from starting while doors are still open
ENGINE BY-PASS VALVE: Prevents doors slamming if stopped while closing
SAFETY REVERSING DOORS: Open automatically if touched while closing
MOTORMAN SIGNAL LIGHTS: Indicate to motorman when all doors are closed
WINDOW SILL HEATERS: Permit clear vision in cold weather by keeping the motorman's window free from frost, snow and sleet
ELECTRIC HEATERS: With open and enclosed coil element, have carefully designed cases which positively eliminate accidental contact
SAFETY SWITCHES: Fully enclosed, offer absolute protection to the operators

Comfort:

THERMOSTATS: Maintain an even car temperature under all conditions
ELECTRIC HEATERS: Furnish an even and comfortable heat for passengers
AUTOMATIC VENTILATORS: Introduce fresh air and exhaust vitiated air

Economy:

THERMOSTATS: Prevent unnecessary waste of current by the electric heaters
MOTOR RESISTOR HEATERS: Utilize the heat dissipated by resistance grids and automatically remove regular heaters from the peak load
MULTIPLE UNIT DOOR CONTROL: Eliminates many unnecessary train men
AUTOMATIC TREADLE DOORS: Permit the use of one man cars and buses without loss of efficiency in handling passengers, or in maintaining schedules

Speed:

PNEUMATIC DOOR ENGINES: Open doors when cars come to a stop, and close them when the power is applied, all automatically
AUTOMATIC TREADLE OPERATED DOORS: Speed up the unloading of passengers and permit the cars to maintain better schedules and faster service

These represent our four contributions to better modern transportation

CONSOLIDATED CAR-HEATING COMPANY, INC.
New York—Albany—Chicago

CONSOLIDATED CAR HEATING COMPANY

OHIO ~

gets the first Fleet of

Studebaker Straight Eight Busses

Splendid Performance on Stiff Grades Proved Superiority of Straight Eights

SEVEN STUDEBAKER Straight Eight Busses, five inter-city and two city type, were put in service on January 25th by the Southern Ohio Public Service Company and its subsidiaries operating between Columbus, Newark and Zanesville, and within the city of Zanesville.

Mr. R. L. Jacobs, General Superintendent of the company, in giving his reasons for this purchase, said, "We are standardizing on Studebakers because our records prove them to be very satisfactory and economical. We operated 1,110,000 miles of inter-city service last year with 14 Studebakers and 6 busses of other makes. The Studebakers covered practically two-thirds the total distance at an average cost of 13 cents a mile. This includes everything but depreciation. And it represents a considerable saving over the operating cost of other equipment.

"Because Studebaker Busses are from 3000 to 5000 pounds lighter than any heavy type bus of equal seating capacity, they cost less to operate. The first cost is about one-half that of the heavier type, therefore the depreciation is less. We also get mighty fine tire mileages on Studebakers. We get a tire average of 30,000 miles on our Studebakers as against 20,000 miles on the heavier busses.

"But what interested us most was the really remarkable performance of the new Studebaker straight eight bus. In traffic it handles with the ease of a passenger car, and its reserve power makes it possible to maintain our close schedules over the Columbus-Zanesville route, half of which is over grades ranging up to 7 degrees. Even with a capacity load, it glides up the steep hills easily at any desired speed.

"We feel that Studebaker offers more for our bus dollar than any other manufacturer—that is why we are sold on Studebakers."

and from other States—

Following the announcement of Studebaker's new Straight Eight bus which is offered in 2 wheelbases and 3 models, orders far exceeded the first month's production. Experienced operators—many of them already Studebaker owners, bought Straight Eights. Today these new units are operating in Massachusetts, Wisconsin, Kentucky, Ohio, Texas, Oklahoma Kansas, Pennsylvania, Indiana, Tennessee, Missouri and in Canada.

STUDEBAKERS are

These seven Studebaker straight eight busses delivered to the Southern Ohio Public Service Company brings their fleet to 21 Studebaker units.

The experience of the Southern Ohio Public Service Company with Studebaker equipment parallels that of nearly 2000 other bus operators who are using Studebakers. These operators have learned by experience that their Studebakers are profit makers because of these four fundamental facts:

1. Studebaker busses are lower priced than any other busses of comparable quality and capacity.

2. The operating cost of Studebakers is lower because the chassis and bodies are correctly designed—all excess weight is eliminated, yet there is no compromise with safety or stability.

3. Due to the use of husky units and clean cut design, Studebaker busses have an unusually low maintenance expense. Proof: 20,000 miles service on each of the 24 Studebakers operated by The Detroit Motor Coach Co., during the last quarter of 1928 showed an average repair cost per bus of $12.24, or less than 7/100 of a cent per bus mile.

4. Lower depreciation is also an important item in Studebaker equipment. The tremendous excess mileage built into Studebaker busses, plus their low initial cost, has enabled bus operators to charge off their Studebakers at a very low rate per mile. When this balances the purchase price, many thousands of profit-producing miles are still left in these busses.

Prices

Studebaker Straight Eight Bus Models and Prices

Model 77
158-inch Straight Eight Junior Chassis

Chassis only, single or dual rear wheels..... $2585

Model 88
184-inch Straight Eight Special Chassis

Chassis only, single or dual rear wheels..... $2985

12-Passenger Seminole Observation Parlor Car..... $6595

Model 99
184-inch Straight Eight Heavy Duty Chassis

Chassis only, single rear wheels.... $3385

Chassis only, dual rear wheels..... $3485

21-Passenger Street Car Bus..... $6095

All prices F. O. B. Factory. Purchase can be arranged on Studebaker's liberal budget payment plan.

Lower first cost operating cost maintenance depreciation

Profit Makers

THE STUDEBAKER CORPORATION OF AMERICA,
Dept. B South Bend, Ind.

Please send complete information on Studebaker Straight Eight Busses, without obligation.

We have_____ busses at present. Check below the Studebaker Bus about which you desire information.

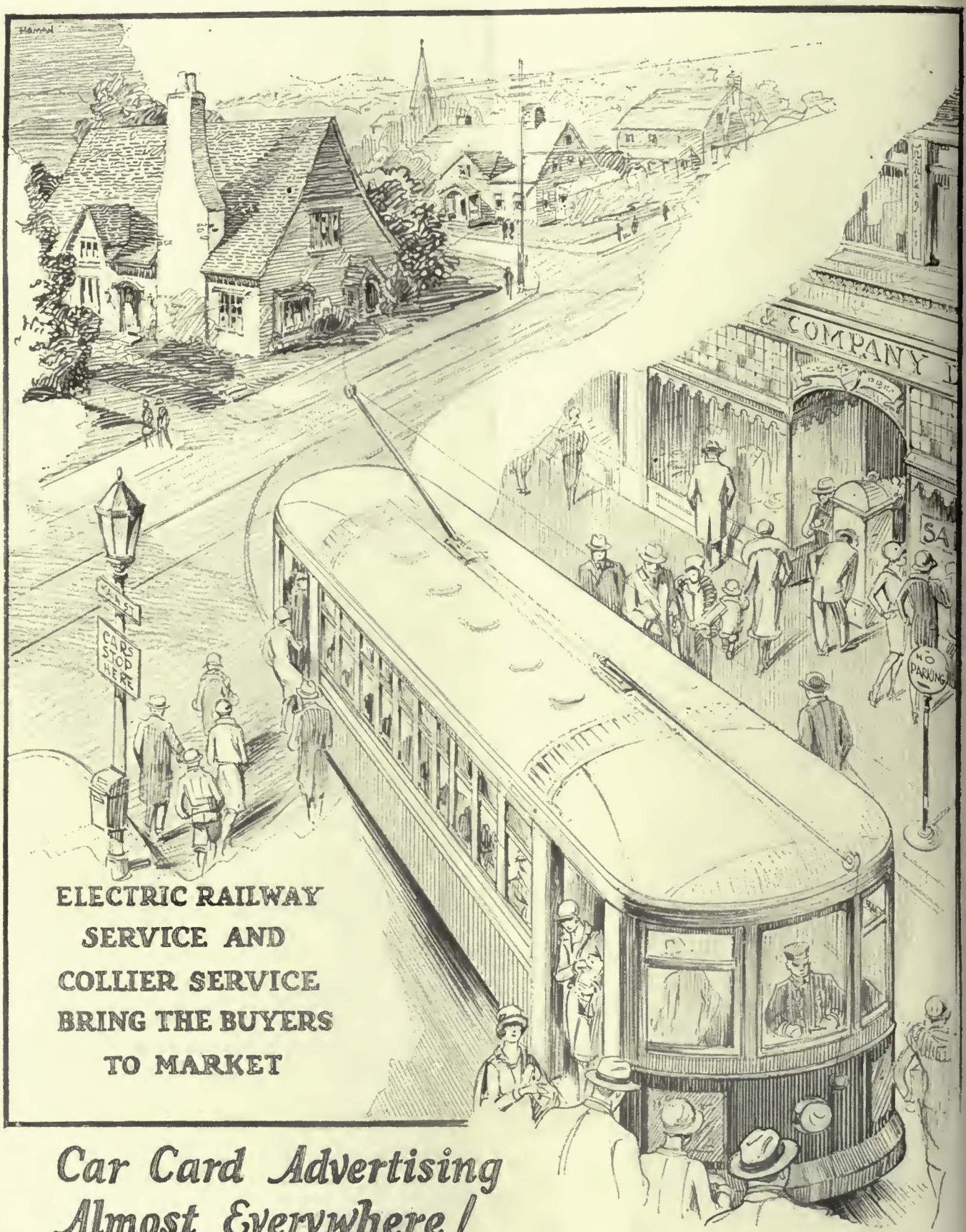
Body Model: Seminole ____ Street Car ____

Name _____

Address _____

City _____ State _____

B-3-29



ELECTRIC RAILWAY
SERVICE AND
COLLIER SERVICE
BRING THE BUYERS
TO MARKET

Car Card Advertising
Almost Everywhere!

BARRON G. COLLIER INC.

NEW YORK CITY

Bankers and Engineers

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, excepting Equipment, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$4.50 an inch
4 to 7 inches..... 4.30 an inch
8 to 14 inches..... 4.10 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.

B.J.

POSITIONS WANTED

ENGINEER—Ways and structures; 9 years' experience with street railway and interurban property. Clean, successful record, high-grade references, seeking position with future. PW-161, Electric Railway Journal, Tenth Ave. at 36th St., New York.

SUPERINTENDENT transportation, broad experience, established successful record city, interurban railways, buses. Will accept position of assistant with future. Salary and location secondary importance. Fine references. PW-162, Electric Railway Journal, Tenth Ave. at 36th St., New York.

POSITIONS VACANT

MANAGER

Experienced street railway man wanted on eastern property operating 75 cars. Must be familiar with all phases of street railway work and successful in public relations. Technical education desirable. Good opportunity for advancement. Apply giving details and references.

PV-163, Electric Railway Journal
Tenth Ave. at 36th St., New York City.

OFFICIAL PROPOSAL

Bids: March 14.

Tracklaying Broad Street Subway

DEPARTMENT OF CITY TRANSIT,
CITY OF PHILADELPHIA, 13TH FLOOR, CITY HALL ANNEX

Philadelphia, Pa., Feb. 20, 1929.

Sealed proposals, addressed to the undersigned, at the office above mentioned, will be received until 12 o'clock noon (Eastern Standard Time), on Thursday, March 14, 1929, and publicly opened immediately thereafter, for:

CONTRACT NO. 213—TRACKLAYING SOUTH STREET TO NORTH OF GIRARD AVENUE.

Specifications and plans may be seen at the office of the Department, on the 14th floor, City Hall Annex, and copies of same with blank forms for proposals, will be supplied to intending bidders upon application. A deposit of Fifty (50) dollars will be required for the specifications and plans. This deposit will be refunded upon return of the specifications and plans in good condition.

Bidders must be skilled and regularly engaged in the class of work for which they are competing.

No bid will be considered unless accompanied by a certified check on a responsible bank or trust company in favor of the City of Philadelphia, to the amount of five (5) per centum of the sum of such bid, in accordance with the provisions of an ordinance approved March 21, 1928, and reprinted in full in the specifications.

The Director reserves the right to reject any or all bids, as he may deem best for the interest of the City of Philadelphia.

C. E. MYERS, Director.

Clearance Sale of All Used Busses

If you are considering the purchase of an absolutely slightly used or rebuilt bus, it will be well worth your time to investigate our stock.

4—Model 54, 6-cyl. White parlor cars, 28-passenger, slightly used, mileage less than 10,000 miles.

3—Rebuilt Model 50-B, 4-cyl. White parlor cars, 26-passenger.

1—Model 53 demonstrator, 4-cyl. White parlor car, 16 passenger.

Write for full particulars

THE WHITE CO.
2520 S. Wabash Ave., Chicago, Ill.

FOR SALE

Center Entrance Trailers

5—Kuhlman Car Co., mounted on Brill 67-F trucks with 24-in. steel wheels; equipped with G. E. air brakes. Seating capacity 58. Length over-all 47 ft. Very good condition. Low price for quick sale.

Erie Railways Co., 231 State St., Erie, Pa.

WANTED

WANTED

50 Ton Locomotive

for 600 or 600-1,200 volt. Quote price and equipment in first letter. Must be completely assembled.

W-165, Electric Railway Journal
7 So. Dearborn St., Chicago, Ill.

Satisfactory Results

An advertiser writes: "We wish to take this opportunity of writing you in connection with the satisfactory results that were produced by our advertising in your 'Searchlight Department.'

"If at any time in the future we have any advertising to place, that comes within the lines of your subscribers, you may be assured that our Advertising Department will give first consideration to your magazine, due to the results that have already been obtained by us."

You, too, can use "Searchlight" Advertising in your business *profitably*. Employment, equipment for sale or wanted, business opportunities, etc.

Address

Searchlight Department

Tenth Ave. at 36th St., New York City.

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

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.

Advertising, Street Car
Collier, Inc., Barron G.

Air Brakes
General Electric Co.
Westinghouse Air Brake Co.

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

Armature Shop Tools
Columbia Machine Works
Elec. Service Supplies Co.

Automatic Return Switch Stands
Ramapo Ajax Corp.

Automatic Safety Switch Stands
Ramapo Ajax Corp.

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

Axles (Front & Rear) Motor Truck & Passenger Car
Timken-Detroit Axle Co.

Axles, Trailer & Motor Bus
Timken-Detroit Axle Co.

Babbitting Devices
Columbia Machine Works

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

Batteries, Dry
Nichols-Lintern Co.

Bearings, Anti-Friction
Timken Roller Bearing Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Columbia Machine Works
Westinghouse E. & M. Co.

Bearings, Center & Roller Side
Columbia Machine Works
Stucki Co., A.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Thrust
Timken Roller Bearing Co.

Bells and Buzzers
Consolidated Car Htg. Co.

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

Benders, Rail
Railway Track-work Co.

Bodies, Bus
Brill Co., The J. G.

Boiler, Tubes
National Tube Co.

Bolts, Case Hardened
American Steel Foundries
Bemis Car Truck Co.

Bond Testers
Electric Service Supplies Co.

Bonding Apparatus
Elec. Service Supplies Co.
Railway Track-work Co.
Una Welding & Bonding Co.

Bonds, Rail
Elec. Service Supplies Co.
General Electric Co.
Railway Track-work Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Books
McGraw-Hill Book Co.

Brackets & Cross Arms (See also Poles, Ties, Posts, etc.)
Columbia Machine Works
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.

Brake Adjusters
American Steel Foundries
Brill Co., The J. G.
Cincinnati Car Co.
National Ry. Appliance Co.
Westinghouse Tr. Br. Co.

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

Brakes—Bk. Systems & Parts
American Steel Foundries
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Columbia Machine Works
General Electric Co.
National Brake Co.
Westinghouse Tr. Br. Co.

Brakes, Magnetic Rail
Cincinnati Car Co.

Brushes, Carbon
General Electric Co.
Westinghouse E. & M. Co.

Brushholders
Columbia Machine Works
General Electric Co.

Buses
General Electric Co.
Studebaker Corp. of America

Buses, Motor
General Motors Truck Co.

Bushings, Case Hardened & Manganese
American Steel Foundries
Brill Co., The J. G.
Bemis Car Truck Co.
Cincinnati Car Co.
Columbia Machine Works

Cables, (See Wires & Cables

Cambric Tapes, Yellow and Black Varnish
General Electric Co.

Car Lighting Fixtures
Elec. Service Supplies Co.

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

Car Steps, Safety
Cincinnati Car Co.

Car Wheels, Rolled Steel
Bethlehem Steel Co.

Carbon Brushes
(See Brushes, Carbon)

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

Cars, Gas-Electric
Brill Co., The J. G.
General Electric Co.
Westinghouse E. & M. Co.

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

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cincinnati Car Co.
Kuhlman Car Co., G. C.
Wason Mfg. Co.

Cars, Self-Propelled
Brill Co., The J. G.

Castings, Brass Composition or Copper
Cincinnati Car Co.
Columbia Machine Works

Castings, Gray Iron & Steel
American Brake Shoe & Foundry Co.
American Steel Foundries
Bemis Car Truck Co.
Columbia Machine Works
Standard Steel Works Co.

Castings, Malleable & Brass
American Brake Shoe & Foundry Co.
Bemis Car Truck Co.
Columbia Machine Works
Timken Roller Bearing Co.

Catchers and Retrievers, Trolley
Esril, C. I.
Elec. Service Supplies Co.

Ceiling Car
Pantasote Co., Inc.

Chairs, Parlor Car
Heywood-Wakefield Co.

Change Carriers
Columbia Machine Works
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Change Trays
Cleveland Fare Box Co.
Electric Service Supplies Co.

Circuit-Breakers
General Electric Co.
Westinghouse E. & M. Co.

Clamps and Connectors for Wires and Cables
Columbia Machine Works
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Cleaners and Scrapers, Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Cincinnati Car Co.

Clutches
Long Mfg. Co.

Coal and Ash Handling (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia Machine Works
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Coils, Armature and Field
Columbia Machine Works
General Electric Co.
Westinghouse E. & M. Co.

Coils, Choke and Kicking
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Coin Counting Machines
Cleveland Fare Box Co.
International Register Co.
Johnson Fare Box Co.

Coin Changers
Johnson Fare Box Co.

Coin Sorting Machines
Cleveland Fare Box Co.
Johnson Fare Box Co.

Coin Wrappers
Cleveland Fare Box Co.

Commutator Slotters
Columbia Machine Works
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Commutators or Parts
Columbia Machine Works
General Electric Co.
Westinghouse E. & M. Co.

Compressors, Air
General Electric Co.
Westinghouse Tr. Br. Co.

Condensers
Westinghouse E. & M. Co.

Connectors, Solderless
Westinghouse E. & M. Co.

Connectors, Trailer Car
Columbia Machine Works
Consolidated Car Heat. Co.
Elec. Service Supplies Co.

Controllers or Parts
Columbia Machine Works
General Electric Co.
Westinghouse E. & M. Co.

Controller Regulators
Elec. Service Supplies Co.

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

Converters, Rotary
General Electric Co.
Westinghouse E. & M. Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Elec. Service Supplies Co.
International Register Co.
Roebling's Sons Co., John A.

Cord Connectors & Couplers
Elec. Service Supplies Co.

Couplers, Car
American Steel Foundries
Brill Co., The J. G.
Cincinnati Car Co.
Westinghouse Tr. Br. Co.

Cowl Ventilators
Nichols-Lintern Co.

Cranes, Hoists and Lifts
Electric Service Supplies Co.

Cross Arms (See Brackets)

Crossings
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Crossing Foundations
International Steel Tie Co.

Crossings, Frog and Switch
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Crossings, Manganese
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Crossing Signals, (See Signal Systems, Highway Crossing)

Crossings, Track (See Track, Special Work)

Crossings, Trolley
General Electric Co.
Westinghouse E. & M. Co.

Curtains & Curtain Fixtures
Brill Co., The J. G.
Pantasote Co., Inc.

Cutting Apparatus
General Electric Co.
Railway Track Work Co.

Dealer's Machinery & Second Hand Equipment
Erie Railway Co.
White Co., The

Derailing Switches
Ramapo Ajax Corp.

Destination Signs
Columbia Machine Works
Elec. Service Supplies Co.

Detective Service
Wish Service, Edward P.

Door Operating Devices
Brill Co., The J. G.
Cincinnati Car Co.
Consolidated Car Heat. Co.
National Pneumatic Co.

Doors and Door Fixtures
Brill Co., The J. G.
Cincinnati Car Co.
Hale-Kilburn Co.

Doors, Folding Vestibule
National Pneumatic Co.

Drills, Track
Elec. Service Supplies Co.

Drum Truing Lathes
Nat'l Rlw'y Appliance Co.

Dryers, Sand
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Ears
Columbia Machine Works
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Electric Grinders
Railway Track-work Co.

Electrical Wires and Cables
John A. Roebling's Sons Co

Electrodes, Carbon
Railway Track-work Co.
Una Welding & Bonding Co.

Electrodes, Steel
Railway Track-work Co.
Una Welding & Bonding Co.

Engineers, Consulting, Contracting and Operating
Becler, John A.
Buchanan & Layng Corp.
Bylesby Co., H. M.
Faile & Co., E. H.
Ford, Bacon & Davis
Hemphill & Wells
Holst, Engelhardt W.
Jackson, Walter
Kelker & DeLeuw
McClellan & Junkersfeld
Richey, Albert S.
Sanderson & Porter
Stevens & Wood
Stone & Webster
White Eng. Co., J. G., The

Engines, Gas, Oil or Steam
Westinghouse E. & M. Co.

Fare Boxes
Cleveland Fare Box Co.
Johnson Fare Box Co.
Nat'l Rlw'y Appliance Co.
Percy Mfg. Co.

Fare Registers
Elec. Service Supplies Co.
Johnson Fare Box Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cincinnati Car Co.
Star Brass Works

Fibre and Fibre Tubing
Westinghouse E. & M. Co.

Field Coils (See Coils)

Floodlights
Elec. Service Supplies Co.
General Electric Co.

Forgings
American Steel Foundries
Brill Co., The J. G.
Cincinnati Car Co.
Standard Steel Works Co.

Frogs & Crossings, Tee Rail
Bethlehem Steel Co.
Lorain Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Frogs, Track (See Track Work)

Frogs, Trolley
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Fuses and Fuse Boxes
Columbia Machine Works
Consolidated Car Heat. Co.
General Electric Co.
Westinghouse E. & M. Co.

Gaskets
Westinghouse Tr. Br. Co.

Gas-Electric Drive for Buses
General Electric Co.
Nat'l Rlwy. Appliance Co.

Gas Producers
Westinghouse E. & M. Co.

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

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Gear Blanks
Brill Co., The J. G.
Standard Steel Works Co.

Gear Cases
Columbia Machine Works
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Gears and Pinions
Bemis Car Truck Co.
Columbia Machine Works
Elec. Service Supplies Co.
General Electric Co.
Nat'l Ry. Appliance Co.
Tool Steel Gear & Pinion Co.

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

Girder Rails
Bethlehem Steel Co.
Lorain Steel Co.

Grinders & Grinding Supplies
Metal & Thermit Corp.
Railway Track-work Co.

Grinders, Portable Electric
Railway Track-work Co.

Grinders, Portable
Railway Track-work Co.

Grinding Bricks and Wheels
Railway Track-work Co.

Guard Rail Clamps
Lorain Steel Co.
Ramapo Ajax Corp.

Guard Rails, Tee Rail, and Manganese
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Guards, Trolley
Elec. Service Supplies Co.

Harps, Trolley
Columbia Machine Works
Elec. Service Supplies Co.
General Electric Co.
Star Brass Works

Headlights
Elec. Service Supplies Co.
General Electric Co.

Headlining
Columbia Machine Works
Pantasote Co., Inc.

Heaters, Bus
Nichols-Lintern Co.

Heaters, Car (Electric)
Consolidated Car Heat. Co.
Railway Utility Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air & Water
Smith Heater Co., Peter

Heaters, Car, Stove
Smith Heater Co., Peter

Helmets, Welding
Railway Track-work Co.
Una Welding & Bonding Co.

Hoists and Lifts
Columbia Machine Works

Hose, Pneumatic
Westinghouse Tr. Br. Co.

Instruments, Measuring, Testing and Recording
General Electric Co.
Westinghouse E. & M. Co.

Insulating Cloth, Paper & Tape
General Electric Co.
Okonite-Callender Cable Co.
Okonite Co.
Westinghouse E. & M. Co.

Insulating Machinery
Amer. Ins. Machinery Co.

Insulation (See also Paints)
Electric Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
Okonite Co.
Okonite-Callender Cable Co.
Westinghouse E. & M. Co.

Insulator Pins
Elec. Service Supplies Co.

Insulators (See also Line Materials)
Electric Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Interurban Cars (See Cars, Passenger, Freight, Express, etc.)

Jacks (See also Hoists & Lifts)
Columbia Machine Works
Elec. Service Supplies Co.

Journal Boxes
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Elec. Service Supplies Co.

Lamps, Guards and Fixtures
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

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

Lamps, Signal and Marker
Elec. Service Supplies Co.
Nichols-Lintern Co.

Lanterns, Classification
Nichols-Lintern Co.

Letter Boards
Cincinnati Car Co.

Lighting Fixtures, Interior
Electric Service Supplies Co.

Lightning Protection
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Line Material (See also Brackets, Insulators, Wires, etc.)
Electric Ry. Equipment Co.
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Locking Spring Boxes
Lorain Steel Co.
Wm. Wharton, Jr. & Co.

Locomotives, Electric
Cincinnati Car Co.
General Electric Co.
Westinghouse E. & M. Co.

Lumber (See Poles, Ties, etc.)

Machinery, Insulating
Amer. Ins. Machinery Co.

Manganese Steel Castings
Bemis Car Truck Co.
Lorain Steel Co.

Manganese Steel Guard Rails
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Manganese Steel, Special Track Work
Bethlehem Steel Co.
Wm. Wharton, Jr. & Co.

Manganese Steel Switches, Frogs & Crossings
Bethlehem Steel Co.
Lorain Steel Co.
Ramapo Ajax Corp.
Wm. Wharton, Jr. & Co.

Mirrors, Inside and Ontside
Cincinnati Car Co.

Motors, Generators, & Controls for Gas Electric Buses
General Electric Co.

Motor Buses (See Buses)

Motorman's Seats
Brill Co., The J. G.
Cincinnati Car Co.
Elec. Service Supplies Co.
Heywood-Wakefield Co.

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

Nuts and Bolts
American Steel Foundries
Bemis Car Truck Co.
Cincinnati Car Co.

Oxyacetylene—See Cutting Apparatus

Packing
Westinghouse Tr. Brake Co.

Paints and Varnishes (Insulating)
Electric Service Supplies Co.

Paints & Varnishes, Railway
Nat'l Ry. Appliance Co.

Paving Material
American Brake Shoe & Foundry Co.

Pickups, Trolley Wire
Elec. Service Supplies Co.

Pinion Pullers
Elec. Service Supplies Co.

Pinions (See Gears)

Pins, Case Hardened
American Steel Foundries
Bemis Car Truck Co.

Pins, Case Hardened, Wood and Iron
American Steel Foundries.
Westinghouse Tr. Brake Co.

Pipe
National Tube Co.

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

Planers (See Machine Tools)

Plates for Tee Rail Switches
Ramapo Ajax Corp.

Pliers, Rubber Insulated
Elec. Service Sup. Co.

Pole Line Hardware
Bethlehem Steel Co.
Elec. Service Supplies Co.
General Electric Co.

Poles, Metal Street
Elec. Ry. Equipment Co.

Poles, Ties, Posts, Piling & Lumber
Bell Lumber & Pole Co.

Poles & Ties, Treated
Bell Lumber & Pole Co.

Poles, Trolley
Elec. Service Supplies Co.
National Tube Co.

Poles, Tubular Steel
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
National Tube Co.

Potheads
Okonite-Callender Cable Co.
Okonite Co.

Power Saving Devices
National Ry. Appliance Co.

Pressings, Special Steel
Cincinnati Car Co.

Pressure Regulators
General Electric Co.
Westinghouse E. & M. Co.
Westinghouse Tr. Brake Co.

Radiators
Long Mfg. Co.

Rail Braces & Fastenings
Ramapo Ajax Corp.

Rail Filler
Carey Co., Philip

Rail Grinders (See Grinders)

Rail Joints
Rail Joint Co.

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

Rail Welding
Metal & Thermit Corp.
Railway Track-work Co.
Una Welding & Bonding Co.

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

Railway Welding (See Welding Processes)

Rattan
Brill Co., The J. G.
Elec. Service Supplies Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Rattan Car Seat Webbing
Heywood-Wakefield Co.

Registers and Fittings
Brill Co., The J. G.
Cincinnati Car Co.
Electric Service Supplies Co.

Reinforcement, Concrete
Bethlehem Steel Co.
Carnegie Steel Co.

Repair Shop Appliances (See also Coil Banding and Winding Machines)
Elec. Service Supplies Co.

Repair Work (See also Coils)
Westinghouse E. & M. Co.

Replacers, Car
American Steel Foundries
Cincinnati Car Co.
Elec. Service Supplies Co.

Resistance, Wire and Tube
Westinghouse E. & M. Co.

Resistances
Consolidated Car Heat. Co.
General Electric Co.

Retrievers, Trolley (See Catchers and Retrievers, Trolley)

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

Roofing, Car
Pantasote Co., Inc.

Sanders, Track
Brill Co., The J. G.
Elec. Service Supplies Co.
Nichols-Lintern Co.

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

Sash Metal Car Window
Hale-Kilburn Co.

Scrapers, Track (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Elec. Service Supplies Co.

Seating Materials
Brill Co., The J. G.
Heywood-Wakefield Co.
Pantasote Co., Inc., The

Seats, Bus
Brill Co., The J. G.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Seats, Car (See also Rattan)
Brill Co., The J. G.
Cincinnati Car Co.
Hale-Kilburn Co.
Heywood-Wakefield Co.

Second Hand Equipment
Erie Railway Co.
White Co., The

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

Shovels
Brill Co., The J. G.

Shovels, Power
Brill Co., The J. G.

Signals, Car Starting
Consolidated Car Htg. Co.
Elec. Service Supplies Co.
National Pneumatic Co.

Signal Systems, Block
Elec. Service Supplies Co.
Nachod & U. S. Signal Co.

Signal Systems, Highway Crossing
Nachod & U. S. Signal Co.

Slack Adjusters (See Brake Adjusters)

Sleet Wheels and Cutters
Cincinnati Car Co.
Columbia Machine Works
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.

Smokestacks, Car
Nichols-Lintern Co.

Snow-Plows, Sweepers and Brooms
Brill Co., The J. G.
Columbia Machine Works

Snow Sweeper, Rattan
Heywood-Wakefield Co.

Soldering & Brazing (See Welding Processes & Appar.)

Special Trackwork
Bethlehem Steel Co.
Lorain Steel Co., The
Wm. Wharton, Jr. & Co.

Splicing Compounds
Westinghouse E. & M. Co.

Splicing Sleeves (See Clamps and Connectors)

Springs, Car and Truck
American Steel Foundries
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.
Standard Steel Works Co.

Sprinklers, Track and Road
Brill Co., The J. G.

Steel, Electric Furnace
American Steel Foundries
Timken Roller Bearing Co.

Steel, Open Hearth
American Steel Foundries
Timken Roller Bearing Co.

Steel and Steel Products
American Steel Foundries

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

Stokers, Mechanical
Westinghouse E. & M. Co.

Stop Signals
Nichols-Lintern Co.

Storage Batteries (See Batteries, Storage)

Strain, Insulators
Electric Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Strand
Roebling's Sons Co., J. A.

Street Cars, Passenger (See Cars, Passenger, Freight, Express, etc.)

Sweepers, Snow (See Snow Plows, Sweepers and Brooms)

Switch Stands and Fixtures
Ramapo Ajax Corp.

Switches
General Electric Co.

Switches, Selector
Nichols-Lintern Co.

Switches and Switchboards
Consolidated Car Htg. Co.
Elec. Service Supplies Co.
Westinghouse E. & M. Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track (See Track Special Work)

Tampers, Tie
Railway Track-work Co.

Tapes & Cloths (See Insulating Cloth, Paper & Tape)

Tee Rail Special Track Work
Lorain Steel Co.
Ramapo Ajax Corp.

Telephone & Telegraph Wire
J. A. Roebling's Sons Co.

Telephones and Parts
Elec. Service Supplies Co.

Testing Instruments (See Instruments, Electrical Measuring, Testing, etc.)

Thermostats
Consolidated Car Htg. Co.
Railway Utility Co.
Smith Heater Co., Peter

Ticket Choppers and Destroyers
Elec. Service Supplies Co.

Ties, Mechanical
Dayton Mechanical Tie Co.

Ties and Tie Rods, Steel
International Steel Tie Co.

Ties, Wood Cross (See Poles, Ties, Posts, etc.)

Tires
Goodyear Tire & R. Co.

Tongue Switches
Wm. Wharton, Jr. & Co.

Tools, Track & Misc.
Columbia Machine Works
Elec. Service Supplies Co.
Railway Track-work Co.

Towers and Transmission Structures
Westinghouse E. & M. Co.

Track Grinders
Metal & Thermit Corp.
Railway Track-work Co.
Ramapo Ajax Corp.

Track, Special Work
Columbia Machine Works
Ramapo Ajax Corp.

Trackless Trolley Cars
Brill Co., The J. G.

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

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ALPHABETICAL INDEX TO ADVERTISEMENTS

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.

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Cincinnati Car Co.

Tree Wire
Okonite Callender Cable Co.
Okonite Co.

Trolley Bases
Westinghouse E. & M. Co.

Trolley Bases
Brill Co., The J. G.
General Electric Co.

Trolley Material, Overhead
Elec. Service Supplies Co.
General Electric Co.
Westinghouse E. & M. Co.

Trolley Pins
Bemis Car Truck Co.

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Trolley Wheel Bushings
Star Brass Works

Trolley Wire
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Trucks, Car
Bemis Car Truck Co.
Brill Co., The J. G.
Cincinnati Car Co.

Truss Planks
National Tube Co.

Tubing, Steel
National Tube Co.
Timken Roller Bearing Co.

Turbines, Steam
General Electric Co.
Westinghouse E. & M. Co.

Turnstiles
Elec. Service Supplies Co.
Perey Mfg. Co., Inc.

Turntables
Elec. Service Supplies Co.

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Westinghouse Tr. Br. Co.

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Ventilators
National Ry. Appliance Co.

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Cincinnati Car Co.
Consolidated Car Htd. Co.
Nichols-Lintern Co.
Railway Utility Co.

Welded Rail Joints
Lorain Steel Co.
Metal & Thermit Corp.
Railway Trackwork Co.
Una Welding & Bonding Co.

Welders, Portable Electric
General Electric Co.
Railway Track-work Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Welders, Rail Joint
General Electric Co.
Railway Track-work Co.

Welding Processes and Apparatus
Metal & Thermit Corp.
Railway Track-work Co.
Una Welding & Bonding Co.
Westinghouse E. & M. Co.

Welding Steel
Railway Track-work Co.
Una Welding & Bonding Co.

Welding Wire
Railway Track-work Co.
Roebling's Sons Co., J. A.

Welding Wire and Rods
Railway Track-work Co.

Wheel Guards (See Fenders and Wheel Guards)

Wheel Grinders
Wheel Truing Brk. Shoe Co.

Wheel Presses (See Machine Tools)

Wheels, Car, Steel & Steel Tired
American Steel Foundries
Bemis Car Truck Co.
Standard Steel Works Co.

Wheels, Trolley
Columbia Machine Works
Elec. Ry. Equipment Co.
Elec. Service Supplies Co.
Star Brass Works

Whistles, Air
Westinghouse E. & M. Co.
Westinghouse Tr. Brk. Co.

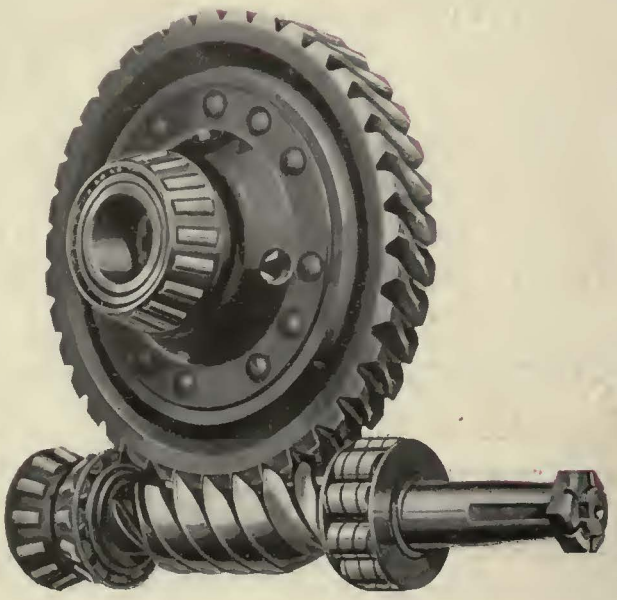
Window Guards and Fittings
Cincinnati Car Co.

Wire Rope
Roebling's Sons Co., J. A.

Wires and Cables
Okonite Co.
Okonite-Callender Cable Co.
Roebling's Sons Co., J. A.
Westinghouse E. & M. Co.

The Performance
The People
The Profit

Timken Worm Drive for electric railway cars contributes to Profit; by making possible a degree of comfortable Performance which induces People to ride. Timken Worm Drive is permanently dead silent, long lived, simple, highly and uniformly efficient. It means fewer pounds to haul, less power consumed, lower operating and maintenance cost.



TIMKEN WORM DRIVE TRUCKS FOR ELECTRIC RAILWAY CARS

THE TIMKEN-DETROIT AXLE CO., DETROIT, MICH.