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ELECTRIC RAILWAY JOURNAL

On the Chicago, North Shore & Milwaukee R.R.

A Convincing Answer to a Natural Question

shoes have been very much improved since that time. No actual measurements of wire are taken, but the condition found on inspection shows conclusively that there is less wear on the trolley wire due to the use of sliding contacts than there is due to wheels.

The sliding contactors put a high gloss or polish on the wire very similar to the polish on a good commutator. No lubrication is used. With the pole in the operating po

Of course the first question that enters your mind is the amount of trolley wire wear!

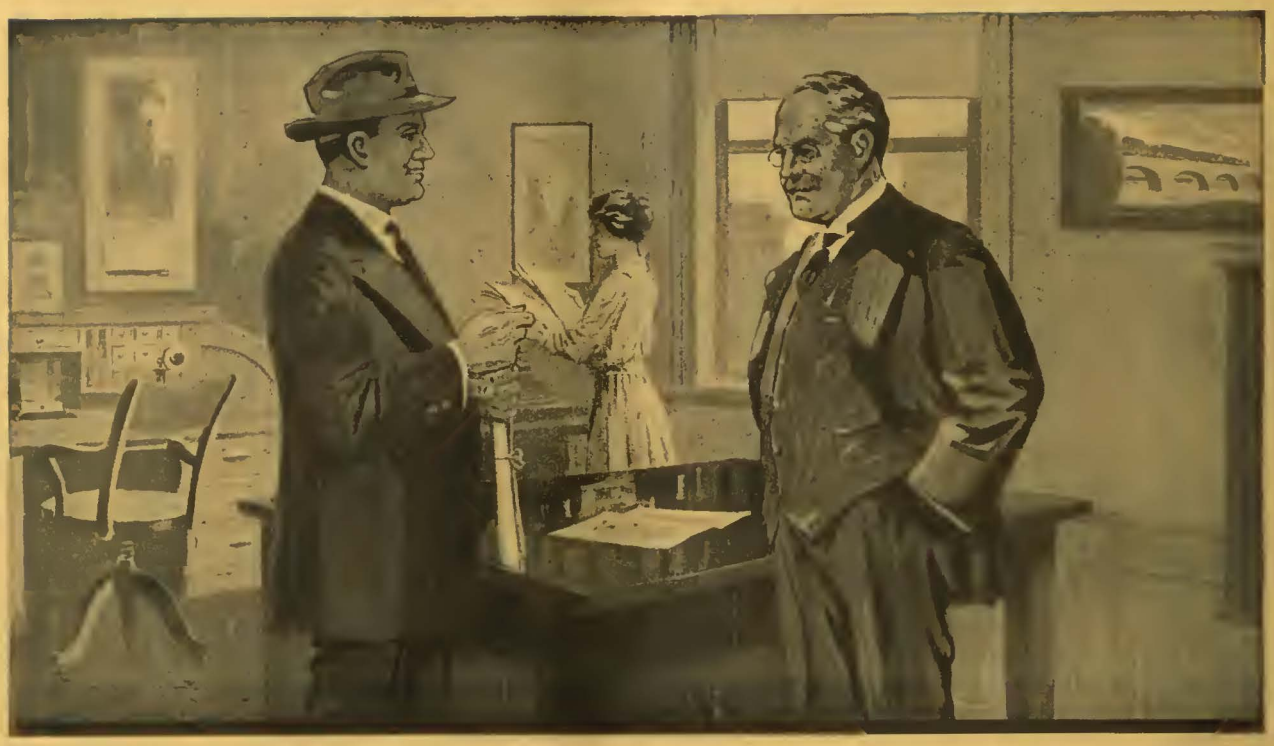
That question is answered by no less authority than the Electrical Engineer of the Chicago, North Shore and Milwaukee R.R. Co. The above paragraph is clipped from an article written by him.

More than six years' experience with Miller Trolley shoes on this noted railroad system shows conclusively that Miller Trolley Shoes *cause less wire wear than wheels.*

A trial under proper conditions will convince you!

Miller Trolley Shoe Co.
Boston-21, Mass.

MILLER TROLLEY SHOES



Post-Convention Topics

"Joe," said the Vice President, "I have been reading your report on what you saw at the recent A.E.R.A. Convention Exhibit. That Low-Floor HL Control Equipment the Westinghouse people had in their exhibit seems to have taken your fancy."

"Boss," said Joe, "that equipment certainly fills the bill for low-floor cars. It can be mounted directly against the car sills as there are no parts that require inspection from above, inspection being made entirely from the sides, which is mighty handy, then, too, all the switch parts are interchangeable with our line switches. The eight switches are contained in one box, four on each side, mounted back to back. It's the most compact arrangement you ever saw."

"That's very interesting, Joe," said the Vice President. "We must keep this low-floor, HL control in mind when we order that new lot of double-truck, low-floor cars we were talking about."

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Westinghouse

Vol. 60, No. 19 New York, November 4, 1922 *Pages 733-768*

ELECTRIC RAILWAY JOURNAL

HENRY W. BLAKE, Editor

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WABCO is the new Brake Cylinder Packing Cup which in two years has upset every precedent for packing cup efficiency and economy.

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WABCO does both!

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WESTINGHOUSE TRACTION BRAKES

O-B Type A-4. Section Insulator—Patented

New O-B Section Insulator Introduces New Trolley Wire Clamp

Rocker clamping piece which tightens its hold on the wire when trolley tension increases.

To all the virtues of O-B Type A-3 Section Insulator, add a better clamping device and you have the new O-B Type A-4 Section Insulator.

The new clamp, which is illustrated here, works on a cam action. As the trolley tension increases, the holding power of the clamp increases. It is really a rocker notched to grip the wire and held down by two bolts.

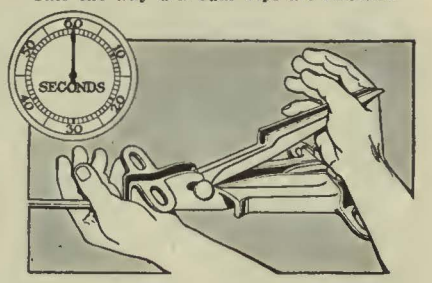
Like O-B Type A-3, described on page 355 of Catalog No. 18, this insulator is equipped with cam tips. You know what cam tips mean—quick installation and a smooth approach for the trolley wheel.

Trolley tension is carried by two wood strains (inch and a quarter diameter) **in the same horizontal plane as the wire.** This prevents buckling. Pull off eyes are also in the same plane as the wire so that there is no tipping tendency when guy wires are attached.

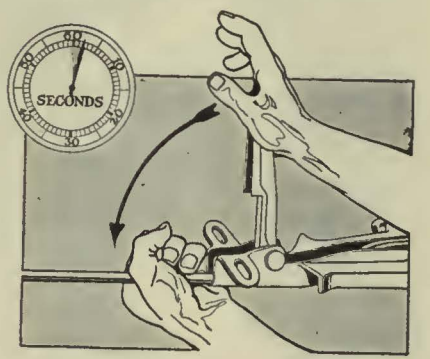
Runner pieces are readily renewable. Feeder lugs are provided on each end casting. A-4 can be suspended directly from the cross span wire or the yoke unscrewed and the insulator attached to a standard trolley hanger.

Everybody who used it liked O-B Type A-3. Perhaps you'll like A-4 with its new anchorage better.

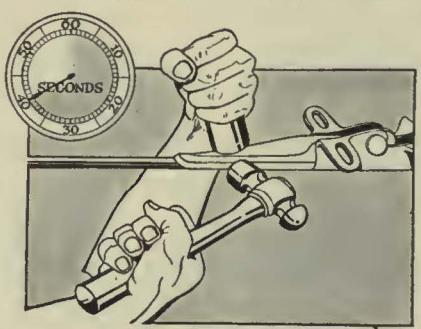
This the way O-B Cam Tips are installed



Slip tip under hooks—



Turn over and down on the wire—



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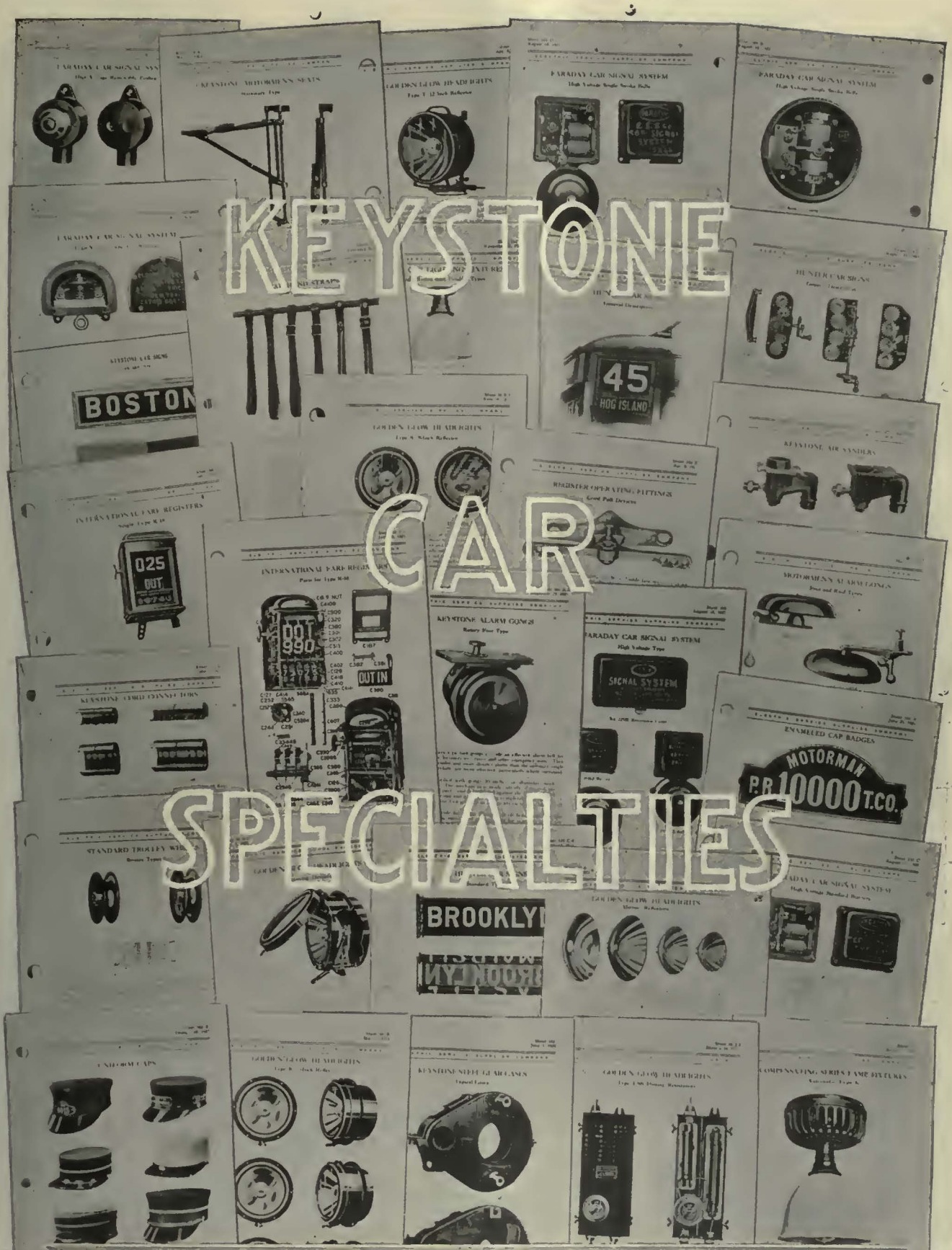

Part of Keystone Service to Electric Railway Operators is these up-to-the-minute data sheets on car equipment and supplies. Look over these sheets and write for complete sets of whatever data sheets interest you.

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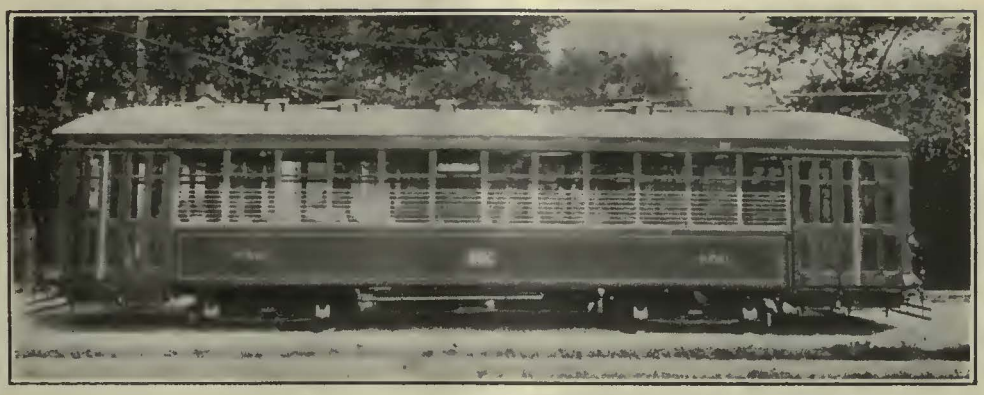

One-Man, Two-Man All Around the Town

Good for any kind of service, city or suburban, light or heavy, are these one-man, two-man cars of the Milwaukee Electric Railway & Light Company.

The company has put in all sorts of stunts—there's the idea of employing auxiliary fare collectors who have a special crank to open the rear right-hand door, so passengers can be handled at double speed where congestion exists.

The active all-day doors—those at the front—are air-operated, of course.

With National Pneumatic door engines, of course. The company has hundreds of 'em in train service, too, and knows they're good.

Get Ready for Busy Days
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Door and Step Operating Mechanisms **Door and Step Control**
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Performance Economy and Price Economy Combined in Bates Expanded Steel Poles

Supposing that Bates Poles had no first cost advantage over other types of construction, they would still be a good investment from the standpoint of superior service rendered.

In this installation at Ft. Smith, Arkansas, Bates poles are used for electric railway overhead and for street lighting brackets also. This combination use avoids the use of double pole lines, as is sometimes used, and besides the economy, presents a much more pleasing appearance.

Notice the pole on the right-hand curb. The Bates concrete pole butt is set into the sidewalk, giving a flush setting that is easy to place and fits in with standard sidewalk and curb construction. Nothing can cause deterioration of the pole butt or the steel pole in its setting.

The first pole on the left is built up of two Bates one-piece poles side by side to give stiffness to carry the load without guy wires. Combinations of this kind are easily arranged with standard poles.

These Bates Poles are good for a life of fifty years at a conservative estimate. They are of ample strength for even heavy loads in addition to the street railway overhead. Maintenance is cheap, and always effective, for every inch of pole surface can be reached with a paint brush.

Their great strength, long life, easy maintenance, and their adaptability would warrant a greater first cost than for other types of poles. Yet Bates Poles today cost less than any comparable type of pole.

Ask our engineering staff for data and prices.

Bates Expanded Steel Truss Co.

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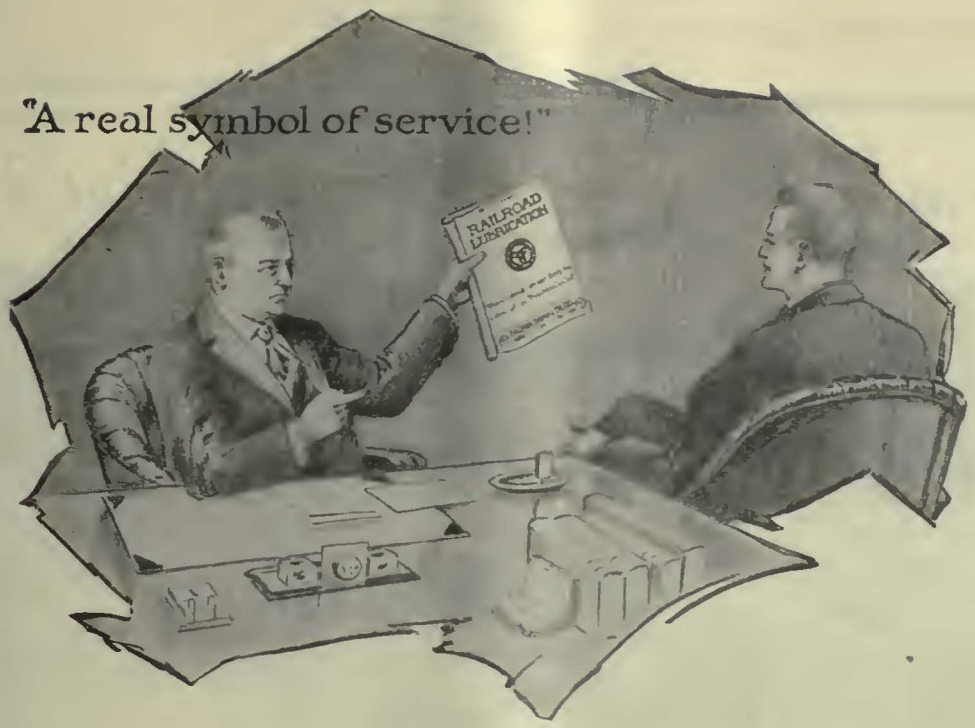

Not your shoulders — but ours!

WHEN Galena Service takes hold of your lubrication, it assumes the responsibility of delivering satisfactory results.

Galena Service Engineers are not theorists, but trained specialists familiar with every detail of your mechanical equipment and its lubrication requirements.

From the selection of raw materials, through the stages of special process in manufacture and to the final application and correct use of the lubricants, Galena Service works for your interest in the advancement of efficient and economical operation.

Through the practical experience and personal cooperation of this competent organization the railways under Galena lubrication are saving thousands of dollars annually by the elimination of the expensive troubles of faulty lubrication.

"When Galena Service goes in—
Lubrication troubles go out!"

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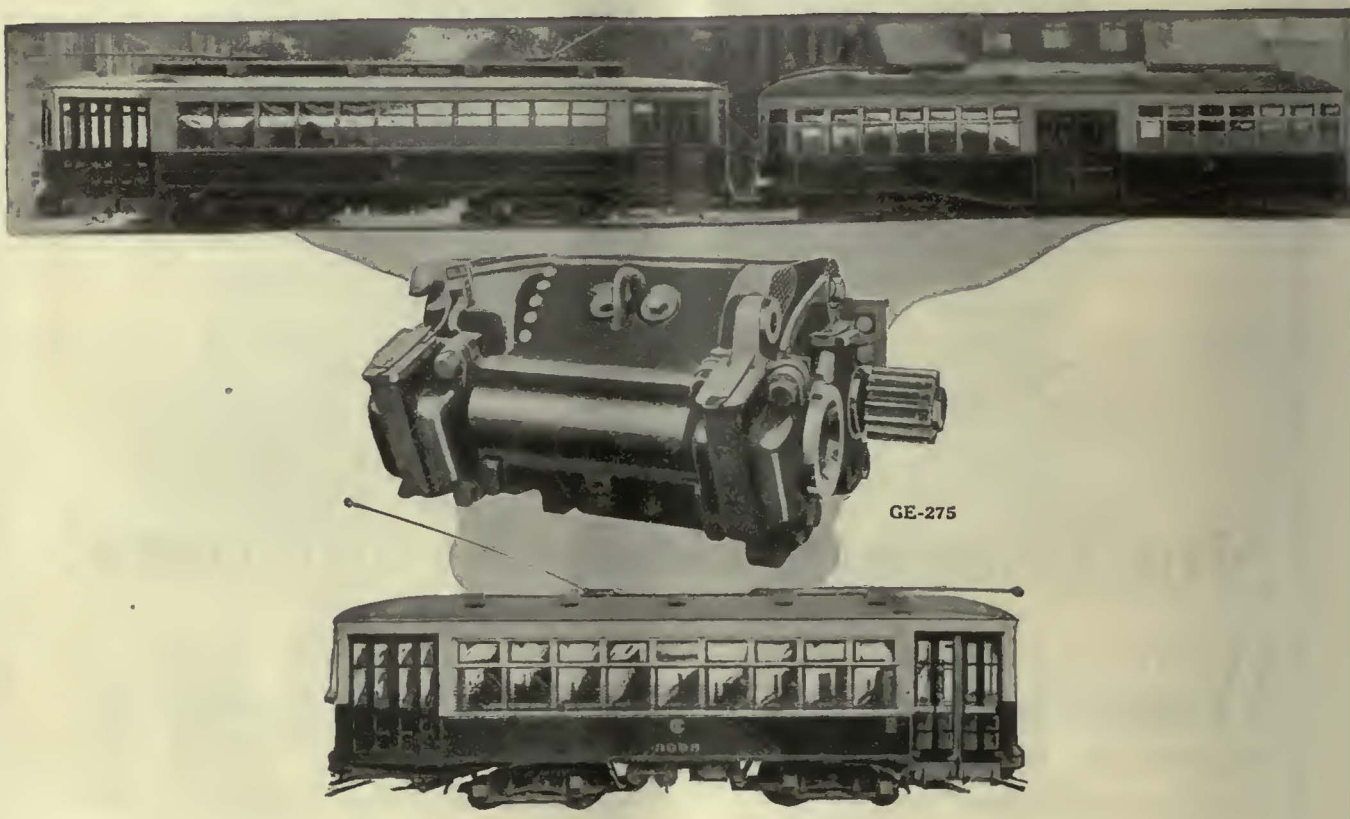

366 Motors Just Ordered

Standardization means simplification.

The GE-275 motors recently ordered for the Chicago Surface Lines are interchangeable on either the 69 double-end, wide-platform, two-man cars to handle trailers or on the 45 new light-weight, one-man cars. In brief, the same motor will be used as four-motor equipments on the big cars with trailers and as two-motor equipments on the smaller cars.

Thus, the Chicago Surface Lines strive to give the most service with least upkeep. And the adaptable GE-275 motor pointed the way.

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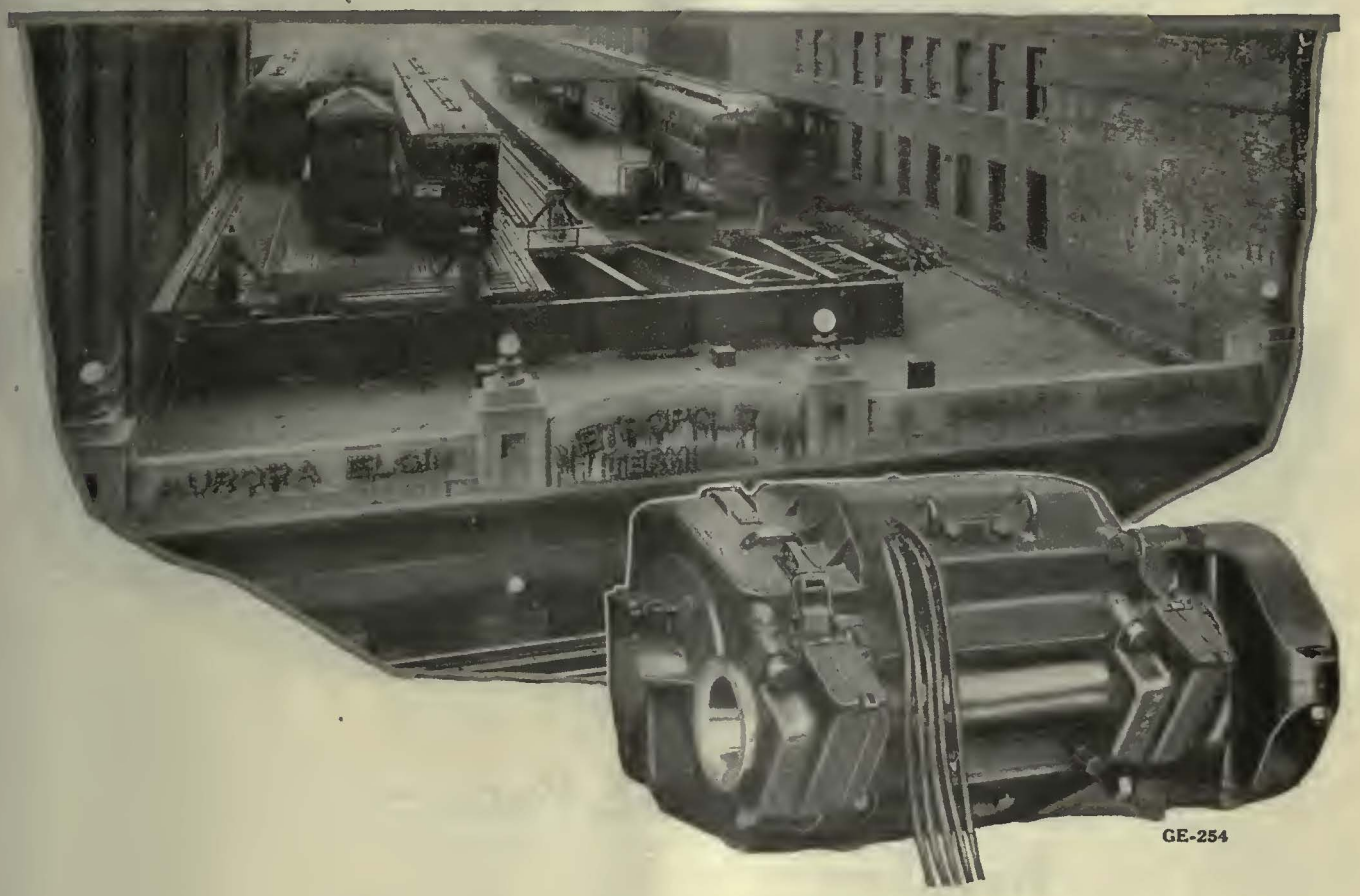
Third-rail Road Adds More Equipment



GE-254

Standardized on "G-E"

One of the great third-rail systems of America, the Chicago, Aurora & Elgin Railroad, has just completed 20 years of service. Reorganized now as a purely heavy-traction system, this road is on its way to still greater usefulness as shown by its recent order for 20 steel passenger cars, including a diner.

For years, G-E motors have been standard on the Chicago, Aurora & Elgin, first used in fours on the motor cars and then in pairs on motorized trailers. For its new rolling stock, G-E motive equipment was selected because of the reliable performance that has been given by the older G-E equipment in this severe service.

So that, equipment for the 20 new cars includes GE-254 motors and type M control, duplicating that now in operation.

MEMBER AERA 1922

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Factors Necessary to Determine a Just and Reasonable Wage

UNDER the transportation act, the Railroad Labor Board, in determining what is a just and reasonable wage, is directed to take into consideration the following seven factors:

1. The scale of wages paid for similar kinds of work in other industries.
2. The relation between wages and the cost of living.
3. The hazards of employment.
4. The training and skill required.
5. The degree of responsibility.
6. The character and regularity of the employment, and
7. Inequalities of increases in wages or treatment, the result of previous wage orders or adjustments.

Of these, the last five relate primarily to the conditions of railway employment, while the first two represent between them quite different bases for determining wages in any industry. When results derived from them do not coincide, greater weight must be given either to one plan or the other. How and to what extent to do this was the problem which faced the Labor Board in its decision on the question of the wages of the maintenance of way men this week. Both factors were considered by the board, which wisely declares it lays greater stress on the first basis or that of the scale of wages paid for similar kinds of work in other industries. Its decision also points out that an increase of 2 cents in the wages of the trackmen is thereby warranted, whereas under the cost of living plan there would be no increase because there had been no increase in the cost of living.

After all, the law of supply and demand is the one which practically will have to be controlling in any rising wage market, whether a company or labor board wishes to consider it or not. If men can secure higher wages elsewhere than in the case under arbitration, they will not stay on their old jobs simply because figures can be produced to show that they are receiving a "living wage." The law of supply and demand is also very much simpler to apply. Evidence varies as to the most fundamental facts of the cost of living method, namely, the average number of dependents and the average number of workers in a family, and a still greater problem is to decide the standard of living and the cost of it. One housekeeper can live well and save on a sum which would not be sufficient for bare living to another.

It is indeed well that the United States Labor Board had the conviction and courage to explode the appealing theory that the "cost of living" should be considered as a main factor in establishing wages before the hold of this theory upon industry should become any more firm. The weakness of this method is demonstrated by the efforts of labor so to increase the standard of living that wages should continue to climb despite the downward trend of prices of necessities. If the living-wage plan were sound it would have carried wages down just as it carried them up, and labor's experts would not have had to devise new standards of living to counteract natural laws. The standard of living should improve, to be sure, but not so rapidly as to wreck the industry in the process.

Incidentally, the increase in wages of the trackmen granted in Chicago and the increase in the steel wages made last summer call attention again to the growing scarcity in the labor market, particularly in the class called "common labor." In the past the greater part of the supply in the country of this class of labor has come from immigrants, particularly in recent years from Italy and other southern European nations. This supply has been largely cut off, owing to the present immigration law, and with the present increased business activity the lack of men to do unskilled work will seriously hamper industrial expansion hoped for in the early future. This does not mean that there need be a return to the old immigration limitations, which were largely educational. Some change, however, should be made to admit those who are able, by their entrance, to increase the national wealth as well as the opportunities for those in this country to serve in more skilled positions.

The Rotary Converter Must Look to Its Laurels

DURING thirty years, more or less, in the conversion of low-frequency alternating current to low-voltage direct current, the rotary converter has come gradually almost to monopolize the electric railway power field. It is a wonderful machine in its operation and has reached a high degree of perfection within its range of possibilities. Even at a frequency as high as sixty cycles and a d.c. voltage of more than 1,000 it performs well. The motor-generator, however, is still required to supplement it in high-voltage railway work, notably in railroad electrification, but the motor-generator has gradually retired from what has come to be recognized as the legitimate field of the "rotary."

While the rotary converter has been pursuing the even tenor of its way inventors have been endeavoring to produce a "static" converter with a view to eliminating the commutator and the bearings. The mercury-vapor converter has seemed the most promising possibility. This device has come into use for arc-lighting circuits and has been used for railway purposes also. The 5,000-volt experimental railway distribution installed on the Michigan Railway by the Westinghouse company in 1915 utilized this type of converter, it being well adapted to high-voltage work. The same company had used it on an experimental locomotive operated on the New Canaan branch of the New Haven Railroad during the preceding year.

Abroad the vapor converter is making real progress. Within the past few years it has been adopted by a number of tramways on the Continent and quite recently

in Great Britain. Its present status was described in an extensive paper read at the Brussels meeting of the Union Internationale de Tramways early last month. The extent of its use will come as a surprise to many, and this use is in reality more extensive than the number and kilowatt capacity of installations will indicate to Americans because the power requirements of foreign tramways are relatively less than those of this country. The rotary converter has a real rival in the mercury device, which has noiselessness and simplicity, besides its non-rotative quality, to recommend it.

There has also appeared recently on the horizon a new possible rival of the "rotary" in the form of the high-power vacuum tube. The immediate field for this is in radio transmission, but there appears to be no limit to its ability to transform power from alternating to direct-current form. Its progress will be watched with interest, to put the case mildly.

All of this does not mean that present substation apparatus is going to be "scrapped" in the near future. There is a certain engineering appeal in a reliable piece of apparatus like the rotary converter. Its place in the electric railway field is being made more secure by the application of automatic control. In its favor also is a certain prejudice against what might be termed non-dynamic devices for power transformation. The mercury-vapor converter was invented many years ago and is still used to a comparatively small extent. The vacuum tube is in the future as far as large power is concerned, but its application to railway work, if it is applicable at all, is likely to be much more rapid than that of the mercury arc rectifier has been.

Pittsburgh Security Holders Successfully Placated

ONLY a week ago three questions intervened and threatened to delay the reorganization of the Pittsburgh Railways. Two of these had to do with financing and the third with the matter of the acceptance of the franchise conditions by the municipalities through which the road runs. All of them have now apparently been removed. A local financial institution has agreed to underwrite a new issue of securities to the amount of $5,000,000, and the holders of underlying liens have relented, as it were, and no longer insist that in the reorganization the priority of their liens remain undisturbed and that the Philadelphia Company act as guarantor of them. As a result the reorganization will proceed with one bond covering all the properties as a first lien and general refunding mortgage into which all the present mortgage securities will be merged on an equal basis as regards security, even if not ratably.

To Pittsburgh all this is big news. It is also big news elsewhere than in Pittsburgh. It shows a growing appreciation on the part of security holders of the fallacy of too stout insistence upon mortgage rights where such insistence may mean disintegration of a system and destruction of earning power that inheres in the operation of the system as a whole. The same spirit now shown in the Pittsburgh case was manifested in somewhat different form when the Manhattan Elevated Railway stockholders agreed to accept a scaling down of their lease guarantees as part of the program to save the Interborough. The same spirit has also been shown in the New Orleans reorganization. It is a manifestation that would appear to augur well for the impending reorganizations in St. Louis and Brooklyn.

Only Through Co-operation Can the Track Paving Question Be Settled

THAT municipal and electric railway engineers can discuss a mooted question without coming to blows was amply proved by the conference on street railway track paving held in Philadelphia recently under the auspices of the Engineers' Club of that city. There were three sessions of this conference, each filled with animated discussions of this one topic. There was thus ample opportunity to cover all disputable points in detail, and the men who attended the conference and who sent in written contributions to the discussions were in a position to bring out the vital topics because they were talking about their every-day experiences. While of course each side presented the argument from its own point of view, each was obliged to see the case from the other side. There was real evidence of a disposition to fairness, which is to be expected from engineers and is necessary to a solution of an engineering problem.

The Philadelphia conference emphasizes the fact that the design of electric railway track structure and the design of street paving have gone along side by side and very rapidly in recent years. There has been some co-ordination between them, but not enough. This is evidenced by the disagreement as to details which still persists. Obviously, as electric railways have in most cases been required to maintain the paving in the track area, their engineers have tried so to design the track structure as to minimize the maintenance cost and at the same time allow for a maximum salvage at such time as complete reconstruction becomes necessary. Municipalities have naturally concerned themselves principally with the paving outside of the track areas. Thus in the same street contiguous strips of paving are kept up by different interests, and peace can only prevail when there is close co-operation between them. While it is true that a track is an entity in itself it must also be recognized that in the street it is essentially a part of the paving. The whole must therefore be considered as an engineering unit whether it is viewed from the side of the highway engineer or the way engineer.

Forward-looking municipalities recognize the essentiality of street railway service and, therefore, the necessity for tracks in the streets. To the extent to which the city governments represent the thinking element of the population they are inclined to be square in connection with these tracks. The utilities, on their side, admit that tracks complicate the paving problem, but insist that, when the traffic which they handle is considered, they do not cause more street expense than is warranted by the taxes they pay. They are gradually convincing city governments that their enormous paving tax on top of the general tax is inequitable.

However, entirely aside from the question of tax burdens, which will in due course be properly adjusted, there remains the problem of proper adjustment of track and paving design to yield the minimum over-all maintenance expense. This exists whether the municipality and the railway pave their respective strips as at present or whether the city paves the entire street area. The engineers are the men who best understand the situation. If they will get together and determine the proper paving for any given case, their ideas will have much weight with their respective superiors. The Philadelphia conference is a move in the right direction. Another is the action of the American Society for Municipal Improvements in opening its membership to utility engineers.

Excavating Track in Chunks with a Derrick

Methods Adopted in Removing Old Track and Type of Construction Used for New Track in Connection with Reconstruction of Surface Tracks in Fulton Street, Brooklyn, N. Y.—Solid Concrete Construction with Steel Ties and Granite Block Pavement Was Replaced with Wood Tie Construction and Sheet Asphalt Pavement

By R. C. Cram
Engineer of Surface Roadway, Brooklyn Rapid Transit System

THE surface tracks of the Brooklyn City Railroad Company in Fulton Street, between Court Square and Flatbush Avenue, Brooklyn, N. Y., probably carry about as heavy car traffic as will be found in any one part of the country, as the traffic schedules call for the passage of 2,400 cars per day over each track. Meanwhile, vehicular and pedestrian traffic is particularly heavy. A description of some of the problems which were met in connection with the reconstruction of these tracks under such heavy operating conditions should be of some interest.

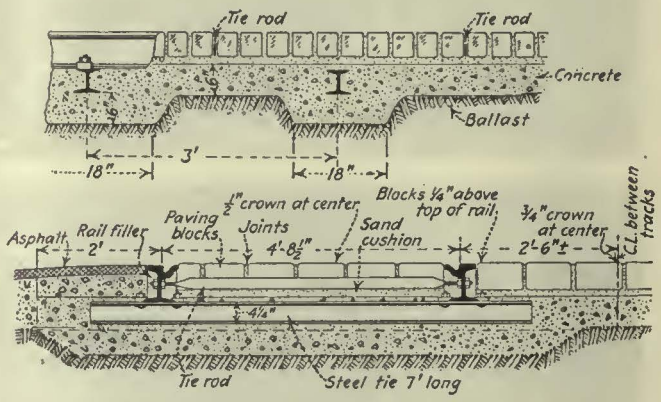
The old tracks were laid in 1908 some time after the construction in this territory of the rapid transit subway under Fulton Street. The tracks were laid in backfill about 18 in. in depth between the top of the roof of the subway and the sub-grade for the ties. The tracks were built of what is known as solid concrete construction using Carnegie steel ties, Type M, 7 ft. 6 in. long, spaced 3 ft. on centers with B. S. Co. 7-in. grooved girder rail, Section 112-284, the rail having been designed and rolled especially for the company. This form of construction is shown in one of the illustrations.

The joints were originally of the special riveted type which had some use in Brooklyn for a short period. This consisted of $\frac{5}{8}$-in. x 4½-in. x 29½-in. bars riveted directly to the rail webs and held in place by sixteen rivets, eight in each rail end. These bars, as will be noted in one of the illustrations, did not provide for any bearing on the base or under side of the head of the rail, and the joints were so installed that a steel tie came immediately under the center of the joints.

When the rail was removed, there was still perhaps two years wear left in the head, but the groove had been so badly cut by the wheel flanges that it was breaking down. Meanwhile for the past five years there had been excessive expense due to replacements of the riveted joints, which had failed to stand up under heavy traffic conditions imposed. These conditions were primarily responsible for the track removal. The grouted granite block pavement had withstood the traffic in remarkably good shape and probably would have continued to do so for a long time to come. It was found that the renewal of the track was desirable in order to eliminate the excessive maintenance expense which the records showed. There were about 4,400 ft. of single track involved in the reconstruction work.

Heavy Daytime Traffic Complicated Reconstruction Work

The vehicular and car traffic conditions were such that all of the work had to be done during the night, because during the day the rush-hour traffic is much prolonged and daytime rerouting of cars could not readily be accomplished with any degree of satisfaction to the riding public. The highway and police regulations also made inadvisable any attempt to do daytime work of this nature in this street, which is the main thoroughfare in the principal downtown shopping district, and these tracks form the "neck of the bottle" through which all cars must pass in order to reach New York via Brooklyn Bridge. All of the operations consequently were carried on between the hours of 8 p.m. and 5 a.m., with an hour off for the men for lunch at midnight. It was required that new track be laid ready for traffic in the morning in place of the old track which was removed, so that regular service could be maintained without any interruption during daylight hours. During the above hours, car traffic fortunately could be diverted from both



Section of Track Removed from Fulton Street, Brooklyn

tracks without serious inconvenience to the public. Before the work was started, the public was notified of the diversion by car cards and by posters placed upon the elevated railroad columns along the street.

The principal difficulties in the work which naturally controlled its progress were the excavation of the grouted granite pavement and the removal of the old solid concrete track construction. Air-operated cutting tools and drills were used for cutting the sheet asphalt outside of the rails and for spotting holes in the concrete preliminary to the removal of the track structure proper. The air drills were used to break the concrete into sizes convenient for handling, which required a row of holes on the 2-ft. line outside the outside rails, together with a row of holes on the center of the devil strip. After these holes had been made, the drills were concentrated upon the concrete base in order to break it up. After the first night or two this procedure was found to be very slow, and steps were taken toward speeding the work.

At first, in the course of the removal of the concrete, jack holes were made and ordinary 15-ton track jacks were used partially to lift the tracks in order to permit manual separation of ties from the concrete. The rails had previously been cut by the acetylene cutting torches.

It was soon found that the work accomplished with

Reconstructing a Piece of Heavily Traveled Track in Brooklyn, N. Y.

No. 1. Air drill cutting cross trench in concrete between steel ties, acetylene torch cutting rails.

No. 2. Cross trenches finished; rails cut immediately above trenches.

No. 3. Crane loosening a complete section of track from adjacent section, preparatory to loading.

No. 4. Loading a section of complete track, with solid concrete foundation, upon the crane car.

No. 5. Sub-grade is nearly ready to receive new ties when old track is removed.

No. 6. One track laid ready for concrete. One track concreted ready for asphalt pavement.

No. 7. Sheet asphalt laid in one track, in direct contact with association standard 7-in. girder grooved rails. Puzzle, find the cast-weld joint.

the use of ordinary track jacks was quite limited; therefore to secure increased production a number of 25-ton geared jacks were substituted. Two of these jacks with two men each, or a total of four men, accomplished as much work in a shorter space of time than did four ordinary track jacks with sixteen men. Even with this improvement in the method of breaking up and removing the concrete there was still some congestion and delay to actual laying of new track. This was caused by the time required manually to remove the concrete and either to load it upon work cars or place it temporarily upon the roadway for later loading; this in turn delayed the preparation of the roadbed for the new track.

The accompanying views clearly show how the excavation work was finally conducted, so that with a force of about half the men originally engaged upon removal of old trackwork proper, it was found possible to remove and lay three times as much track nightly as was done during the first few nights before the final removal method was in working order. This method ultimately resolved itself into the following procedure:

Procedure as Determined by E perience

The air drills spotted holes on the 2-ft. line about 18 in. apart, and also made holes, as previously mentioned, on the center line of the devil strip at a similar spacing. Cross trenches in the concrete were then cut with the air drills, spaced about 9 ft. apart in order to include three steel ties. A jack hole was also made in the concrete in the devil strip at a steel tie about midway between the cross trenches. The rails were cut with the torches immediately above the cross trenches in the concrete. One geared jack was then placed in the jack hole, and the action of this jack was sufficient to loosen the entire mass over the sub-grade and to break the bond of the concrete between holes. The entire section of the first track removed was raised up by the jack sufficiently to permit the attachment of chains thereto, and a Brownhoist derrick then lifted the entire section from the street to the platform of the derrick car. After a certain number of these sections had accumulated on the derrick car, they were transported to a near-by flat car, upon which they were reloaded for removal.

When these work cars were completely loaded they were taken to one of the large dumps in an outlying section of the city and the entire mass was then pushed overboard by the regular pusher cars which are operated on this dump for the purpose of disposing of refuse of this kind. It will be seen that there was no attempt to salvage the rails or steel ties, as the cost for this would balance, if it did not outweigh, the value of the salvaged material.

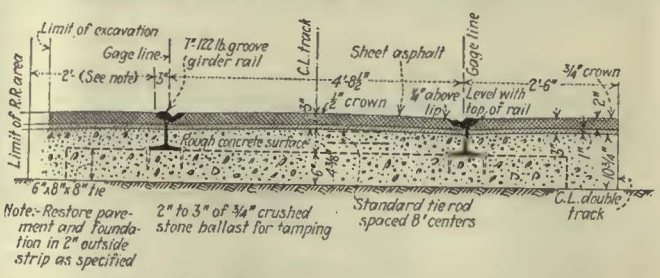
When a section of the old track had been removed in the manner described there was very little grading work necessary to prepare the sub-grade to receive the new track, although it was found desirable to furnish some ¾ in. crushed stone partly as a tamping material and partly as a means for filling up occasional excessive depths of the trench to reach the required sub-grade for the ties.

Upon the sub-grade thus prepared the standard 7-in. track construction, which is in current use in Brooklyn, was installed. This consists, as will be seen in the illustration, of association standard 7-in. 122-lb. grooved girder rails laid upon 6-in. x 8-in. x 8-ft. heart, rough-sawn yellow pine ties spaced 2 ft. on centers and spiked thereto with four standard hook-head spikes in each tie; standard ⅞-in. x 2-in. x 60½-in. double-end tie rods were installed on 8-ft. centers. The rails were joined by means of standard cast-weld joints laid opposite.

The Asphalt Paving Was Laid in Direct Contact with the Rails

Following the installation of the track the concrete was installed at the proper level for sheet asphalt pavement and extended from the base of the tie to a level substantially three inches below the tops of the rail heads. After the concrete had set a sufficient length of time the sheet asphalt wearing surface for the pavement was installed by the company's asphalt paving contractor and it will be noted, in one of the illustrations, that the asphalt was laid in direct contact with the rails, both inside and outside thereof.

In connection with the placing of concrete, considerable time and labor was saved in mixing by having the sand and gravel mixed at one of the yards and brought to the job in work cars. It was then only necessary to provide a chute, by means of which the material was transferred from the car to the hopper of the concrete mixer, the latter located on one track while the car with the concreting materials was on the other track. As



Section of New Track Installed on Fulton Street

previously noted both tracks were available during the night for construction operations, and this feature greatly assisted in the performance of the work.

In connection with the removal of the grouted granite block pavement, good use was made of the Clark pavement plow for breaking up the pavement prior to its removal from the street, and advantage was taken of the plow toward the latter end of the job for removing the pavement in the space between the two tracks by means of a special sort of single-tree rigging which permitted the plow to be pulled properly by two cars, one on each track, and without causing damage to the draft rigging. Light for the night work was provided for by special five-light incandescent lamp clusters, suspended overhead from the elevated railroad structure which runs through Fulton Street.

Total Maintenance Cost on This Track Equaled the First Cost

It has been stated that the old track was installed in 1908. Some interest may attach to the record of the maintenance cost up to the time of removal. During the first six months of 1922, the sum of $697 had been spent upon joint repairs, with the incidental paving cost included. A total of $51,217 has been spent in maintenance during the fourteen years the tracks were in service, and of this sum $41,593 was spent upon the joints and paving therefor. As the estimated cost of the new tracks was $51,050, it will be seen that maintenance has consumed an amount practically equal to the cost of renewal.

The average annual maintenance cost per foot per year has been substantially 89.6 cents. Meanwhile the

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Speed, m.p.h.	11.30	15
Weight of single-truck car (summer), lb.	17,000	.....
Weight of double-truck car (winter), lb.	37,000	26,000
Seats per hour one way, summer	50	48
Seats per hour one-way, winter	40	48
Kilowatt-hours per car-mile	1.42	2.0
Car-hours annually	20,961	20,961
Car-miles annually	216,900	216,900
Increased speed, per cent	.....	33⅓
Decreased running time, per cent	.....	25

With the property was included a power plant, built in 1897, with equipment satisfactory for that time. However, the Connecticut Company management realized that power could be secured more cheaply from a modern plant, and arranged to purchase power from the Winsted Gas Company, from which it is secured over a high-tension line at 22,000 volts, three-phase.

The substation apparatus installed consists of two 200-kw. Westinghouse motor-generator sets, with three 125-kva. transformers. Much of the apparatus is of the outdoor type.

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Total conducting transportation, exclusive of wages of motormen and conductors	2,427	2,427
Annual platform expenses	23,341	13,625
Total traffic (credit)	166	167
Total general and miscellaneous	5,216	5,216
Total operating expenses	$55,950	$50,652
Decreased operating expenses	.....	5,298
Interest and depreciation on new cars (15% of $30,000)	.....	4,500
Annual saving	.....	$798

The new equipment cost about $20,000, and energy is purchased for 2½ cents per kw.-hr. The company estimates that, using the fiscal year ending Dec. 31, 1921, as a basis, the cost of energy for the current year will be about $10,000. Adding interest at 7 per cent and depreciation at 4 per cent on the new equipment, the total cost of energy for the year will be $12,000. In 1921 the cost for power was $19,800. As the total operating expenses for a year are estimated at $66,000, the change mentioned will save the company 11.8 per cent of the operating expenses.

While the rehabilitation of the power supply in this case is important, the change in rolling stock is also a feature. The company purchased three double-truck one-man safety cars, of which the details were given in the Feb. 18, 1922, issue of this paper, page 576. These cars are heavier than the old single-truck open cars which were used, but are lighter than the old double-truck cars.

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State public utility information committees were shown to be very successful in their work of disseminating traction information through matter supplied to the newspapers. And finally, public speaking was shown to be a most effective means of reaching the news pages of the newspapers. The rotary clubs, merchants' associations, etc., are glad to have representatives of electric railways come and talk about a subject that interests everybody in the community. As a result they come to think of the street railway as a personality, and besides thus creating a sympathetic understanding, the newspapers will print a speech where they would ignore the same thoughts sent to them as contributed matter. And to get the most value of a talk of this kind, from the advertising standpoint, it should be written out in advance and given to the newspapers to be released when the address is made.

In regard to the general business situation, H. A. Wheeler, a Chicago banker and formerly president of the United States Chamber of Commerce, said that "there is more money for investment available now than ever before in the United States. There is nothing unfavorable in the business situation. The electric railway business has bridged a period of great distress and has come into easier conditions of operation. But there is no assurance of freedom from political interference."

Carl D. Jackson, chairman Wisconsin Railroad Commission, brought out in his address how paving burdens, excessive taxes, unregulated competition, and other obstacles to the giving of good service are to the detriment of the rider. He also laid stress on the importance of co-operation between regulatory and taxing bodies.

Hon. Walter W. Warwick, former Comptroller United States Treasury, advanced the thought that perhaps the best opportunity to secure the large amount of new money required by the electric railways each year is to go to the plain citizen, the man of small means, who went into the investment business in large numbers during the war and now is ready to invest money got out of government securities, or additional savings, in something else. This man is the man for the electric railways or any other vital industry that needs new money and friends. But this plain citizen wants something more than a promise to pay if all goes well. He wants first of all to know all about your business, just as he did about the Liberty bonds when he invested in them. The railway having won his investment, he will stand with you and fight with you as long as he is convinced that your methods are honest. If you want to sell this plain citizen, it is best to be prepared to talk his language. The average financial statement goes over his head, and some one who talks plainly will get his support and his money.

The Convention Thinking on the Bus

In the course of his address, Mr. Warwick made reference to the bus problem and expressed confidence that the electric railway is in no danger of displacement. He said that electric railways have been, and they will remain, our chief means of local transportation. He did not expect to see street cars supplanted by buses. The latter are efficient for light traffic, but they cannot serve mass transportation. The experience in England has proved this, he believed. Buses give way to tramways wherever traffic increases to a point to warrant it. He said he doubted if any large American city could handle its traffic with buses exclusively; certainly not at a reasonable fare.

Mr. Brush addressed the convention pointedly on this subject and reminded the members that they are transportation men, not merely electric railway men. "You, gentlemen, are experts in managing transportation," he said. "You ought not to sit by and let any beggar buy a truck and put some seats in it and go into this business as a novice, merely because you say the people have got to ride in your cars. The transportation manager should not hold any such idea, because it cannot be done. Therefore, I want to say that I want to see the men whom I have known so well for so many years become 'transportation men' and undertake successfully to furnish that character of transportation which the people want and for which they will pay enough to insure a fair return on the amount of money invested in the business. It is immaterial whether this transportation be by airplane, electric bus, perpetual motion machine or anything else. . . . I do not care whether people ride in buses or wheelbarrows, but why permit these parties to come in and undertake to furnish something which you have been trained to do throughout your lives and to embark in competition with your business, in which you are expert?"

The committee on trackless transportation took the position that all of the transportation requirements of any community should be furnished by one agency and that that agency should be the electric railway company. The public has already been convinced to a large extent that this business is a natural monopoly, and hence it is the duty of electric railway men, as public servants charged with the responsibility for conducting the highway transportation, to study and consider the availability of every feasible unit or method for furnishhing this service. The committee also stated that while it recognized that the electric car running on rails is the most reliable and economical method of urban, suburban and interurban travel, especially for mass transportation, there is, however, a field in transportation in which the railless vehicle can furnish service satisfactory alike in operation and economy. This applies where the traffic is so light that the higher cost per passenger while operating the bus is offset by the relatively high fixed charges per passenger which result from the electric railway's investment in tracks. The possibility of utilizing the motor bus or trackless trolley should therefore be kept in mind by electric railway operators, the committee admonished, either where they are confronted by the necessity of extending transportation service into sections where traffic will be light, or in the economically similar situation of being required to rebuild tracks on a line where the traffic is too light to warrant the new track investment. In the latter case, the economic procedure might be to abandon the track and install bus service.

In considering the effect of bus service upon the financial situation of the electric railways, the committee concluded that if the services of both means of transportation are co-ordinated, the net return of each will be reflected in the net return of the electric railway. Part of the new capital required annually in the operation of a street railway may well be used in the development of trackless service in the field above mentioned. Present investment in the electric railway is thereby conserved, the growing demand for service met, and the return to the investor stabilized. In addition to the function of supplementing street railway service at the same rate of fare, there exists in some of the larger cities a demand for a transportation service at a higher rate of fare which shall insure a seat for every passenger.

A Pacific Coast railway man had found from his experience that in addition to whatever benefits may be derived from an electric railway company putting money into the stage business itself, the greatest benefit is that which comes from co-operation with the independent stage men. In Seattle the railway company has adopted the policy of owning the trunk line facilities, both interurban and stage, and of offering facilities to independent operators at the various terminals, such as ticket facilities, joint advertising of schedules, etc. As a result there has been a great use of these depots by independent operators who bring in large numbers of passengers to the interurban lines. This has produced an improvement of 40 per cent in the net earnings of the interurban in the past six months.

The example thus set by the interurban has meant more money for both railway and stages and has generally improved the whole transportation situation of the community.

The motor vehicle regulatory law developed by a committee for proposal as a uniform law throughout the country suggested the levy of taxes for the use of the highways on a ton-mile basis, the rate to be lower for pneumatic tired vehicles. It would also require liability insurance and a bond conditioned on the payment of all fees, taxes and charges due the state. Safety of vehicles, twenty-one-year-old drivers, a speed limit of 25 m.p.h. for passenger buses and 20 m.p.h. for freight trucks would also be required. One prominent executive in discussing this proposed uniform law pointed out that any regulation which may seem to impose heavy burdens upon the motor carriers may some day come back to plague those railways who go into the business themselves.

The committee on valuation reported that the most recent decisions uphold "fair value of the property at the time of inquiry" as the proper basis for rate making. As a result of the committee study, the association took the position that the yardstick method of valuation be employed wherever applicable, that endeavor be made to complete arrangements with the National Association of Railway and Public Utilities Commissioners for a search for broad fundamental principles of valuation, and that a study be made of price trends and a method worked out by which they may be used in determining fair value of the property.

In the matter of federal taxation the association decided on the policy that any sales tax passed by Congress should follow the example of the French and Canadian acts and exempt regulated industries, and that it should provide sufficient revenue to enable the elimination of the existing surtax and excess profits tax on individual and corporate incomes; that on the question of the normal income tax the public utilities should urge that this should not exceed the present rate; that any tax on undistributed earnings of corporations should be so worded as not to apply to earnings which are reinvested or held for reinvestment in the property within twelve months after the year in which they accrued, or which, together with the earnings distributed, do not exceed say 10 per cent return on the value of the property; that in the event the sales tax is not passed, an attempt should be made to have reduced the very high registers of the surtax on personal incomes on the ground that the present registers are so confiscatory that they are defeating the purpose for which they were created.

The work of the committee on education urged the desirability of co-operation with institutions of learning in arranging summer work on electric railway properties for students as part of co-operative courses; that the supervisory forces on an electric railway be given instruction in the fundamental economic problems of the industry in general and of the property employing them in particular; and that Americanization work be taken up among employees who do not speak English; and finally that there should be provision for instruction in courtesy to the public.

Activities of the Accountants' Association

The Accountants' Association laid particular stress upon the wisdom and advantage of using the budget system in making expenditures. The need for forecasting revenues and expenditures for the period ahead was considered essential to businesslike and economical operation of a railway system. One of the greatest activities the Accountants' Association can follow was considered to be to work out a proper system of accounts for depreciation. The Accountants' Association, in conjunction with the public relations committee of the parent association, is working with the Interstate Commerce Commission in the endeavor to establish proper rules for depreciation.

The Accountants' Association heard a very able paper which developed the fundamentals of scientific accounting. It also held a joint meeting with the Engineering Association and discussed methods of instituting better co-operation between engineering and accounting departments.

Transportation and Traffic Association

The program of the T. & T. Association was an epitome of the work of the transportation manager. The committee reports and papers discussed the three fundamentals of transportation; first, supplying the means of transportation service, i.e., the best type of car and the best type of platform employee; second, providing that the car shall run through the streets safely but rapidly; and third, inducing the public to patronize the service thus presented.

Recognizing that the natural tendency of any producer is to view the problem of the best way of selling his service rather too much from his own standpoint, the association wisely followed the plan of last year in asking some one from outside the association to talk on this phase of the work. Last year the association secured the viewpoint of an expert salesman, W. L. Goodwin, general manager Society for Electrical Development, who argued in favor of the establishment of a sales organization on each property. This year Edward Hungerford also made some valuable suggestions. His points related primarily to publicity and public relations, and may be summarized by the advice to make the goods for sale attractive, even to the point of meeting the prejudices of the purchaser if they are not too unreasonable. In other words, if the purchaser thinks more about the shape and color of the package in which the goods are supplied, as, for example, if he wants tickets sold in advance, it is good policy to accommodate him, even if no actual reduction in fare is made. Other valuable suggestions were made in the report of the committee on merchandising transportation, and then the meeting ended with the round table on the weekly pass. The most striking feature of this discussion was the satisfactory results noticed on each property using the pass.

The report and discussion on traffic regulations emphasized the revolution effected in street movement and occupancy by the general use of automobiles. This change comes in part from the large number of vehicles moving on the streets, but in still greater degree from the street congestion produced by parking of vehicles. This latter point was particularly emphasized by Lieut. John Martin of the Chicago Police Department, who unreservedly declared that the present Chicago ordinance which prohibits parking in the Loop district between 7 and 10 a.m. and 4 and 7 p.m. is not sufficient. Prohibition of all parking in this district, in his opinion, will greatly simplify the traffic problem. He admitted that this is difficult to bring about because merchants seem to have the idea that their business would be interfered with, but actually an unobstructed front before a store is far better from a business point of

view for the proprietor, and vehicles should simply be permitted to load or unload passengers or merchandise. An ordinance permitting parking for even a limited time within the business district is inadequate.

The safety discussion consisted largely of testimony to the necessity of safety measures in modern railroading. The extended campaign conducted by the chairman of the safety committee, including an elaborate exhibit, and the addresses on safety before the other associations impressed this idea firmly on the delegates.

Car design was considered and it elicited much interest. The discussion showed that the turnstile car is one of the live developments in one-man car design at present, though all managers are not united in its favor, and that the Chicago automatic exit door is a very likely development in future one-man cars.

The discussion on personnel and training of transportation employees centered around the report of the committee on that subject which is opening up a new vista on this phase of the subject. It developed the fact that the Market Street Railway had been applying special tests to motormen for a year or more, which developed some very interesting practical data as to the worth of some of the suggested schemes of determining good and poor men. A paper by a Baltimore doctor demonstrated the scientific possibilities of studies along these lines. The convention concluded with an "interurban hour," which was considerably longer than an hour and proved as useful to interurban men as any previous session of the association. Perhaps the most interesting part was the description of the bus situation in California, where the largest electric railways are installing motor bus lines.

The Engineering Association's Work

At the Chicago meeting, possibly even more than usual, the Engineering Association convention was the fruition of a strenuous year of committee work. Reports of committees containing nearly 500 pages had been distributed generally to the membership in time for inspection, if not for assimilation in advance of the meeting. The educational value, along engineering lines, of the reports and discussions was great. The decision of the association to put the Engineering Manual into really convenient form for use was noteworthy. At reasonably frequent intervals the members will now have up-to-date Manuals without the almost impossible task of keeping their loose leaf copies revised.

The specifications contained in the Manual were much enriched this year, particularly by the work of the committee on way matters. The committee's specifications for standard frogs and car-clearance easements, locations of tongue switches at crossovers and turnouts, and sundry track materials received unanimous approval.

The Chicago meeting would have been worth while if only as the occasion for inaugurating the much-heralded rail-joint tests. The American Association showed its confidence in its engineering auxiliary by voting to put $10,000 into engineering research. This sets a precedent, and if the engineers can demonstrate that money invested in this way will bring a satisfactory return to the investors, they will have paved the way for other much-needed research in the future.

Closely related to this work on rail joints was the discussion at the joint session of the American Welding Society and the Engineering Association. The industry is going to benefit by this co-operation, an example being the rail-joint tests referred to above, which will be made under the auspices of the American Bureau of Welding, a subsidiary of the Welding Society with representation from the Engineering Association and other interested bodies.

The engineers showed their common sense in deciding to get together on the subject of rail and wheel tread contour. As rails and wheels are continually engaged in modifying each other's contour, it would seem that the coming joint study of the subject will bring results. Heretofore the equipment and way committees have been asked to co-operate, but no adequate machinery was provided to harmonize conflicting requirements. The new joint committee will this year undoubtedly have many interesting conferences and ought by next fall to get somewhere. In view of the appointment of this committee the association decided not to revise the wheel contour standards this year.

The committee on power distribution reported on an interesting bit of work, the magnitude of which is likely to be overlooked. This committee, in order to bring out the essentials of distribution with the aid of automatic substations, set for itself a hypothetical installation which was made as nearly practical as such a problem can be. Then a number of different solutions for the problem were found, and the results were tabulated in such a way as to permit ready comparison. As the committee members had access to all available data on their subject, their solutions ought to prove highly suggestive. Railway companies would pay a consulting engineering firm a large fee for a piece of work like this. Here it is had for nothing. They would probably appreciate it a great deal better if they paid for it.

Real progress in the direction of car design standardization was indicated in the report of the committee on unification in car design. The committee made concrete recommendations as to certain details. The report was approved and continuation of the work was voted. The work on standardization of shop layouts, done by the committee on buildings and structures, also was notable. The inclusion in the Manual of suggested layouts will, it is believed, increase the present tendency to more effective arrangement of shop equipment.

The engineers showed by the work of their committees on engineering-accounting, and purchases and stores and by the time devoted to these subjects at the meeting that they are vitally concerned with costs. This will serve to offset the belief sometimes held that engineers are likely to overlook the economic phase of their activities.

There was some disappointment in connection with the report of the committee on heavy electric traction, not entirely unexpected, in the statement that the plan of the association for a co-operative committee had not met with general approval from other associations. An "American committee on electrification" seemed so obviously desirable a thing that postponement of its realization is unfortunate. Such a committee will, of course, be formed in time, and the sooner it is formed the less duplication of work will there be in compiling information on current practice in this field.

After careful study of the suggestions made by the retiring president, W. G. Gove, last year, the committee on reorganization reported that many of Mr. Gove's ideas have been since carried out or are in process of being carried out, but that the constitution and by-laws of the association provide substantially for its needs. This will prove gratifying to those who were active in formulating this document many years ago.

Paris-Orleans Railway Electrification Is Progressing

The Large Number of Locomotives Which Have Been Ordered for Initial Installation Will Be Largely of French Make, but America Will Furnish the Control Equipment

AFTER careful investigation into the possibilities of electrification, the railroads of France have decided to electrify more than 5,000 miles of their tracks. The following lines have all made definite plans for electrification: The Paris, Lyons & Mediterranean, running to Marseilles, Nice, Monte Carlo and into Italy, as well as into the Alps, where heavy grades are encountered; the Midi, operating in the southern part of France, and the Paris-Orleans.

The Paris-Orleans Railway is taking the initial step in electrifying approximately 143 route-miles, including its main line extending from Paris to Vierzon. The trains of the Paris-Orleans leave Paris from Quai d'Orsay station, traveling first through one of the most densely populated sections of Paris. They then head practically southwest for Orleans, a distance of about 75 miles. En route to Orleans, the road passes through Bretigny, from which point a short branch line to Dourdan will be electrified.

Orleans, a city of more than 70,000 inhabitants and located on the River Loire, is the terminal for a large number of lines. This city, which is one of the oldest in France, is famous for its celebration each year of the anniversary of its deliverance from the English by Jeanne d'Arc in 1429.

From Orleans the line runs by Nouan and Sabris in passing to Vierzon. Vierzon, which is approximately 123 miles from Paris, is the terminus of the steam-engine division which the railroad is now electrifying.

For operation over this zone and a future extension south of Vierzon 200 locomotives will be purchased. The orders for the first 120 locomotives have already been placed with a group of French manufacturers, namely, Compagnie Electro Mecanique, Société Schneider, Forges et Ateliers de Construction Electriques de Jeumont and Compagnie Thomson-Houston, each of which will build a portion of the locomotives or equipment.

TABLE I—LOCOMOTIVE DIMENSIONS

Length between buffers	41 ft. 5 in.
Length of cab	36 ft. 3 in.
Width of cab	9 ft. 10 in.
Total wheelbase	28 ft. 11 in.
Rigid wheelbase	8 ft. 10 in.
Distance between truck center pins	10 ft. 0 in.
Diameter of new wheels	47¼ in.
Thickness of steel tires	3 in.

Each locomotive will rate approximately 1,400 hp. for one hour and approximately 1,200 hp. continuously, both ratings being at 1,350 volts direct current. A single box cab will be mounted on two 0-4-0 swivel trucks, the total weight of locomotive complete being approximately 66 tons (132,000 lb.). The mechanical parts, however, will be of sufficient strength to permit of ballasting to 79.35 tons, without any modification other than a change in springs.

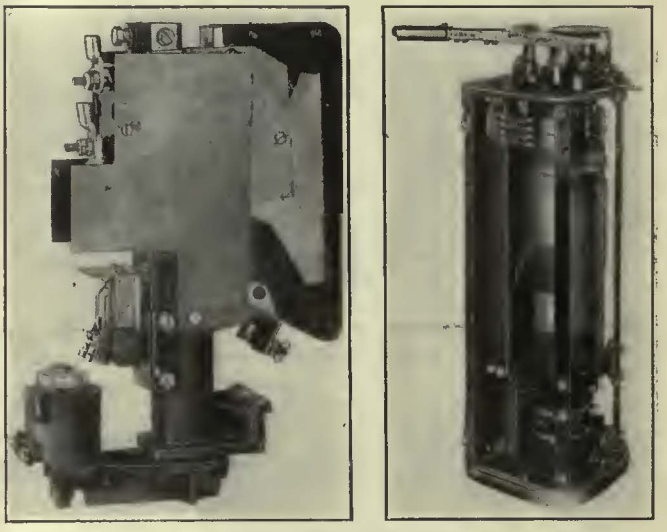
The dimensions of each locomotive are given in Table I.

The specified tractive efforts for these locomotives are given in Table II, these being with a gear ratio of 21 to 62 and wheels of 47¼-in. diameter. Each axle will be driven by a series-type, 1,500-volt, four-pole motor rated at 300 hp. continuously at 1,350 volts and 350 hp. for one hour at 1,350 volts.

Details of the Control

The complete control equipment will be built by the Westinghouse Electric & Manufacturing Company at its plant at East Pittsburgh, Pa., which furnishes the following information regarding the details:

The locomotives are designed for double-end control, multiple-unit operation and are governed through a low-voltage battery train line. Westinghouse type-HBF electro-pneumatic control, now standard on many of the large roads in America, will be used. The main circuit diagram of this is shown in the accompanying diagram. The motors will be connected first in series, then in series-parallel and finally in parallel. Twelve series notches, nine series-parallel notches and nine parallel points will be provided. The last two notches of each combination are field control notches, the field strength being reduced by means of inductive shunts as shown. Variations in tractive effort from notch to notch must be kept very low on account of the limited strength of the car couplings. The circuits are arranged so that regenerative control and dynamic braking may be provided later with a minimum change, by adding the necessary equipment in space left for that purpose. None of the locomotives will be provided with regenera-



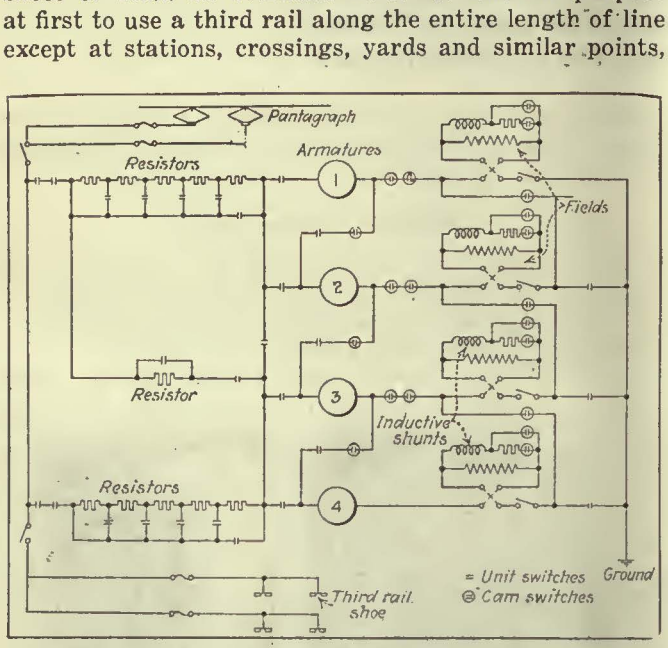
At Left, One of the Unit Switches Which Help Make Up the Complete Control Switch Group. At Right, Master Controller with Cover Removed, Arranged for Left-Hand Drive

TABLE II—SPECIFIED CONTINUOUS TRACTIVE EFFORTS AND SPEEDS

Tractive Effort in Pounds	Speed M.p.h.		
15,600	6.4	Series connections	Full field
12,200	8.6	Series connections	Min. field
15,600	13.7	Series-parallel connections	Full field
12,200	17.9	Series-parallel connections	Min. field
15,600	28.4	Parallel connections	Full field
12,200	36.8	Parallel connections	Min. field

tive control at present, but extensions to the south of Vierzon will be over profiles which will warrant the use of this feature.

Power is to be received either through third rail shoes or from an overhead wire. It was the purpose at first to use a third rail along the entire length of line except at stations, crossings, yards and similar points,



MAIN CIRCUIT DIAGRAM, ELECTRO-PNEUMATIC CONTROL FOR PARIS-ORLEANS LOCOMOTIVE

but the idea has been modified so that the use of the overhead conductor will be considerably extended.

The pantograph trolleys will be of the air-raised, gravity-lowered type. A main knife switch will be provided for isolating the locomotive circuits from the trolleys and another will disconnect the circuits from the third rail shoes.

BOTH UNIT SWITCHES AND CAM SWITCH GROUPS WILL BE USED

The main circuit connections will be made by means of unit switches and cam-switch groups, each being operated by compressed air at 70 lb. pressure. Use is made of cam switch groups only where it is found desirable to provide a mechanical interlocking of switches and where the cam shaft can be arranged for two positions only. Where cam groups must have three or more operating positions, the difficulty of stopping the cam shaft on an intermediate position would introduce a complication in the control and reduce its factor of reliability. Unit switches are also preferable for arc-breaking service.

Overload protection is provided by the use of an overload relay for each individual motor circuit and also one for the main feed. A ribbon type fuse is placed in the circuit of each trolley and one fuse is placed on each side of the locomotive connected between the third rail shoes on that side and the main knife switch. Provision will be made for installing a high-speed line switch at a later date, should this be found necessary in order further to protect the motors against flashing.

One master controller will be placed in each end of the locomotive, to the left of the locomotive center line, with the brake valve to the left of the controller. The controller handle extends to the left of the controller for operation with the right hand. This arrangement is to conform to the standard French system of running on the left hand tracks.

Each locomotive will be provided with two blowers for motor ventilation and two compressors. The blowers will be arranged so that the failure of either will not cut off ventilating air from the motors. Expulsion type fuses will be used to protect these circuits. The control battery will be charged in series with the blower and compressor motors by the use of a battery-charging resistor and relay.

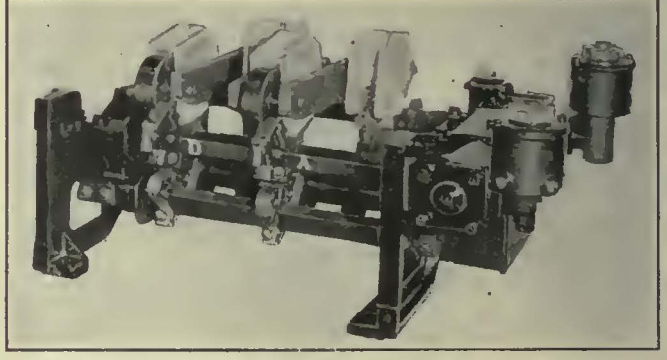
RIGID TESTS MUST BE MET BY EQUIPMENT BEFORE ACCEPTANCE

Very complete and thorough tests will be made of the various items of equipment both before installation in the locomotive and after the locomotive is complete. Preliminary acceptance of each of the first ten locomotives will be given only after it has operated satisfactorily for a distance of 15,500 miles. The balance of the locomotives will be given preliminary acceptance after operating satisfactorily for a distance of 1,863 miles. Each breakdown of more than four hours will extend the preliminary acceptance run by 621 miles for every two days or less that the locomotive is out of service due to defects. The preliminary acceptance for the first ten locomotives, however, will be given within three months after their delivery if the necessary mileages have not been covered by that time. Subsequent locomotives will be given preliminary acceptance at the end of one month if the necessary distance has not been covered within that time.

Final acceptance of each locomotive will be given one year from the date of preliminary acceptance providing the locomotive has operated a distance of 31,000 miles. If the distance operated has been reduced on account of defective construction or design this final acceptance will be extended three months if the locomotive has operated more than 21,700 miles and six months if less than this distance. All dates, however, are based on very reasonable allowances and afford the manufacturers every opportunity to fulfill their part of the contract with the minimum of hardship.

It is expected that the first of these locomotives will be in operation by Oct. 1, 1923, and that the order will be completed by Jan. 1, 1925. This averages approximately four locomotives delivered per month between these dates.

This electrification will be watched with considerable



CAM SWITCHES FOR PARIS-ORLEANS LOCOMOTIVE CONTROL

interest, for while this division extends over a fairly level country and no such tonnages are encountered as are handled in America, the fact that a complete steam division is to be electrified insures a direct comparison between the operation by steam and electric and many interesting facts are expected to be obtained from this electrification.

Track in Paved Streets

At a Meeting at the Engineers' Club in Philadelphia This Subject Was Discussed from the Standpoint of the Design of Streets for Street Railway Traffic

ON OCT. 9, 1922, there was held in Philadelphia, under the auspices of the Engineers' Club of that city, a conference on the design and construction of streets for street railway traffic. Engineers from a number of cities besides Philadelphia, including a number of prominent electric railway men, were in attendance. A full report of this meeting will appear in due course in *Engineers & Engineering*, the publication of the club.

In opening the meeting John Meigs, the chairman, extended the hospitality of the club to the visitors present, and then read a letter from John A. Griffin, city engineer of Los Angeles, Calif. In this letter Mr. Griffin explained that in Los Angeles it is the practice to install double track on streets 11-ft. centers and put single track in the center of the streets. Headers next to the rail have been omitted in paving laid during the last three years. Asphalt concrete is now used in place of cement concrete. In general the railway company maintains the pavement from 2 ft. outside the outside rail on one track to 2 ft. outside the outside rail on the other track.

The next speaker was R. C. Cram, engineer of surface roadway, Brooklyn Rapid Transit System, who spoke on track locations.

Track Locations

Mr. Cram said that the location of the various utilities in the public streets is becoming more and more a serious problem for the municipal engineer. In the large cities the street railway is the only one which occupies the surface of the streets, the others being underground. The location of manhole heads in the streets complicates the railway's special trackwork. At one point in Brooklyn there are eleven such heads at one intersection. There is a need for closer co-operation between municipal and utility engineers in regard to location, and many cities are finding it desirable to set up special bureaus charged with the design and location of subsurface structures.

More consideration might well be given to the possibility of constructing normal sized sanitary and storm sewers in two lines, one at each side of the street. The construction of all such sub-surface utilities prior to the construction of street railway tracks of permanent character is greatly to be desired. Otherwise, there is apt to be unnecessary digging up of the streets. The sidewalk spaces, also, might be more generally used for locating certain utilities. There is some objection to this from the legal standpoint, but on new streets these objections should not obtain.

The central location of railway tracks in streets is considered by all competent authorities to be best for cities. On wide thoroughfares parked spaces are desirable for the cars. On them better car schedules can be maintained and operation of cars is quiet. Railways can more conveniently maintain parks than paving, and the tendency to neglect the track is less when it is in such locations than where pavements must be opened for track repairs. Side location of tracks, although found in some cases, is not desirable from any standpoint.

Where there are two lines of track in the center of the street, a drainage problem is presented since the crown or cross-section used for streets without tracks should not be employed. The plan sometimes followed of dropping the outside rail to conform to the crown is not desirable. It increases paving troubles and produces side thrust, with consequent wear on track, wheels and journals.

A frequent source of trouble with tracks in central locations comes from the disturbance of the sub-grade due to settlement over cross-trenches made for service connections, etc. The railway has little control over such trenches, and undue expense to the railway on account of these trenches can be avoided only through the co-operation of municipal and utility engineers.

The influence of street widths upon the location of all utilities is marked. A minimum of 42 ft. is desirable. On the other hand, when roadways reach widths of 60 ft. there is temptation to owners of trucks to back them up to curbs and "hog" the available roadway.

Whatever the width of the street, the track need not form an obstruction. It is only when street car traffic is very heavy on narrow streets that the railway use of the street can be said to restrict its use in any way. Even then the parked automobile is more of a nuisance than the street car.

The next address was on track specifications by H. H. George, engineer of maintenance of way Public Service Railway, Newark, N. J. Mr. George's remarks are abstracted below:

Track Specifications

Street railway engineers are confronted with many factors in the determination of the type of track construction most suitable for the conditions on their property. One factor is maximum weight of equipment and volume of traffic to be carried and another is the condition of the soil on which the track must be placed, and its ability to support the loads. Soil which under natural conditions would be unsuitable for supporting a track structure may sometimes be made entirely satisfactory by rolling into the soil cinders, slag or crushed stone or, in the latter case, it may be that the run of the crusher will accomplish the best results rather than the use of a uniform sized ballast. Then again, conditions may be such that drainage of some kind or another should be resorted to. The existence of storm water sewers in the streets has a very large effect on the conditions of the sub-surface soil in many cases.

The last important factor is that of economy, and it is in meeting this requirement that the engineer is called upon to exercise his greatest ingenuity, and is largely responsible for the many different details of track construction in use by electric railway companies in this country today. One engineer will advocate stone ballast. According to his ideas 6 in. of such ballast should be placed under each tie. Another engineer, while agreeing that stone ballast is the proper material to use, will say that 4 in. under the tie is sufficient. Still another engineer will say that just as satisfactory results are obtained by the use of gravel, crushed slag, or perhaps cinders for this purpose. Probably all three are obtaining satisfactory results, and it is here that local conditions play a very important part. In one locality crushed stone may be scarce, it may have to be hauled a long distance, while gravel is obtainable locally at a low cost. In the other case it may be that good cinders are obtainable whereas neither stone nor gravel is to be had at a reasonable cost. Or it may be that the natural soil condition is such as to make it unnecessary to use any other than the natural soil for ballast.

In the matter of ties, some engineers specify white oak ties because they can still obtain them locally or within a reasonable distance of their property. But it would be out of the question to require every property to use white oak for this purpose, for it could not be obtained in sufficient quantities at any price. There are plenty of other woods which answer the purpose for electric railway track conditions equally as well at considerably less cost. Many otherwise inferior classes of woods are made entirely suitable for railway ties by the use of a proper preservative treatment.

Tie plates may or may not be necessary or desirable. This depends entirely on the weight to be carried by each tie, and the compressive strength of the wood at right angles to the fiber. If the rail base and the tie at the rail bearing point are wide enough to provide a bearing area sufficient to keep the unit compressive strength within the proper working limits and prevent excessive cutting during the life of the tie, then tie plates are not necessary and they only increase the cost.

As to the question of rails and joints, we are again confronted with a large assortment from which to choose. And the worst of all is the fact that the rail manufacturers are apparently willing to continue to make new sections as fast as a railway company with sufficient influence makes a request for one, sometimes making that company pay for the cost of the new rolls, and sometimes absorbing this cost in its general manufacturing overhead. In many cases the differences between rails are so slight as to be hardly noticeable. Here again weight of equipment, volume of traffic, design of wheel treads and flanges, as well as details of the rest of the track structure must enter into the discussion.

Some street railway engineers advocate a rigid track structure, that is either steel ties encased in concrete or some form of concrete beam support, while others advocate an elastic or resilient supporting structure for their rails. I have some very decided views on this subject but will not express them for it would open up a field for extended discussion which has no place at a conference of this kind.

The point to which I have been endeavoring to lead throughout this discussion is the impracticability of preparing a definite specification for street railway track construction which is best for all conditions. Neither is it desirable to set up two or three types as standard and say to the railway industry "use this type here, or that type there." Such a specification or standard design would work an unnecessary financial hardship on the largest percentage of street railway companies and would probably not give the best results to a great many others who were financially able to build in accordance with it. And not only must economy in first cost be considered, but economy in subsequent maintenance as well. And last, there is still the fact to face that track wears out and must be replaced and it should be so designed as to permit the maximum salvage at the time of reconstruction. This is equally desirable in the case of pavement. Thus concrete pavement in the track space can be put down at a very reasonable figure, and when it is laid, it looks fine, but rails have a peculiar habit of breaking every once in a while, and the joints go bad and the concrete has to be taken up, and it is almost impossible to make a satisfactory repair job on concrete work. If a company is trying to rebuild, the salvage value of concrete is practically nothing. As pavement is an item that is apt to be frequently disturbed, the cheapest in first cost is often the most expensive in the long run.

Standard specifications for the miscellaneous materials entering into a track can and should be prepared, but to say that any given combination will result in the best track for all conditions would be about as ridiculous as to say that there is one best automobile or one best of anything else that is manufactured by assembling a number of different units together. A track design that might prove entirely satisfactory with one type of pavement would probably be far from suitable with several others. The experience of others is a good guide as to what may be expected from any particular type of construction, but this experience should be determined from careful personal observation and not from camouflaged reports. Efforts along this line should be directed toward laying down the principles which should preferably be followed for various given conditions in order that the best results may be expected.

Mr. George was followed by W. W. Wysor, chief engineer United Railways & Electric Company of Baltimore, who spoke on the design of street railway tracks. An abstract follows:

Design of Street Railway Tracks

In designing street railway tracks, there are so many factors to be considered that it is impossible to provide specifications that would govern in all conditions. Any specifications that are prepared, therefore, and which are meant to apply to the entire track structure, should be only very general in character. Once the particular type of construction is decided upon, more detailed specifications may be prepared; but, even then, local conditions must be considered, if we are to attain the best results from a structural as well as financial point of view. Some of the conditions that must be taken into account in the decision as to the type of track to build are:

Type, weight, etc., of equipment that will operate over the track.

The kind and volume of vehicular traffic, other than street cars.

Nature of underlying soil.

Other structures in the street.

Climatic conditions.

Width of streets and character of paving used.

Character of community served.

Lastly, but by no means least, the financial condition of the concern responsible for the railway.

Manifestly, the light, cheap construction, often found in small towns, would not be suitable for a busy metropolitan district, nor would the heavy, expensive track employed in the congested parts of big cities be justified in the country village.

From a strictly railway point of view, the ideal type of track would be a tee-rail on private right-of-way, but that is obviously impossible. In down-town areas, the necessity of having the entire street available for vehicular traffic of all kinds makes it necessary to pave over the track area and hence to adopt some type of track structure suitable for such paving. In outlying districts, however, where width of streets will permit, it is desirable to maintain the track on a private way, with a driveway on each side. This private way may be inclosed by a curb, hedge, grass plot, row of trees, etc., as the width of the street, character of community and individual taste may dictate. This type of construction permits higher speed, makes for greater safety, less noisy operation, and is less expensive in first cost as well as upkeep.

On very wide boulevards, where there is a large volume of vehicular traffic, it may be desirable to enlarge upon this plan and provide three driveways by separating the tracks, and putting in a center driveway for high speed vehicles.

But it is with tracks in paved streets that we are principally concerned at this time and, in deciding upon a type which will meet the particular requirements, we should consider not only the first cost, but the cost of maintenance and replacement and the ease and facility with which repairs and replacements may be made. Perhaps the ideal track would be one built along the highly scientific lines of the Deacon's masterpiece, the wonderful "One Horse Shay," where all parts were equally good and where a breakdown of one part before another was impossible; but it would be very embarrassing to have the tracks crumble to pieces about 5:30 some busy afternoon.

Let us now consider the influences which cause track to break down or wear out:

1. The wear and tear of the cars themselves.
2. The wear and tear of other street traffic.
3. The presence of other structures in the street, which necessitates the frequent tearing up of the paving, thus impairing the track foundation.
4. Climatic and weather conditions.
5. Presence in the soil of substances which cause chemical, electrolytic or other destructive effects.

That portion of the track structure which directly receives the wear of cars and vehicles is the rail and, assuming that we have chosen wisely and well in selecting the other materials that go to make up the entire track structure, the life of the track is determined by the rail. Therefore, we should select a rail which will give maximum life, as well as meet satisfactorily the local conditions. The rail should be heavy and stiff enough to withstand the shock of traffic without undue bending or vibration. Opinions vary greatly on the best type of rail, but, probably, all will agree that what might be required for one place would be unnecessarily expensive for some other location; or that, where a so-called "girder" rail may be desirable in some streets, in others a tee-rail will answer every requirement equally as well and, at the same time, be more economical and more satisfactory from an operating point of view.

For main streets, where improved paving is used, or for heavy traffic, where there may be unimproved paving, the writer believes in heavy rail of whatever type, and that the comparatively small added cost of a heavy over a light rail is more than justified in the longer life thus given to the track.

That engineers differ on the design of rail or that local conditions require different treatment is attested by the large number of sections that have been rolled and still others that are being

added to the list from time to time. At least two of the more recent sections were designed to meet local conditions entirely.

The next thing of importance is the selection of the proper method of joining the rails together, for, if the life of the track as a whole depends on the rails, the life of the rail in turn depends on the joints. Street railway engineers realized many years ago that the common form of bolted joints could not be depended on to give satisfactory service in paved streets, and their attention has been turned toward some way of welding rails together, so as to, as far as possible, eliminate the joint.

There are at present at least four well developed types of welded rail joints, all of which have met with considerable success. Railway engineers, however, are not content with the progress that has been made in the art of welding rails together and are continually seeking how they may improve upon the present methods or discover new methods. This is a very live subject before the American Electric Railways Engineering Association.

Having selected the rail, it should be laid upon a foundation that will properly support it throughout its life. Here, again, local conditions make it impossible to lay down any specific rules to govern all cases. Attempts have been made to eliminate the ties and support the rails directly on concrete beams or slabs, but none of these has proved successful. The usual practice is to support the rails on cross ties of wood or steel, laid on ballast of some sort, or, in some cases, on the natural soil where it is of such character as to justify this procedure. The ties should be of such quality that they will not decay during the life of the rail and of sufficient size and density to prevent the rail cutting into them seriously. They may be assisted in this last respect by the use of tie plates. The foundation under the ties should be of sufficient stability to support the track, paving, and live loads without appreciable settlement or movement of ties, and of such character that it will not in the presence of water work into muck and permit a pumping action to be started. This sub-foundation should be self-drained, with ample provision for carrying the water to city sewers or other suitable places of disposal, or else it should be so dense as to be impervious to water. Beyond this, it would seem needless to go.

While some attempts have been made to build so-called "permanent" foundations, where it would only be necessary to renew the rails from time to time, I do not believe they have been attended with much success, for streets are subject to settlement, due to construction of numerous underground structures, such as sewers, water, steam, gas pipes, conduits, etc., and as a general proposition, when the time comes to renew the tracks, they must be given a general resurfacing and realigning.

General Discussion

In the discussion of the papers by Messrs. Griffin, Cram, George and Wysor, which was participated in generally by those present, the importance of standardization of street widths was first emphasized. Much of the present difficulty, one speaker said, is because streets were not designed for present-day traffic. The importance of so designing track as to adapt it to the subsoil was also emphasized, one speaker pointing out that the greatest wear in paving is along the tracks, particularly at crossings and rail joints. This is because the subsoil is not sufficiently stiff to sustain the travel at those points. The use of more ties and less ballasting might help. In locations where subsoil conditions are especially bad, some special arrangement should be made, such as the placing of a concrete slab underneath at those points.

Another speaker pointed out that in Philadelphia there are very numerous right angle crossings, involving great difficulty with paving. The trouble with the crossing is not so much with the joints as it is the impact due to the flange bearing of the wheels coming into action on the floor of the grooves. Putting a concrete slab underneath or incasing the intersection in concrete does not help.

Another speaker referred to the concrete paving of tracks in Birmingham, where some track was so paved in 1908. This is in nearly perfect condition today. As to standardization of track he said that it is physically impossible to pick out one type that will meet all conditions. In New Orleans, for example, the subsoil is a black, gummy mass which actually flows. Under these circumstances some kind of a concrete base must be used. The same speaker declared that the interests of the street railways, the city and the public are identical. Hence, the city and track engineers ought to work together, and not at cross-purposes as formerly. The greatest asset that the street railway can have is a satisfied public, hence its interest is in having good paving in the track area. This means good foundations and good joints, with tracks built for durability and not for cheapness.

A speaker from Akron, Ohio, told about the laying out of Firestone Park, where the utilities were located so as to minimize street cutting. Even where a city resolves not to permit cutting of new paving for an extended period, leaks will develop or service connections will have to be changed, so that the utilities should be placed right at the start. In Akron a minimum width on double track streets of 56 ft. has been adopted, and for single track streets 42 ft. This is to permit the passing of automobiles parked at the curbs. This speaker was favorably impressed by some light track construction noticed in Columbus, Ohio, where the track is laid with steel ties on a concrete mat. There is no adhesion between the mat and the concrete in which the ties are imbedded.

Regarding the placing of utilities under the sidewalk, the speaker said that this had been done in Philadelphia to a great extent recently. He understood it to be the rule now that every one putting in a new sidewalk must reserve a certain amount of space for underground structures. As to the effect of rigid foundations on track stability, he cited an illustration from Philadelphia, where the track had to be laid on the concrete roof of the subway. This construction has been very substantial and has withstood the hammering at crossings. He thought that track engineers by this time ought to know what mass of concrete is sufficient to put upon a soil to resist the blows when cars cross frogs.

Following the general discussion, E. J. McIlraith, superintendent of buildings and structure, Philadelphia Rapid Transit Company, said that while some of the P. R. T. track standards are criticised as not being adequate, it must be recognized that factors are involved over which the railway has no control. For example, the natural soil in Philadelphia is in general rather sandy. Experience seems to show that in that soil, at least, a better track can be kept up without a massive concrete substructure than with one. Last year several miles of track were renewed on streets where heavy concrete substructures had been used. Here the track structure was from 1 to 5 in. below grade, and was difficult to renew. Even with concrete substructure, the concrete will settle because the street is constantly being ditched. All dirt hauled away in ditching leaves voids that must be filled by the settlement of the track.

In Philadelphia the load per unit of soil area has a safe value. This is the criterion whether a street railway is being built or piers for a bridge. The load per square foot must be kept down and the moisture kept away.

When streets are reconstructed there should be no difficulty in providing the necessary distribution of the load. This can be done by use of the proper quality and quantity of ballast, with the proper rail, or a special rail with close spacing of ties can be used, or again, the soil can be filled first with a lighter material, such as cinders or coarse gravel and then a concrete mat can be built around the ties. In some cases the coarse gravel can be used alone.

At crossing intersections the foundation should not be too rigid. The yielding type of support is not desired, but a resilient foundation is best.

Water will drain toward crossings, and it will filter through the paving. Thus, water must be accepted as inevitable and a foundation provided that will not fail if it begins to yield. The trouble in Philadelphia is not due to the foundation alone, but to the fact that the water takes away the cross-rail support itself.

What is true with foundations is also true with paving. In this connection it should be remembered that the hammer blows which come on the foundations of a street railway crossing from heavy rubber tired vehicles going over them at high speed are more severe than those which come from the street railway car bumping over the intersections, although the noise is not so great. Most

of the troubles at crossings can be laid at the door of the very heavy truck. At this point the speaker pointed out that some paving put in on Chestnut Street, Philadelphia, last year, is failing at the crossings, but not at the foundation shoulders. This seems to indicate that, as the hammer blows of vehicles are on the shoulders as well as the intersections, the former should show failure as well as the latter.

Prof. S. H. Stephenson of Rutgers College pointed out that it ought to be possible to make tests of rail joints in the laboratory because a long time is required for tests in service in the street. Several college laboratories are working along other lines of track testing. Referring to the hammer blow or impact on track, he said that this blow from heavy trucks amounts to from four to as high as seven times the static load, depending upon the character of the street. Laboratories ought to be able to help in determining conditions to reduce this impact.

As to the hammer blow, another speaker said that the blow on a concrete base at a joint where the rails are out of surface about ⅛ in. produced by the four wheels of a city car moving at 20 m.p.h. is about 200 ft.-lb. This is for a 37,000-lb. car with a normal load of passengers.

The other sessions of this conference will be reported in later issues.

Important Papers Presented at Brussels Convention

Wide Range of Topics Covered at the Eighteenth International Congress Under the Auspices of the Union Internationale de Tramways, de Chemins de Fer d'Intérêt Local et de Transports Publics Automobiles

TEN papers were scheduled for presentation at the meeting of the Union Internationale de Tramways, held at Brussels, during the first week of October. A list of these was printed in the issue of the *Electric Railway Journal* for Sept. 2, page 329. An abstract of the paper by C. J. Spencer, general manager London Group of Tramways, was given in the issue for Oct. 14, page 641. Abstracts of others of the papers follow. A report of the discussion will be given in a later issue.

Electrification of Short Railways

A. Pirard, manager Société Anonyme d'Enterprise générale de Travaux de Liège, read a paper on the system of electric power to use on short-line electric railways. He said that the system could be determined roughly by means of the formula $D = aC + \frac{Ktp}{nn'}$, in which D represents the annual cost for energy, C the capital invested in generating and distributing equipment and motors; a, rate of interest and amortization on C; K, energy consumption in watt-hours per ton-kilometer measured at the locomotive or car, n the line efficiency, n' the transformer and substations efficiency, p the cost per kilowatt-hour at the point of purchase, and t the number of ton-kilometers per year. This formula does not take into consideration the expenses of transportation employees or of substation or line maintenance, rolling stock, etc., which are largely the same for all systems of electrification though slightly less for direct current.

Of these factors, t and p are constant, and K is from 5 per cent to 10 per cent less for direct current. The terms C, n and n' are affected by the following considerations, whatever the system used:

1. When the length of line is such that only one substation would be required, the term C is very nearly the same for direct current or single phase, since the higher cost for copper with direct current is balanced by the higher cost for insulation with single phase. The term n is also about the same for both systems. The term n' depends on the manner of transforming the energy. If motor-generators are used it is about the same, but it becomes more favorable for direct current where rotaries or mercury arc electrifiers are used. The advantage of direct current also is greater as the size of the terms t and p become more important. The necessity of obtaining a high value for n' will be often, in the same system, one of the elements of a choice of voltage, since to obtain the same value for n' the zone served by one substation would have to be larger as the trains are heavier and their spacings greater.

2. Where the system has several substations there are two cases to consider, namely, (a) where the term tp is very important and (b) where the term aC is predominant.

Where no special equipment is necessary to overcome the effects of induction in neighboring telephone or telegraph lines, the term C is considerably less for the single-phase system, and it is the second term tp on which the choice of the system will depend. If tp is very large, since the value of K is less with direct current and the divisor nn' approximates unity, the term $\frac{Ktp}{nn'}$, in the case of direct current, is able to counterbalance the increase in the term aC and give advantage to direct current. If tp is not large, the advantage of the high efficiency is not sufficient to compensate for the increase in first cost and the advantages with direct current.

To resume, for those countries where the general system of distribution of energy is three-phase, at a frequency of more than 25 cycles, high-tension direct-current is preferable when (1) the system is not of great extent or (2) in a system of considerable extent when (a) the price per kilowatt-hour is high or the traffic is heavy, and (3) when the public authorities are very strict in regard to induction on neighboring telephone lines. On the other hand, the single-phase system is preferable in systems of great extent where the cost per kilowatt-hour is low and traffic scanty, and where electrification nevertheless is desirable because of the high cost of coal and its large consumption on heavy grades.

Motor Omnibus Services in London

A paper with the title "Organization of Motor Omnibus Services in a Great City" was read by H. E. Blain, assistant managing director London Underground Railways and London General Omnibus Company Group.

WASHING A LONDON BUS BY MEANS OF A SPRAYING MACHINE

The omnibus company, he said, provides street passenger carrying facilities within a 30-mile radius in every direction, taking Charing Cross, London, as a center. It is at present operating 149 routes, with a route mileage of 1.992, employing 3,090 vehicles and more than 21,000 employees. The longest route is nearly 29 miles. During 1921 more than 668,000.000 passengers were carried and 98,745,000 bus-miles run. The operating receipts were nearly $42,000,000 (at par of exchange).

These bus facilities are furnished from thirty-two garages, and there is also a central employment and training school. The Londoner likes the double-deck vehicles, due to his preference for obtaining the maximum of fresh air while traveling. There is no covering over the top deck of any London omnibus. The latest type of bus carries twenty-four passengers inside and twenty-eight outside. There are 312 of these now in operation and the number will shortly be increased to 900.

The garages were originally made self-contained as regards cleaning, repairing and overhauling of vehicles. Now all large repair work is done at a central point. The garages have the following distinctive features: Each is divided into two sections, engineering and operating. The former, set aside to deal with the dock overhauling, is equipped with such machines as a small lathe, sensitive drill, screw press, etc., and a staff which deals with the vehicles kept in from three to six hours each day. There is a garage foreman who is responsible for the dock overhauls and for turning out the omnibuses daily in a fit and safe condition. On the operating side, output assistants deal with the allocation of drivers' and conductors' duties, and depot cashiers deal with the daily receipts. In many of the garages, institute and mess rooms have been provided with billiard and rest facilities.

Each garage has a staff of men specially engaged in the adjustment and tuning up of engines. They devote their attention to the six omnibuses whose fuel consumption is shown on the daily chart to be the worst.

The central overhaul works cover 31 acres and are divided into two parts: Body building, repair and paint shops covering about half the total space; the chassis overhaul section, stores and auxiliary departments, such as millwright toolroom, electrical and experimental sections. From the moment an omnibus to be overhauled enters the gate it goes through a series of consecutive operations which progressively deal with the removal and overhaul of the body, the dissembly and reassembly of the chassis units and the remounting of the body ready for relicensing. The re-erection of the chassis proceeds on a moving platform 220 ft. long by 8 ft. wide which moves at floor level at a speed of 14 in. per minute.

The works include an experimental and research department, and a laboratory for the analysis of all classes of fuels and oils, and for the testing of samples of any material.

Great care is taken in selecting and training the right type of personnel for the company. Drivers take a training covering an average period of twenty-eight days and conductors one of about fourteen days.

Great care is also taken in selecting and working routes. Long routes have been found advantageous, and it is the custom to operate service from a residential suburb on the outside of London right through the center portion and out to a terminal point in a suburb on the other side. Loading diagrams are used to show graphically the characteristics of the traffic, and careful check is kept on the relative efficiencies of successive schedules by the use of a "schedule comparison card."

The London omnibus fare system is based on mileage and the average charge per mile in 1921 was just below 1 penny (2 cents).

Mr. Blain's paper was illustrated by means of charts in colors showing the details of the ways in which the various operating problems are solved.

Present Status of the Rail Car

The accomplishments in the line of self-propelled rail cars for short railways were covered in a paper by J. Decroës, Brussels. He touched lightly on the subject of steam and storage battery cars. The former has no advantage over the steam locomotive, he said, while the latter has a limited field.

On the other hand, Mr. Decroës pointed out, the gasoline vehicle has demonstrated its reliability on roads and has a place in rail transportation. It permits the furnishing on short railways of service which cannot be profitably supplied by steam locomotives. Its use results in lower operating costs through elimination of firemen and in some cases of conductors—that is, where the driver can collect the fares. Fuel cost is reduced, and that for water is eliminated. There are also the following: reduced wear on tracks, elimination of smoke and flexibility of speed control.

Two types of transmission for rail cars are available, electric and mechanical. The former has the advantage of the absence of the speed-changing gear, but offsetting this are greater weight, higher cost and lower transmission efficiency. However, when the power to be transmitted is large, the electric transmission seems to be preferable. The 250-hp. Diesel-electric cars used on Swedish railways furnish an example.* The extension of the use of this type of car depends on the availability of cheap fuels, such as heavy oil or possibly gas produced on the car. Steps have been taken in this direction. In countries which do not produce gasoline, it is important to utilize fuels which are widely available.

Mr. Decroës explained that a questionnaire had been sent to 200 railways in the attempt to secure the information on this subject, but with meager results. He, however, gave a general résumé of the practice in different countries. For example, in England the gasoline-bus and, more recently, the trolley bus have been widely used. There are few short railways like those on the continent and rail cars are not used. In Belgium experiments are being made with the Pieper rail car.

Latest Type of London Bus, of Which Nine Hundred Will Soon Be in Use

Several manufacturers in that country are developing cars.

In Canada and the United States the heavy cars have not given the desired results. Recently several railroads have put into commission light cars seating twenty to thirty persons. The cars seating twenty, used in the vicinity of Montreal, have made more than 12 miles to the gallon and operated at a cost of about 12 cents per mile. The operation is said to have been satisfactory.

In France the rail car which has attracted most attention is the small one used on the meter-gage Deux-Sèvres line.† The weight of this vehicle empty is but 5,000 lb., and it will carry from eighteen to twenty passengers comfortably, or thirty as a maximum. It is driven by an 18-hp. engine and the operating cost is about 21 cents per mile. The State Railways is also experimenting with rail cars with encouraging results. A car weighing 7 tons was recently tried out on the line between Les Mureaux and Versailles. The Mosines-Berliet Company, which has had much experience with gasoline tractors, etc., has tested out a rail car between East Lyons and Aoste-St. Genise (45 miles) where speeds of 28

*See issue of this paper for Aug. 5, 1922, page 193.

†See issue of this paper for March 25, 1922, page 513.

m.p.h. on the outgoing and 21½ m.p.h. on the return trip were made, with an average mileage of 8 per gallon. A 30-ton load was hauled on the return trip. The Dion-Bouton Company has also constructed a light car which was tried out between Toury and Pithiviers in the Loiret Department. This has an electric drive and weighs, equipped, about 12,000 lb. The gasoline consumption was such as to give a mileage of 11 per gallon.

The above are selected from the examples given by Mr. Decroës, several more being given in the original paper. Based on these examples and the general study of the subject, he concludes about as follows:

If on a short railway, traffic on certain trains is light, or if new trains must be added to supply a light service demand, the use of rail cars may well be considered.

The number of such vehicles in use at present is too small and the period of their use too short to warrant close estimates of results to be expected in a given case. However, the results obtained prove that the operation of rail cars for light traffic costs less than steam locomotive operation.

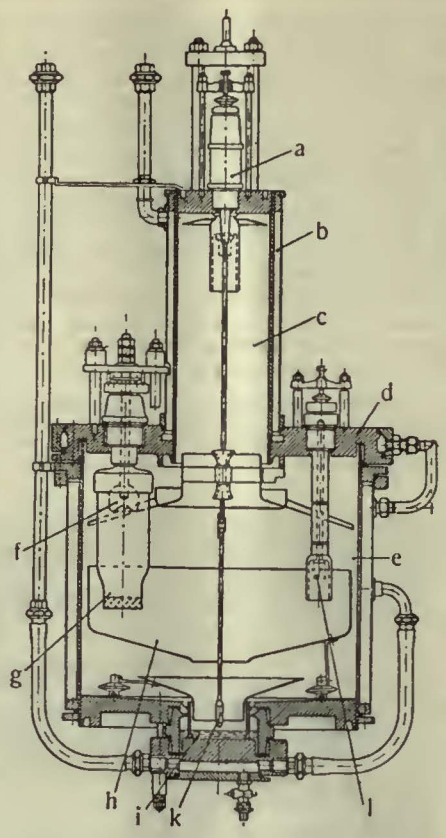
While awaiting the result of longer experience with these vehicles to permit the best mechanical arrangement of their parts, the gasoline bus can be used as a guide in the design of rail cars.

Finally, it is possible that the studies under way looking toward the utilization of heavy oil, anthracite, etc., on rail cars may ultimately result in a new form of economical transportation.

THE MERCURY-VAPOR CONVERTER FOR TRAMWAYS

M. A. Odermatt, engineer with Brown, Boveri & Company, Baden, Switzerland, presented an elaborate paper covering both the theory and practical application of the mercury-vapor converter on tramway systems. The invention of this device he considered one of the most important in the domain of modern electric technique. It is adapted to electric railway power supply on account of its economy and simplicity as compared with motor-generators and rotary converters. The mercury-vapor converter is, said Mr. Odermatt, the ideal converter, converting alternating current to direct current quietly and without the intermediary of revolving parts, its characteristics being such as to compare advantageously with those of the static transformer for alternating current. He then took up the fundamental theory of the device, following this with descriptions of the equipment made by his company.

This apparatus is made of sheet steel, consisting of two closed cylinders. The larger of these, which is located at the bottom of the apparatus, is the working cylinder, containing the electrodes. The other, placed above, is the condensing cylinder. The working cylinder contains at the bottom the cathode, consisting of an insulated pool of mercury. Two sets of anodes are suspended from the top of the working cylinder, one set being the principal anodes and the other the exciting anodes. There are six anodes, each consisting of a cylinder of polished steel.



CROSS-SECTION OF MERCURY VAPOR CONVERTER

a—Starting anode.
b—Cooling jacket.
c—Condensing cylinder.
d—Cover of main cylinder.
e—Main cylinder.
f—Main anode.
g—Directing envelope around anode.
h—Arc deflector.
i—Mercury cathode.
k—Starting terminal.
l—Exciting anode.

The anode is surrounded by an iron cylinder which directs the electric arc toward the cathode. The principal cylinder and the condensing cylinder are surrounded by a refrigerating envelope. The joints are packed in mercury and a pump is used to maintain a vacuum in the cylinders.

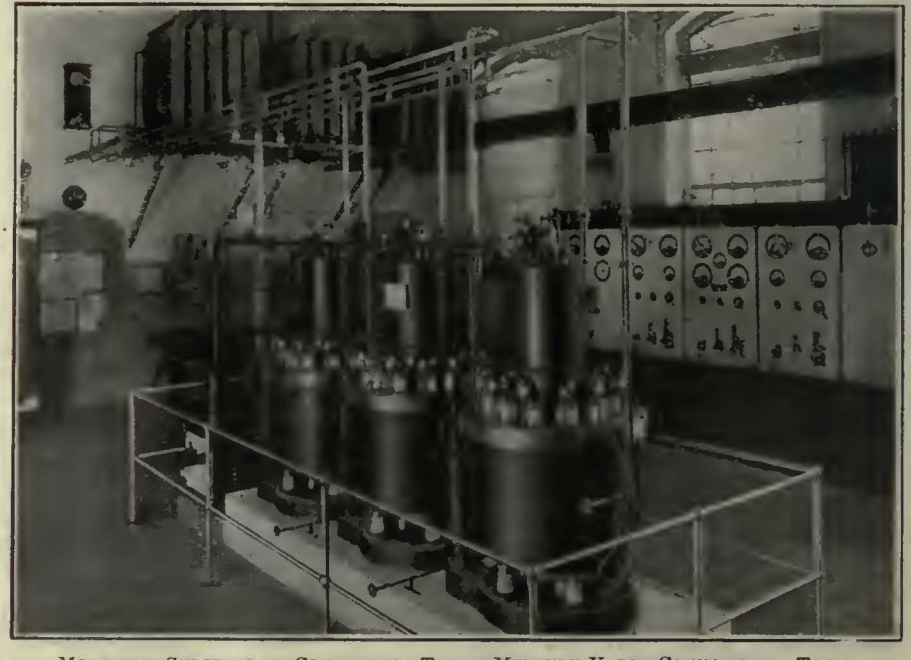
As compared with other forms of converter, the mercury vapor type is superior in that the efficiency is the same for all loads and the efficiency increases with increase in voltage. The advantages of this type can be summarized somewhat as follows:

1. High efficiency, regardless of load.
2. Simplicity in starting and in supervision.
3. Minimum of wear and tear, due to absence of rotating parts, and with a consequent low maintenance cost.
4. Insensibility to momentary overloads and short circuits.
5. Lightness, with consequent simplicity in foundations and in apparatus for handling.
6. Simplicity of accompanying apparatus.
7. Noiselessness of operation.

Brown, Boveri & Company have installed or have under construction 190 installations of mercury-vapor converters, involving 390 units and about 102,000 kw. The first tramway installation was made in 1915 in a substation at Schlieren near Zurich.

The substation of the Lausanne Tramways at Mézières is notable on account of the great overload which it carries. A single converter provides service for an 11-mile line from Lausanne to Moudon. The profile of this line is such as to produce violent fluctuations in current. The equipment was installed in 1917 and produces a saving about 30 per cent over motor-generators.

All of the tramway service in the city of Berne is furnished from a sub-



MONBIJOU SUBSTATION, CONTAINING THREE MERCURY-VAPOR CONVERTERS. TOTAL CAPACITY 800 KW., AT 3,100 VOLTS, A.C., 520 VOLTS, D.C.

station at Monbijou, commissioned in 1919. It has operated so well that it has not yet been necessary to touch any one of the three cylinders which it contains. During the peak load from noon to 2 p.m. the mercury equipment is reinforced with motor-generator groups operating in parallel.

The most important installation in Great Britain is that furnished this year for the tramways in Glasgow. It comprises three converter cylinders, of a total capacity of 1,400 kw. at a voltage of 520. A 2,200-kw. outfit is being installed in Rotterdam, and the first converter in Belgium will be installed this fall to feed the tramways of Liége.

Mr. Odermatt mentioned a number of other important installations of mercury vapor converters in tramway and railway service.

Application of Electric and Other Welding on the Track and in the Shops of Electric Railways

In a paper of considerable length on this subject, M. E. d'Hoop, of the Brussels Tramways, gave a résumé of the practice of electric railways, with particular reference to the procedure followed in the United States. In this paper he credited the *Electric Railway Journal* with much of the information on United States practice. He said that the introduction of electric welding in Belgium is so recent that there is not yet much experience to relate. However, his studies of the subject had opened up so wide a horizon that he was pleased to give the Brussels conference the results. After describing briefly the practice in Detroit, Milwaukee, Baltimore and elsewhere, Mr. d'Hoop said that in the United States, in case of welding of new track, the rails are furnished with but one bolt hole at each end and the bolts are removed after welding. This, he thinks, will become general practice.

The Liége Tramways, Mr. d'Hoop stated, have developed a novel form of welded joint which does not require fish plates. The rails are first carefully aligned and the ends are forced slightly apart by means of a wedge driven between the heads. With a carbon arc, the bases and lower part of the webs are cut away to leave a space of about 0.8 in. A steel plate is then placed under the rail bases, bridging over the space, and being held temporarily in position by means of wedges. The space is then filled in by welding, the metal being allowed to protrude to form a swelling. The rail heads are then welded together and the surface is filled in as necessary. This joint requires about 5½ lb. of welding metal and about two hours of time to make. The cost is about 35 francs. The advantages claimed for this joint are flexibility and low cost.

Mr. d'Hoop discussed in some detail the subject of electrodes, referring to the three types: bare electrodes, electrodes coated with a flux which also acts as a guide for the arc, and electrodes consisting of a soft core surrounded with the particular alloying materials required. The bare electrodes are cheap and are in general use in the United States and England. They are more difficult to use than the others and produce a less stable arc. The second type of electrode is used largely in Germany. The flux coating guides the arc and also facilitates the welding. Electrodes of the third type are at present expensive.

Mr. d'Hoop closed the first part of his paper with brief descriptions of the cast-weld, thermit and gas-weld joints, and then took up arc welding in the shops. He mentioned the ease with which repairs to motor shells, wheels, etc., can be made, and cited the practice of the government railways of Sydney in constructing trucks with the aid of welding and without rivets. Another case was a motor shell broken in twelve pieces, which was repaired in Albany, N. Y., by welding. He expressed belief in the future development of rail-tire welding, quoting the Indianapolis & Eastern Traction Company and the Spokane & Inland Empire Railroad as examples of roads on which this work had been done successfully. He foresaw a radical change in the future in the work of maintaining wheels, due to the development of this process, and referred to the automatic welding machine of the General Electric Company.

Mr. d'Hoop closed his paper with these conclusions:

The process of arc welding possesses considerable advantages over most preceding processes, above all in the repair of broken parts and the rehabilitation of used pieces. It enables work to be done which would be impossible by other means. It is an important source of economy in construction and operation.

There is a field for arc welding in the shops as well as in connection with the track.

It is necessary to use materials appropriate to the work in welding. Further, success depends on the skill of the welders. To remedy the difficulty of recruiting and developing good welders, it is suggested that professional schools create special sections for the instruction of arc welders. Large companies could have schools in their own works.

It is desirable that the art of welding be recognized and the processes standardized, so that its cost may be included accurately in estimates.

Automatic Substation Situation Summarized

An elaborate report on automatic substations, prepared by L. C. Sekutowicz, director of technical service of the Lyons Tramways, was presented in abstract. The report considered in particular the General Electric, Westinghouse and Brown-Boveri systems of automatic control. The essential operating features covered were: Starting, synchronizing, determining correct polarity, regulation of voltage and stopping; eventually starting, connecting and stopping a second machine. The author pointed out that the rotary converter must be protected on the alternating-current side from short circuits, failure of power and lack of symmetry in the three-phase circuit or inversion of phases and on the direct current side against short circuits, overloads and reverse current.

The most delicate operation involved is assuring the correct polarity. The General Electric Company uses for this purpose an exciter, and for extra reliability controls the operation through a polarized relay. The Westinghouse Company uses self-excitation and verifies the polarity by means of a small polarized motor, of which the armature is connected to the brushes and, revolving in one direction or the other, controls the excitation. The Brown-Boveri Company uses a relay known as a "polarizer," which interrupts the excitation if the polarity is wrong so as to permit the converter to slip a pole.

The report then went into detail regarding the ways in which the several functions of the control apparatus are performed, which are familiar to readers of the *Electric Railway Journal*. The principal systems were described in detail. The following advantages of automatic control were listed in the paper:

1. Elimination of the personal equation in substation operation.
2. Economy in operation.
3. Savings due to elimination of light-load and no-load losses.
4. Reduction in cost of feeders and facility for increasing transmission capacity by the addition of new substations.
5. Improved reliability of operation due to the several protective devices included in the plan of automatic operation. These include high-tension protection, limitation of overload and instantaneous suppression of short circuits.

The paper concluded with an expression of regret that the prices of automatic control equipment and of mercury vapor converters are too high to permit rapid extension under present conditions in Europe. At the same time it is hoped that conditions will change rapidly so that utilization of these improvements will be possible.

In the preparation of this report the committee prepared a questionnaire relative to the automatic substation. The questions were framed so as to bring out information regarding automatic electric railway substations in Europe, opinions as to the extent to which the control cou'd be used on different systems, opinions as to the desirability of using remote control, savings in operating costs likely to occur with automatic substations, ideas as to the value of the general load dispatcher, extent to which automatic protective devices have been used in manual substations, etc.

Wisconsin Utilities Association

THE 1923 convention of the Wisconsin Utilities Association will be held in Milwaukee at the Hotel Pfister on March 22-23. Further details will be announced later.

European Electric Railway Financial Conditions*

A Consideration of the Increases in Expenses of Tramways, Interurban Railways and Motor Buses as Compared with Pre-War Conditions

BY M. A. MARIAGE
Operating Manager of the Société de Transports en Commun de la Région Parisienne

AS THE RESULT of an inquiry on financial conditions of electric railways in Europe in the countries included in the membership of the Union, 108 replies were received, representing about 30 per cent of the number of those addressed. The class of enterprises and the countries included are shown in Table I. The chief data sought were increases in the number of passengers carried per car-kilometer, increases in operating costs per car-kilometer, and changes in fares.

In general the length of lines has not increased since before the war except in a few special cases, as in Cherbourg, in France, for example. There has, however, been a considerable increase in passengers per car-kilometer (car-mile). This is shown in Table II, which also shows (1) that the increase has been greater in the countries which were engaged in the war than in those which remained neutral, and (2) that different systems in the same country show quite a range of increase. Thus, in France the percentage increased varies from 14 to 86 per cent, while the average is 28 per cent. The variations generally can be explained through a variation in the business activity of the different cities, while the increase is caused in the inability of the systems, because of their financial condition, to increase their service with the increased traffic.

Fares were raised but not as rapidly as the cost of operation nor to the same extent. This is shown in Fig. 1. As will be seen, the average increase in fares has lagged behind the increase in expenses, and has not yet caught up with the expenses except in Switzerland and Denmark (Fig. 1) or with cost of living or wholesale prices, except in Denmark (Fig. 3).

Table III gives the percentage increase in receipts per passenger and in fares. Here also it will be seen that generally in the belligerent countries the percentage increase in receipts per passenger carried has not kept pace with the percentage increases in fares, while in the neutral countries the percentage increase in receipts per passenger has generally been equal to or greater than the percentage increase in fares. The only explanation for this discrepancy in the countries engaged in the war is that certain fares, work-

*Abstract of paper presented at the convention of the Union Internationale de Tramways, de Chemins de fer d'Intérêt local et de Transports publics Automobiles, Brussels, Oct. 2 to 6.

TABLE I—REPLIES TO INQUIRY

	Tramways	Interurbans	Bus Lines
Belgium	2	2	..
Denmark	2	..	..
England	4	..	1
France	44	19	6
Holland	2	1	..
Italy	1	4	..
Norway	1	..	..
Poland	1	..	..
Spain	2	..	..
Sweden	2	..	..
Switzerland	6	6	2
Total of each kind	67	32	9

Total number of replies: 108, or about 30 per cent of the number of inquiries sent out.

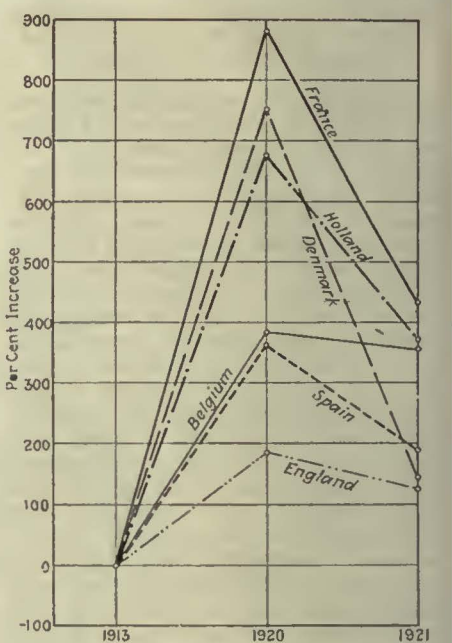


FIG. 2—PER CENT INCREASE IN COAL COST

TABLE II—NUMBER OF PASSENGERS PER CAR-KILOMETER AND PER CENT OF INCREASE COMPARED WITH 1913

		Actual			Per Cent of Increase	
		1913	1920	1921	1920	1921
Belgium	Société des Chemins de fer Economiques	4	5	5	25	25
	Brussels tramways	3.4	4.3	4.3	26	26
Denmark	Copenhagen tramways	4.	4.48	4.4	20	10
Great Britain	London tramways	5.5	7.5	7.2	36	30
	Glasgow tramways	8.57	10.34	9.92	20	15
France	General average	3.994	5.093	5.156	27	29
	Perpignan system	3.24	6.05	6.08	86	86
	Cannes tramways	2.8	3.2	3.2	14	14
	Strasbourg tramways	3	4	4	33	33
	Paris system	6.25	8.03	7.21	28	15
Holland	Amsterdam tramways	2.71	4.38	4.67	61	72
Poland	Warsaw tramways	5.81	11.32	8.54	95	46
Spain	Barcelona tramways	5.8	10.1	11.8	74	93
Sweden	Malmo tramways	3.4	4.6	4.5	35	35
Switzerland	Basel tramways	4.71	4.62	4.49	d2	d5

d—Decrease.

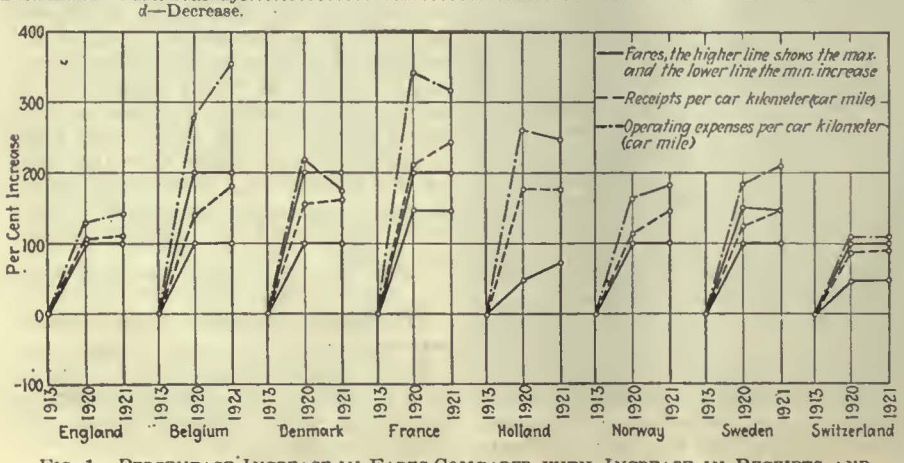


FIG. 1—PERCENTAGE INCREASE IN FARES COMPARED WITH INCREASE IN RECEIPTS AND EXPENSES PER CAR-KILOMETER (OR CAR-MILE)

TABLE III—PER CENT OF INCREASE AS COMPARED WITH 1913

	In Receipts per Passenger		In Fares	
	1920	1921	1920	1921
Belgium	86	1.02	100 to 200	100 to 200
Denmark	96	1.09	100 to 200	100 to 200
England	54	61	100	100
France	1.04	1.31	150 to 200	150 to 200
Holland	1.09	1.32	50	70
Italy	97	83	250	250
Norway	1.16	1.49	100	100
Spain	52	58	—	—
Sweden	97	1.22	100 to 150	100 to 150
Switzerland	85	97	50 to 100	50 to 100

TABLE IV—PERCENTAGE INCREASE IN OPERATING EXPENSES PER CAR-KILOMETER COMPARED WITH 1913

	1920	1921
Belgium	275	352
Denmark	215	175
France	339.5	316.4
Holland	106.6	110

TABLE V—DAILY WAGES IN VARIOUS COUNTRIES WITH PER CENT INCREASE COMPARED WITH 1913

England		England (Pence)		Belgium (Belgian Francs)		Spain (Pesetas)		France (outside Paris District) (French Francs)		France (Paris District) (French Francs)		Switzerland (Swiss Francs)	
		Wages	Per Cent Increase	Wages	Per Cent Increase	Wages	Per Cent Increase	Wages	Per Cent Increase	Wages	Per Cent Increase	Wages	Per Cent Increase
Motormen	1913	69	...	4.36	...	6.33	...	4.61	...	6.972	...	7.482	...
	1920	161	130	15.00	240	11.00	70	14.86	220	23.993	240	13.71	80
	1921	146	110	18.90	330	10.00	50	15.66	260	25.440	260	14.34	90
Conductors	1913	49	...	4.12	...	4.17	...	4.50	...	7.039	...	7.10	...
	1920	150	200	14.70	250	7.50	80	13.64	200	20.709	190	13.26	80
	1921	138	180	18.65	350	7.16	70	14.37	220	22.075	210	15.03	110
Inspectors	1913	75	...	5.30	...	4.53	...	5.63	...	7.811	...	9.55	...
	1920	165	120	17.70	230	8.50	80	16	180	23.710	200	17.30	80
	1921	163	120	21.70	310	8.33	80	16.80	190	24.974	210	18.21	90
Repair shop men	1913	63	...	4.35	...	4.58	...	5.16	...	5.25 to 9.50	...	6.85	...
	1920	155	140	17.95	310	7.19	30	16.06	210	15.20 to 22	190 to 130	14.77	110
	1921	146	130	20.26	360	7.64	60	16.51	220	16.24 to 23.84	200 to 150	15.41	120

men's fares and commutation tickets, for example, were not increased in protion to the single fares.

The operating expenses of the tramway systems in Europe have increased because of the higher wages and cost of coal and other materials. Table IV gives these figures for four countries in percentage increase per car-kilometer

TABLE VI—PERCENTAGE INCREASE IN THE COST OF COAL AS COMPARED WITH THE 1913 PRICE

	1920	1921
Belgium	390	369
Denmark	763	151
England	182	139
France	890	450
Holland	690	374
Spain	377	190

TABLE VII—PRICE INDICES

	1913	1920	1921
Belgium	100	...	368
Denmark	100	140	145
England	100	314	202
France	100	509	345
Holland	100	281	181
Italy	100	624	578
Norway	100	377	269
Spain	100	221	190
Sweden	100	359	222
Switzerland	100	...	190

for the years mentioned as compared with 1913. They also show a greater increase in the belligerent than in the neutral countries. Graphically these data are shown in Fig. 1.

If the figures on expenses are analyzed further, some interesting results appear. Table V shows the increases in the principal classes of labor. The average daily wage is made up by dividing the total sum paid annually in the classification mentioned by the number of men employed multiplied by the number of days worked by these men in that year. These figures show that in Belgium, France and Switzerland the wages still seem to be tending upward, particularly so in Belgium, while in England and Spain they are tending to droop slightly.

It should be said that the figures are not quite comparable because in the greater part of the countries mentioned in 1913 the average working day was nine or ten hours, whereas in 1920 and 1921 it was legally eight hours. This increase in labor cost has a very large influence on the total increased cost of operation. For instance in the large systems in Paris in 1921, the labor costs amounted to 63 per cent of the operating receipts. On that system between 1913 and 1921 wages were increased seven times, namely, on Sept. 15, 1916, June 1, 1917, Oct. 15, 1917, July 1, 1918, Jan. 1, 1919, March, 1920, and July 16, 1921. This list does not include the change to the eight-hour day, which went into effect on June 2, 1919, nor the date when a vacation period of twenty-one days a year went into effect, or in July, 1919.

Fig. 2 and Table VI show the increase in the price of coal in 1920 and 1921 as compared with 1913, though it does not take into consideration differences in the quality of the coal bought. Here the differences between belligerent and neutral countries are not so marked. The reason is that neutral countries are not producers of coal, and in England there has been a drop in coal cost comparable with that in wages.

The increased cost of new construction is shown approximately by Table VII, which gives comparative wholesale prices in the years mentioned. This does not correspond exactly with the increases in the fixed charges, because the latter includes amortization and interest on the capital. Thus, an installation which cost 1,000,000 francs in 1913 would require at 4½ per cent interest and on the basis of amortization in thirty years setting aside the sum of 61,390 francs yearly. This same property in 1921 would have cost 3,450,000 francs and with interest at 7½ per cent on a thirty-year amortization the annual charge would be 292,115 francs. Hence the increased capital charge would not be exactly 3.45 times but

$$\frac{3.45 \times 292{,}115}{161{,}390} = 4.76 \text{ times.}$$

Bus Transportation

The bus industry in Europe is still young. In France in particular, it had hardly begun, outside of Paris, at the beginning of the war, and at that time practically all the buses were requisitioned by the military authorities. Since the close of the war, outside of Paris, most of the lines have been operated by small companies from which it is difficult to get any very definite technical data. Some figures, however, are obtainable. Table VIII is based for

TABLE VIII—PASSENGERS CARRIED IN BUSES

In Paris Per Bus-kilometer	In London Per Bus-mile
6.38 in 1913	6.6 in 1913
7.51 in 1920	9 in 1920
6.98 in 1921	8.9 in 1921

TABLE IX—PERCENTAGE INCREASE IN BUS-OPERATING COSTS AS COMPARED WITH 1913 IN THE PARIS DISTRICT AND IN ENGLAND

Operating Expenses	France		England	
	1920	1921	1920	1921
Transportation	220	205	151	143
Maintenance	330	250	184	198
General and miscellaneous	300	260	46	114
Average	290	240	149	154

Paris on the reports for 1913 to 1920 of the General Omnibus Company and in 1921 on the figures of the Société des Transport en Commun de la Région Parisienne. These figures show an increase in loading after the war, as compared to pre-war figures, with a tendency to droop in 1921.

Fares have increased, but differently in various localities. In Paris they are from 20 to 150 per cent higher than before the war. The gross receipts in Paris are from 60 to 160 per cent higher, and in London in 1921 were double those in 1913. Table IX shows the increase in percentage of operating expenses in Paris and in England. Labor costs in bus service have increased about as on the tramways. It

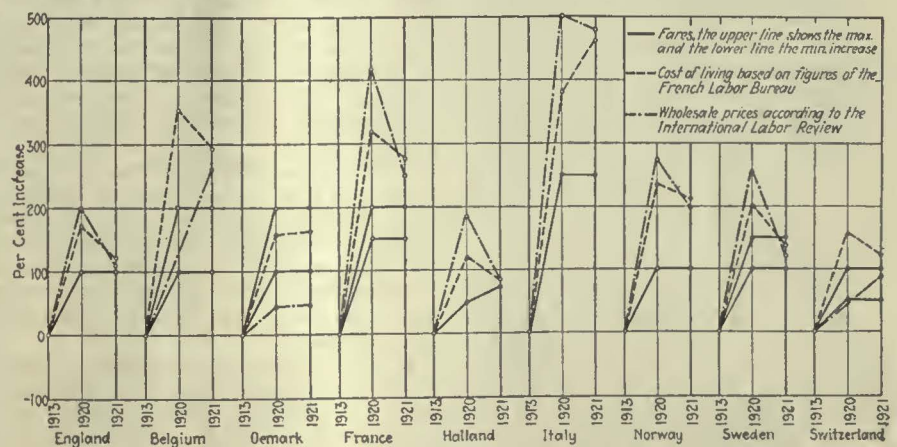


FIG. 3—PERCENTAGE INCREASE IN FARES AS COMPARED TO INCREASE IN COST OF LIVING AND WHOLESALE PRICES

has been impossible to get general figures on the increase in fuel cost, but in Paris in 1920 fuel cost eight times and in 1921 5.3 times as much as it did in 1913.

It would be interesting to get some figures on trackless trolley operation, but none of the companies replied to the questionnaire.

National Personnel Association

THE first annual convention of this association, which has taken over the activities of the National Association of Corporation Training and the Industrial Relations Association of America, will take place in Pittsburgh on Nov. 8. Among the speakers will be Prof. Michael Pupin of Columbia University, Magnus W. Alexander of the National Industrial Conference Board, George F. Quimby, industrial service secretary of the Associate Industries of Massachusetts; H. M. Jefferson of the personnel development department, Federal Reserve Bank of New York; Rowland Rogers of Columbia University; Dr. E. K. Strong, Jr., Carnegie Institute of Technology; C. S. Ching, United States Rubber Company; Dean R. L. Sackett of Pennsylvania State College, Dr. E. S. MacSweeney, New York Telephone Company, and E. K. Hall of the American Telephone & Telegraph Company.

American Association News

T. & T. Executive Committee

THE executive committee of the Transportation & Traffic Association met at association headquarters, New York, Friday, Oct. 27, to discuss plans for this year's work. It was decided that at the convention next year the program of the T. & T. Association will be so arranged as to give the members one free day during the week in which to give particular attention to the exhibits, or to visit other association meetings. The suggestion was made to the American Association executive committee that it might work out to advantage if all the associations would follow a similar plan, staggering the free days of the various associations. It was thought that this might be practical with all the associations except Engineering, which requires the full four days to complete its work.

A motion was adopted that all committee reports shall be completed and a copy sent to each member of the executive committee at least two weeks in advance of the meeting at which the executive committee will pass upon the reports. It was also decided that all approved reports should be printed and sent out to the membership in advance of the convention. This will necessitate greater promptness in getting the committee work under way and completed, and July 1 was set as the final due date.

A recommendation to the executive committee of the American Association was made that the railway association co-operate with the National Safety Council and that the T. & T., Claims and Advertising Associations should each appoint one member to carry out this co-operation.

Consideration of the report of the subjects committee occupied the further attention of the committee. The suggested study of the use of radio by the T. & T. Association was referred to the Engineering Association, but it was planned that a representative of the former association be selected to co-operate with the engineering committee to help determine what use of radio is desirable. This representative, or some one using radio, will then be invited to present a paper before the T. & T. Association as to the work done and the prospect of the use of radio.

To a committee on bus operation the executive committee assigned the task of compiling data from the experience of electric railway companies which are using buses covering details of operation and cost of this service, including trolley buses. This will not be a study of where the bus may be used, but a compilation of facts from the definite experience of member companies, perhaps including the information as to why these companies had put in bus service, in each instance.

For the work of the committee on one-man car operation the executive committee decided not to pursue the study further with respect to urban operation but directed the committee to confine its activities to the study of the subject as applied to suburban and interurban operation, with particular reference to operating practices, rules, dispatching methods, etc.

The name of last year's safety committee was changed to the committee on accident prevention, and the committee directed to continue the work along the line of further safety slogans, newspaper articles to help in the work of safety engineers, and follow up the previous work. The committee will also be requested to make an analysis of accidents with reference to causes, relative number in different localities on a given property, and to outline the manner and advisable extent of co-operation with civic bodies in safety work.

It was decided to discontinue the work of the committee on personnel and training of transportation employees, and in place of the committee report to have a paper on the "maintenance of men."

It was decided to recommend to the American executive committee that the subject of relations with employees be assigned this year for further study, including pension systems, group insurance and other plans of co-operation, such as legal and medical aid, sick and accident insurance, etc. This subject has not been studied by the association since the comprehensive report of 1916, which was never released.

To the committee on merchandising transportation was assigned a continuation of the study of developing the riding habit, but adding thereto methods of making salesmen of the employees. This will comprise a co-ordination of the employee work in connection with merchandising with the report of the committee last year. The committee will also study means of developing the freight and express business.

The committee on traffic regulation will be assigned the task of keeping in touch with all movements to standardize traffic and to see that the railway association has representation at such meetings.

Those present at the meeting were: President G. T. Seely, J. V. Sullivan, Edward Dana, W. H. Boyce, T. C. Cherry and J. K. Punderford.

New Bulletins Available

THE following special reports have been prepared by the American Electric Railway Association and are available to member companies in good standing upon request:

Public Utility Laws—A summary of the laws creating the state public utility commissions, giving an analytical digest of the main provisions covering their jurisdiction and powers over transportation companies. This is the sixth installment of this compilation, which was begun in June.

Safety Work—A summary of a questionnaire prepared by the committee on safety work showing companies engaging in organized safety work, the methods employed and some of the results obtained.

Motor-Bus Decisions — Abstracts of the principal decisions of commissions and courts on questions arising in connection with the operation of buses with particular reference to granting certificates of convenience and necessity.

Weekly Pass—Gives list of companies now operating with a weekly pass, the type of pass and conditions of its use, and a summary of results obtained since compilation of May 1.

One-Man Car Decisions — Abstracts of leading court and commission decisions on various aspects of one-man car operation, including adequacy of service, safety, economics of operation, rates, etc.

Location of Mid-Year Meeting

PRESIDENT EMMONS requests that all companies reply at once, if they have not already done so, to the circular letter of Oct. 18 requesting an expression of opinion from member companies on the desirability of holding the Mid-Year Meeting in San Francisco, and whether they will be able to be represented or not by delegates. So far approximately 25 per cent of the membership have replied.

Recent Happenings in Great Britain

Railway Electrification Important Decision—Reduction in Tramway Men's Wages—Activity on "the Underground"

(From Our British News Representative)

A MOST important decision was rendered by the Electricity Commissioners in the end of September when they refused to consent to the erection by the South Eastern & Chatham Railway of a generating station for working the company's suburban lines about to be electrified. The railway will accordingly have to take its electric power from a supply company. The electricity (supply) act of 1919 constituted the commissioners and gave them wide power for developing and consolidating electric supply in Great Britain. The policy is among other things: to prevent the multiplication of small power stations, to close down minor ones now existing and to concentrate in great stations supply for all purposes, thus securing economy.

Section 11 of the act of 1919 provides that it shall not be lawful for anyone to establish a new or extend an existing generating station without the consent of the commissioners. The proviso, however, is added that in the case of a railway consent shall not be refused unless it is proved that a joint electricity authority or authorized undertakers are or will be in a position to give the railway a supply adequate in quantity and regularity to meet its present and prospective demands at a cost not greater than would have been incurred by the railway in supplying itself. The commissioners find that there are three supply companies willing and able to fulfill these conditions. The railway failed to come to an agreement with any of these companies, but the commissioners find that satisfactory guarantees were forthcoming, that taking a supply from an outside source will save the railway a capital expenditure of more than £1,000,000 on a power station and that the railway will make an annual saving by purchasing the power.

The commissioners also state that the pooling of the railway company's supply with that of other classes of consumers will be an important contribution toward the centralization of generation in Greater London, with all the economies and benefits accruing. Thus it may be inferred that in any future schemes of railway electrification in Britain the railways will not be permitted to provide their own power stations unless a satisfactory and economical supply cannot be obtained from existing undertakers. The South Eastern & Chatham Railway case is the first of the sort under the act of 1919, and it is considered to be highly significant.

On Sept. 28, after a fortnight of negotiations, an agreement was reached on the subject of wages by the National Joint Council for the tramway industry, and the men's delegates resolved to submit the agreement to a ballot of their constituents with a recommendation to accept it. On more than one occasion the negotiations almost broke down and the help of the Ministry of Labor was invoked. When things were at their worst fear arose that the Joint Council might be dissolved. That, of course, would have put an end to national bargaining. The settlement which was arrived at is a compromise, neither side having got all that it wanted.

The original proposal of the tramway owners, both municipalities and companies, was that in view of the heavy falling off in traffic receipts owing to the slump in trade, the sliding scale of wages adopted last year should be abolished and that wages should be reduced by 12s. a week by three monthly installments of 4s. each. The men wished the sliding scale to remain as it was and that there should be no wage reductions except under its provisions. That scale took as its basis a cost of living 135 per cent above the cost in August, 1914. For every fall of five points below that in the official index figure of the cost of living, wages were reduced by 1s. a week. By the last quarterly adjustment the total reductions in wages amounted to 10s., the index figure having fallen 50 points to 85. The index figure at the end of September was down to 79, justifying a reduction of another 1s. a week under the old scale.

By the new agreement a sliding scale is retained, but it provides for a wage reduction of 1s. per week for every four points fall in the index figure. The new sliding scale is also applied all the way back to the basic index figure of 135. The present index figure being 79, it has fallen by 56 points. A wage reduction of 1s. a week for each four points accordingly means 14s. As only 10s. had come off under the old scale, the result is an immediate reduction of 4s. per week. The next adjustment is not to take place until February, 1923, and thereafter the adjustments will be quarterly.

On Oct. 10 it was announced that the employees by ballot had accepted the agreement by 22,436 to 10,541 votes. Of the men eligible to vote 55 per cent voted.

At the recent conference of the Municipal Tramways Association in Newcastle-on-Tyne, three resolutions were passed for taking action. By the first it was decided to appoint a committee to confer with experts of the Post Office on the subject of the liability of tramway authorities for electrolytic damage done to telegraph or telephone cables by stray currents from tramways. At present the tramway authorities are liable even if they observe all the Board of Trade regulations on the subject and even if the Post Office authorities have been negligent. The association naturally wants it altered. Another resolution provides for conferring with municipalities with a view to proper apportionment of the cost of highway construction and maintenance between the rails and tracks.

At present all the cost as regards the tramway area of the road falls on the tramways, and the cost is always becoming heavier owing to the increase of heavy automobile traffic. The introduction of a private member's bill in Parliament to alter the law on the subject was forecasted. The third resolution referred to the executive council with a view to action the subject of getting powers to regulate general street traffic at tramway stopping places. Sir John Simpson, Portsmouth, was elected president of the association for the ensuing year.

The London Electric Railway on Oct. 2 placed a contract with the Foundation Company, London, for the construction of the northern part of the extension of its line to Edgware. Work is already in progress on the part between Golder's Green and Hendon, a length of 1¾ miles, and the new contract relates to a length of about 3 miles from Hendon to Edgware. The price is £258,000, including the electrical equipment, and the work is to be completed in fourteen months. The whole extension is a continuation northward in the open country and on the surface of the Charing Cross and Hempstead underground tube railway, which comes to the surface at Golder's Green. This is part of the development of the London Underground Railway System, the new capital for which has been guaranteed both as to principal and interest by the government under the trade facilities act, the object being to get the work put in hand at once in order to provide work for the unemployed.

The Metropolitan District Railway is taking steps to improve the internal appearance of its all-steel cars. These vehicles are quite satisfactory as regards safety, comfort, and facilities for quick loading and unloading, but it has been felt that the all-steel construction produced a corresponding "all-steel atmosphere." An artist has been commissioned to plan pleasing and harmonious color schemes. Some cars are in gray relieved with yellow and are fitted with brown and gold moquette cushions. Others are in blue relieved with white and have brown plush cushions in the first-class compartments, and brown and gold moquette in the third-class. Still others are in green relieved with two shades of gray, the cushions being brown and green plush. The upright rods from floor to ceiling have been dispensed with in favor of straps. This is a reversion to the old arrangement.

News of the Electric Railways

FINANCIAL AND CORPORATE :: TRAFFIC AND TRANSPORTATION
PERSONAL MENTION

Regulation an Issue

Supervisory Control of Public Utilities Looms Big in New York Governorship Campaign

The campaign for Governor of New York drew to a close in the northern section of the state on Saturday night with Gov. Nathan L. Miller speaking to a rally in Albany. The paramount issues of the campaign are water power and the regulation of public service corporations, with the light wine and beer platform of the Democratic party as an extra "Added Attraction."

Governor Miller in his speech in Albany emphasized the fact that a start has been made, after years of talk, toward a definite program of development of water power through the agency of private capital, but with operations restricted by law and by the Public Service Commission, and that the workings of the Public Service Commission of the State and the New York Transit Commission have been put more nearly upon a judicial basis. He stressed the inaptitude of the Democratic proposal for regulation by the municipalities affected, instead of by a centralized state body, of the public service corporations operating within a particular city, and called especial attention to the fact that the Legislature, under "Al" Smith as Governor, responded to his wishes in the matter of transit regulation in the city of New York.

Farmers Apathetic

Outside of the industrial centers general political apathy prevails all over the state of New York, and the vote on election day promises to be perfunctory rather than enthusiastic. Astute political observers predict a falling off of the up-state vote in general outside of the cities so that the election has all the "earmarks" of being a comparatively close one.

The most enthusiastic supporter of Smith, however, does not claim that he will have the Legislature with him. This is bound to be Republican in any event, and under such circumstances, the chances are very remote of any change being made in the public service commissions law or the conservation law in relation to water-power development.

An unusual degree of permanence and stability was given the New York State Public Service Commission by chapter 134 of the laws of 1921 which provides that the terms of the commissioners shall be ten years each, one to be appointed each two years, and that a commissioner may only be removed by a two-thirds vote of the Legislature, and then only for cause, which virtually means no public service commissioner can be removed for political or emotional reasons and that he must commit a sufficiently flagrant act of misconduct to justify 143 out of 201 elected members of the New York State Legislature in removing him from office. As for changing the complexion of the law to achieve political ends that is nearly always very difficult.

So it will be seen that the election of "Al" Smith as Governor would not necessarily mean the upsetting of the policy of the Public Service Commission as to the regulation of public utility corporations, and the most the Governor could hope to accomplish would be the naming of one Democratic member of the commission in February. Neither would the election of "Al" Smith be a calamity, as it is never the policy of a new administration completely to undo progressive work started by a previous one, while in many quarters the election of a Governor of one political faith with a Legislature of another is accepted as a good balancing wheel for business progress.

$60,000 Viaduct Operation

The troubles of the South New Orleans Light & Traction Company, operating a railway opposite New Orleans, are again engaging attention. The company pleaded financial inability to repair the Newton Street viaduct, in Algiers, when ordered to do so by City Engineer Klorer. At the conclusion of the hearing before the Commission Council of New Orleans the matter was referred to Public Service Commissioner Francis Williams and he has been exerting himself to ascertain whether some solution of the matter could not be arrived at.

He maintained at the hearing, before which he appeared on behalf of the state, that a viaduct in Algiers at the point where it is now located, was imperative, and he was of opinion that the Southern Pacific Railroad, which was interested in the maintenance of the viaduct, should bear its proportion of the expense of repair and maintenance. Counsel for the railroad objected to this suggestion. However, negotiations were opened between both of these interests and a tentative agreement has been reached, which points to an amicable settlement of the difficulty soon.

The street railway will be asked to bear one-fifth of the expense of repairs, estimated by City Engineer Klorer at $75,000, the Southern Pacific Railroad assuming the remaining four-fifths. The work is to be done by the forces of the Southern Pacific Railroad, and the cost will be reduced thereby to approximately $60,000.

Feeder Lines Suggested

President Mitten of Philadelphia Rapid Transit Outlines Plans for Feeders for Frankford Elevated

Thomas E. Mitten, president of the Philadelphia (Pa.) Rapid Transit Company, appeared before the transportation committee of City Council on Oct. 25 and laid before it plans for the construction of three new lines designed to furnish crosstown service in the northern end of the city and serve as feeders for both the Frankford elevated and the Broad Street subway when that link in the high-speed system is constructed.

The main features of the Mitten plan are:

The abolition of the tortuous Route 75 which now winds its way from Ridge and Midvale Avenues to Frankford by way of Olney and Wyoming Avenues.

The construction of a line beginning at the Pelham carhouse in Germantown, along Chew Street, Olney Avenue, Rising Sun Avenue, Adams Avenue, Margaret Street over to Richmond. That line would tie in Germantown with the Frankford elevated.

The construction of another line that would begin at Twentieth and Wingohocking Streets, run eastward along Wingohocking Street to Wyoming Avenue to Unity Street and then to Frankford Avenue, where it would tap the Frankford high-speed line at Church Street station.

The building of a third route that would originate at Twenty-ninth Street and Hunting Park Avenue, traverse Hunting Park Avenue, Erie Avenue and Torresdale Avenue to the Frankford elevated. That line would connect with the Frankford elevated at the Torresdale station.

While no definite announcement was made to that effect, it was learned that Mr. Mitten proposes to have the lines act primarily as feeders for the Frankford elevated, and with that end in view, free transfers would be issued between the new routes and the elevated.

Will Consult Communities

Mr. Mitten announced that as further extensions are contemplated, the company would consult the residents of the neighborhoods affected before planning new routes.

Mr. Mitten came to City Hall ostensibly in response to a resolution introduced by Councilman McKinley requesting the company to run a line over Torresdale Avenue to Frankford. Mr. Mitten surprised the Councilmen by voluntarily offering to build the two additional lines.

An official statement said:

To make possible early development of these proposed lines, co-operation on the part of the city in the matter of street opening and necessary bridging is essential, and to that end the City Council was invited to go over these routes with President Mitten and his engineers on Oct. 30, by which time it is expected the P. R. T. will have a double-deck bus at hand to be used for this purpose.

Mr. Mitten explained that none of the extensions would be self-supporting at the start, but would rather add to the cost of operation of the entire road. He added that service to the people was now the dominant note.

Political Favoritism a Factor in Securing Bus Permits

In a review of the New York Transit Commission's inquiry into the municipality supervised bus system, Clarence J. Shearn, special counsel of the commission, declared on Oct. 29 that the whole Hylan-Whalen bus system "smelled to heaven."

Judge Shearn said that the testimony taken by the commission showed that bus permits were given out through political favoritism, that the insurance firm of which the brother of the Mayor's son-in-law and secretary is a member profited by the sale of bus insurance and that John A. McCarthy, former business associate of Charles F. Murphy, the Tammany leader, had obtained bus permits in the names of dummies.

The points which Judge Shearn said had been established at the hearings before the Transit Commission during the week ended Oct. 28 he summed up as follows:

1. That the Hylan-Whalen system of "revocable permits" for bus operators is vicious and demoralizing.
2. That the genuine need and popular demand for a flexible crosstown bus service has been capitalized by politicians for private profit and the system has been made part and parcel of a political machine.
3. That one method of greasing the path to favor is to pay a public official who owns a garage four times the usual rate for bus storage, while another is to buy a bus of a district leader on his promise to help get a permit to operate.
4. That the bus system has been used not to serve the public, but to provide a soft berth for needy individuals who have a pull.
5. That to hide political favoritism, or worse, a large number of buses on the best paying line in the city are permitted to be run in the name of dummies.
6. That John A. McCarthy, the discoverer of Hylan, has a fleet of buses on the most profitable lines, each one in the name of a dummy.
7. That an ex-detective and brewery collector turns up on the "cream of all the lines," with three buses, costing $18,000, one being concededly hidden in dummy ownership, and manages these in conjunction with McCarthy's fleet, aided by Billy Murphy, a nephew of the Tammany boss.
8. That the insurance firm of Sinnott & Canty, the senior member of which is the brother of the Mayor's son-in-law and private secretary, has divided commissions fifty-fifty with a young insurance canvasser on forty-eight casualty insurance policies solicited from the bus owners since July 1, 1922.
9. That while in the short time available it has only been possible to scratch the surface thus far, the whole Hylan-Whalen bus system "smells to heaven."

Arrangements Made for Taking Over Line

The Cincinnati & New Richmond Railway, which will operate the eastern division of the Interurban Railway & Terminal Company from the East End to New Richmond, Ohio, has been incorporated with a capital of $10,000. The incorporators are: William E. Harton, general manager of the South Covington & Cincinnati Street Railway; Lawrence Langdon, counsel for the Union Gas & Electric Company; Walter Beaty, engineer; Howard High and Frank Woods, local bankers. The company will be organized with Mr. Harton as president; Mr. Langdon, vice-president, and Mr. Beaty, secretary and treasurer. The division was discontinued several months ago because of financial difficulties. Mr. Langdon and his associates concluded arrangements a month ago for taking over the line.

Mr. Langdon said that officials of the Cincinnati & New Richmond Railway were negotiating with L. G. Van Ness, electrical engineer with offices in the Union Trust Building, to operate the line in connection with the Cincinnati, Georgetown & Portsmouth Railway, of which he is general manager. If this plan is carried out, according to Mr. Langdon, the Cincinnati & New Richmond Railway will operate its cars on the tracks of the Cincinnati, Georgetown & Portsmouth Railway from Cincinnati to California, Ohio, and then on its own tracks to New Richmond. Mr. Langdon also said that one-man cars would be operated. A few more details will have to be worked out before the line will again be put in operation.

Praises Rehabilitation Accomplishments

In announcing a payment of $200,000 on the $500,000 installment due the Detroit United Railway on Dec. 1 to apply on the purchase of the city lines, the Mayor of Detroit stated that the department of street railways had done more work in rehabilitation of its lines during five months of municipal ownership than had been done in any previous three-year period. Attention was called by the Mayor to the advisability of continuing the precedent established by the department in making such allotments on a separate bank account, and to the wisdom of cash deposits with which to meet fixed charges arising from operation.

Oct. 1 was referred to as marking the completion of four and one-half months of operation of the municipal lines in Detroit. During this period the department had to revamp the old company's organization and then attack the problem of deferred maintenance, facing at the same time the problem of carrying the heaviest load of the railway year—the summer months.

It was pointed out that the department has not had the advantage of the usual administration statistics which were the property of the old company. With a full year's experience behind the department, decreased cost for succeeding years under the same relative conditions are expected. It has been necessary for the department to run from day to day and month to month, feeling its way along throughout the construction season now near a close.

The Department of Street Railways, the Mayor stated, has exerted every possible effort to bring the property under its control up to the best possible operating conditions. The policy has been, first of all, to provide for quarterly payments of interest and the semi-annual payments of principal to the former owners, and thereafter to put every available dollar into the rehabilitation of property, reserving only a proportion monthly which might act as a protection reserve during the months when traffic naturally decreases.

What Public Ownership Costs

The "Financial Post" Lists Costs Since Toronto Took Over the Transportation Problem

It is just over a year since the Toronto Transportation Commission took over the street railways system, says the *Financial Post*, published at Toronto. In that period rapid progress has been made in the rehabilitation of the property. By night and day work has been carried on without regard to cost in labor or equipment and the results have satisfied a public demanding better service. Hundreds of new luxurious red cars have likewise appeased the public demand for a change. But what is all this costing? The *Financial Post* goes on to explain:

The appropriations last year and this by the city hall have amounted altogether to $23,500,000.

Fares have been advanced to four tickets for 25 cents compared with six and eight tickets—nearly double. This has cost the citizens about $4,000,000 additional.

Every man woman and child in the city has been charged with an expenditure of $45 each, and every passenger carried has paid about double fare—and the financial outpour continues.

In addition the city is losing $1,000,000 a year in its percentage of fares and is able to collect only a fraction of taxes that were formerly paid by the Toronto Railway.

Nothing has yet been paid by the city to the Toronto Railway on the purchase price of the system.

Nor has there been any statement made to indicate if there is a surplus of income over operating cost.

Money, Money Everywhere

While the Toronto Transportation Commission has been making a most spectacular showing the fact remains that modern engineers say that practically nothing in the construction line is impossible if there is enough money available—and the T.T.C. has been troubled with no shortage of funds.

Every investor knows that the test of a private undertaking is not during the progress of the construction when all charges are met out of capital, but after the work is completed when all charges and expenses must be met out of revenue and when revenue is based upon the basis of a fair price for the produce or service. Of course the T.T.C. is fortunate in operating under an act which permits the charging of a fare to meet all expenses, but even under public ownership the people will in the long run be inclined to ask value for their money and that is when the test will come, when the novelty of the new cars and smooth rails has worn off and the people want service for what they spend. For the present, because they have starved under a narrow and short-sighted franchise administered in a manner which gave them just cause for complaint, they are willing to pay anything for better service.

Adopts Trolley Bus

United Railways & Electric Company Changes Motor Bus Service to Trolley Bus

The United Railways & Electric Company, Baltimore, Md., has substituted trolley buses for the motor bus service open since July 1 from Gwynn Oak Junction to Randelstown via Richland over Liberty Heights Avenue. The change was made on Nov. 1 to fulfill the agreement made by the company with the residents, who desired a form of transportation giving outward evidence of some permanency. They agreed to underwrite the expected deficit of $32,000 in the first five years of operation.

Three Brill rail-less cars form the fleet, two of which are needed to operate the 30 minute headway during the morning and evening rush hours. But one vehicle is needed for the hourly service during the normal hours of the day and after the evening rush hours, as the running time for the 6.3 mile line is only twenty-five minutes. This schedule allows a layover of five minutes at each end of the route.

Regular Service Provided

The first bus pulls out of Richland at 5:45 a.m. for Oak Junction leaving there at 6 a.m. for Randallstown. The next bus leaves at 7 a.m. and a bus leaves every thirty minutes thereafter until 9:30 a.m., when hourly service is given until 4:30 p.m. From 4:30 to 7 p.m. buses run every thirty minutes after which hourly service is given until twelve midnight.

The one way through fare is 14 cents divided into two 7-cent zones, the dividing line being at Richland. Fares are collected in the pay enter, pay leave plan, using a Johnson fare box with no overhead check register, that is, passengers boarding irrespective of the direction of travel in the first zone pay the first zone fare of 7 cents on entering, and if they ride into the second zone must again pay another zone fare on leaving. Passengers that board in the second zone pay only as they leave the bus. No transfers are exchanged with the Woodlawn Avenue cars at Gwynn Oak Junction, with which the buses make connection to reach the center of Baltimore.

At Richland, which is midway of the route, a 25 ft. x 60 ft. garage has been built.

Small in Charge

The rolling stock as stated consists of three standard Brill rail-less cars with Westinghouse standard automatic foot control, two independent trolley poles fitted with O B swivel trolley wheels.

The highway over which the buses operate is for the most part plain macadam the surface of which has been treated with tar and gravel. Generally it is only 18 ft. wide, although for some distance it has a 2 ft. concrete shoulder on either side.

Local Commission Details Under Consideration

Internal argument concerning salaries to be paid and methods of supervising, employment, delegation of authority, etc., is resulting in rather slow organization of the new Utilities Commission of Louisville, which will be financed by the local utilities. The Louisville Railway, in its new franchise, agreed to pay $10,000 annually toward defraying the expense of a utility bureau. The Louisville Home Telephone Company, also agreed to a similar sum to be paid the city annually.

The Cumberland Telephone & Telegraph Company, which has a franchise expiring, wants to come in on the same sort of basis, and it reported that the Louisville Gas & Electric Company, is investigating the idea, and desires to come under a utility commission, which would check up the various companies, and be in position to show the city what these companies are doing, which would make it much easier to regulate rates.

The City Council is objecting to the proposals embodied whereby an engineer would be appointed to supervise the railway, at a cost of $5,000 annually; and a certified accountant for the telephone company at a similar salary. The Council contends that the salaries are too high. The reasoning may be faulty, but it is pointed out in justification of the stand the city has taken that $5,000 is more than is paid the City Engineer, and equal to the limit that any city employee may draw. The money, however, comes out of funds from the utilities.

There is some discussion of consolidating the various funds and creating a utilities bureau to look after all such matters as come up. This procedure would save in some ways, and make for a more efficient organization.

News Notes

Franchise Granted.—The Crawford County Commissioners have granted the Cleveland, Southwestern & Columbus Railway, Cleveland, Ohio, a franchise for twenty-five years. The company threatened to abandon its line in Crawford County if the franchise was not renewed.

Recommends More Equipment.—Robert M. Feustel, consulting engineer, of Fort Wayne, Ind., has submitted a report to Mayor Plant on the Ottawa (Ont.) Street Railway. Eighteen miles of track extensions, forty-seven new cars, additional snow plows, more car-house equipment, etc., within the next five years, are recommended in the report.

Vote Against Municipal Ownership.—An election was held on Oct. 20 in Aberdeen, S. D., on the question of the city's taking over the Aberdeen Railroad which discontinued car service on Aug. 1 of this year. The official canvass showed that there were 677 votes cast in favor of municipal ownership and 2,798 cast against the proposition.

Preliminary Report Made.—The report prepared by the public utilities committee of the St. Paul Association referred to in the *Electric Railway Journal* issue of Oct. 7 was a preliminary report and was merely given to the St. Paul City Planning Board for its information. The report has not been completed. The report deals with the proposal for an operating consolidation of the electric railways of the Twin Cities.

Mrs. Sawtelle Dies of Injuries in Auto Crash.—Mrs. Elmer S. Sawtelle, wife of the assistant general manager of the Tool Steel Gear & Pinion Company, Cincinnati, died as the result of injuries received in an auto accident near Wheeling, W. Va., on Oct. 23. She was returning with her husband and two of her children from a trip to Washington, D. C., when the car skidded and overturned. The husband and the two children, twelve and eight years old respectively, escaped uninjured. A third child, four years old, had been left at home. Mrs. Sawtelle was prominent in social circles at her home in Hartwell, Ohio, near Cincinnati and had always been very active in Sunday School and missionary work.

Missouri Reverts to the Days of Jesse James.—The many robberies of conductors and passengers on street cars, in the past few weeks, have brought out the offer of a reward of $500 by the receivers of the Kansas City (Mo.) Railways, for arrest and conviction of such robbers. The receivers point out that the crimes are punishable not only under state laws, but, since the receivers are officers of the Federal Court, are punishable for contempt of court by the United States Federal Court for the Western District of Missouri. Notices of the reward have been posted conspicuously in many places. It is said that in practically every case of hold-up of conductors the passengers have also been robbed and terrorized.

Must Have Report Ready on Nov. 10.—Special committees representing the Cincinnati (Ohio) Traction Company and Ohio Traction Company and the Cincinnati Street Railway have been requested to have ready a report on progress they are making in discussing a readjustment of their affairs for Mayor George P. Carrel's traction committee when it meets on Nov. 10. The date was fixed when Froome Morris, vice-mayor, pointed out that conferences can go on indefinitely if no time is fixed. Mr. Morris asserted the question of deferring collection of the annual franchise tax, in order to keep fares from increasing, will be up for discussion on Jan. 1. Mr. Morris further stated that the traction situation should be in definite shape by that time.

Financial and Corporate

New Financing Arranged

Another Step Taken Toward Perfecting Reorganization of Pittsburgh Railways

At a meeting on Oct. 30 attended by Mayor Magee, members of the City Council and President Thompson final steps were taken to put into effect the Pittsburgh Railways reorganization contract, which has been the subject of negotiations for more than a year and a half. Mr. Thompson announced that he had raised the $5,000,000 necessary to make effective the contract between the city of Pittsburgh, the new railway and the Philadelphia Company.

CHANGE IN FORM APPROVED

Mr. Thompson said that the Union Trust Company, Pittsburgh, of which H. C. McEldowney is president, will undertake to provide the necessary funds under the contract upon conditions, explained to the Mayor and Council, all of which were very satisfactory and approved. A slight change in the form in which the financing was expected to be done was approved by Mayor Magee and Council.

The conclusion of these negotiations opens the way for a program of improvements for the Pittsburgh Railways, the need of which has long been felt. This money will provide new cars, carhouse, shop equipment and facilities for performing better service. Steps will be taken for the winding up of the receiverships by foreclosure of the general mortgage or by other sales of the property of the railway so that a new corporation may be formed. The reorganization will be made possible by the Philadelphia Company, city of Pittsburgh, boroughs and townships and holders of personal injury claims agreeing to accept payment over a period of ten years.

Mayor William A. Magee gave out the following statement:

> After a full discussion it was agreed that city officials accept the proposed financing of President Thompson, namely, that $5,000,000 for improvements be raised in the following manner; $2,400,000 on car trust certificates; $600,000 on car trust certificates or otherwise, this total of $3,000,000 to purchase new cars. The other $2,000,000 to be raised on short term loans and to be invested in carhouse and other improvements and betterments.
>
> It was agreed that the law department prepare a resolution to be presented to Council, formally adopting the above plan.
>
> It is understood the company now will take the necessary steps to recover possession of its property by foreclosure, and by the discharge of the receivership and begin the operation of the railways.

PRAISES UNION TRUST OFFICIAL

In speaking of the reorganization plans, Mr. Thompson said:

> The successful financing of the plan to terminate the receivership of the Pittsburgh Railways has been largely the result of the vision of H. C. McEldowney, president of the Union Trust Company. This great banking institution and its executive head know Pittsburgh, believe in it, are confident of its future and are enthusiastic in their efforts to do all in their power to promote its growth and prosperity. They have been fully aware that good street railways transportation is vital and essential to the continuing prosperity of the Pittsburgh district and they have expressed their confidence in the future by agreeing to provide the $5,000,000 necessary to accomplish the reorganization.
>
> The successful negotiations, which promise a speedy termination of the receivership and the organization of the street railways properties, are also the result of the foresight and hearty co-operation of Mayor Magee and the members of Pittsburgh Council and too much credit cannot be given them for their patience throughout the many tedious conferences necessary to effect a complete understanding that was fair to the people of Pittsburgh and to the investors holding securities in the railway properties. They have worked hard to effect the best possible plan and they have shown a knowledge of conditions that indicates intense study of the situation by them.
>
> The first steps toward reorganization of the Pittsburgh Railways were taken two years ago. The problem was to get $5,000,000 of new money to provide those improvements to equipment and operating facilities considered essential to modern management. Everyone who knows anything of street railway operations here or elsewhere in the United States knows that there has been very little, if any, financing of late and that has been one of the problems of the receivers of the Pittsburgh Railways. It has been quite an accomplishment, therefore, to be able to obtain this financial assistance at home as it indicates confidence in the promised service and management, in the co-operation of the Mayor, the City Councilmen and the surrounding municipalities and in the future of the great district served by the railway lines.

Discontinuance Waits on Commission's Ruling

Service on the Springfield & Washington Railway, operating between Springfield and South Charleston, Ohio, will be discontinued within a few months if the State Public Utilities Commission gives the necessary consent. This was the gist of a statement by W. W. Keifer, counsel for the company, who said that the line was daily losing money for its owners.

"There are too many automobiles competing with us," said Attorney Keifer in explaining why the company could not make money, despite the economies affected after G. F. Baker acquired a majority interest in the road by purchasing the holdings of his brother, Floyd Baker, several months ago.

At that time, the new owner announced his intention of introducing several policies to reduce expenses, plans whereby freight and passenger revenue might be increased, and also his idea for a system of bus feeders operating from most of the way stations along the electric line. The plans in some cases were carried out. But, according to Mr. Keifer, the condition which the company faced was one that could not be remedied if the company were to operate from a business standpoint, and it was therefore decided to apply for permission to discontinue the line and junk its equipment. This was one of the first lines to be built in Ohio.

Successor Company Functioning at Spartanburg

The South Carolina Gas & Electric Company, Spartanburg, S. C., on Oct. 1 took over all the plants, property and business of the South Carolina Light, Power & Railways Company. The new company purchased the property and business at a foreclosure sale on July 31, which sale was consummated in the order issued by Judge Watkins of the United States District Court at Anderson on Sept. 30.

The members of the board of the new company are Isaac Andrews, Dr. Ellwood F. Bell, Ben Hill Brown, Baylis T. Earle and Henry M. Earle, Paul W. Fisher, F. B. Lasher, C. C. Hood, E. W. Moher, George B. Tripp, Spartanburg; and T. F. Wickman, New York.

The new officers are as follows: George B. Tripp, president; Isaac Andrews, vice-president; F. B. Lasher, vice-president; Paul W. Fisher, secretary and treasurer; A. S. Jolly, assistant secretary and assistant treasurer.

The new company plans to make extensive improvements to its various plants and properties. These will include increasing the capacity of the hydro-electric plant at Gaston Shoals on the Broad River, improvements and additions to the steam plant and gas plant in Spartanburg, the erection of an additional transmission line from Spartanburg to Gaffney, additions to the substation plans of the company located in Spartanburg and Gaffney, the erection of additional electric lines in the city and the adjacent territory, the addition of several miles of gas mains in various parts of the city which will take care of the requests of many householders who have been anxious for the gas service but which service heretofore could not be furnished, and various other improvements.

$10,414 Surplus in Toledo in September

Operations of the Community Traction Company, Toledo, Ohio, resulted in a surplus of $10,414 for the month of September. An additional $384 of interest on the cash balance has been added to the stabilizing fund, bringing it up to $167,322 as of Oct. 1.

Increase in car riding was the most encouraging aspect of the monthly report.

Daily average riding was 162,638 revenue passengers. In comparing this with the car mileage operated there was shown a density of riding of 7.82 revenue passengers per car-mile. This is compared with 7.53 for August and 7.43 for September a year ago.

Ratio of operating expense to gross revenue was increased to 69.709 per cent as compared with 68.840 per cent for the previous month, largely due to the increased expenditures for maintenance.

With increased riding so far in October it is predicted that revenue passengers will total nearly 5,000,000 for the month.

I. R. T. Plea Allowed

Commission Acts Favorably on Application for Security Issue in Connection with Reorganization

The New York Transit Commission on Oct. 27 gave its approval to the application of the Interborough Rapid Transit Company for authority to issue and dispose of the new securities which will underlie the Interborough-Manhattan reorganization plan. Orders were granted permitting the company to issue $10,500,000 in new 6 per cent ten-year notes, $6,153,060 of which will be used to purchase new equipment, and to issue $34,330,000 of 7 per cent ten-year notes, secured by the pledge of existing bonds of the face value of $27,570,000 and $32,032,000.

The commission's approval is the latest step in the internal reorganization of the Interborough Rapid Transit Company, which had its inception in conferences with Judge Julius M. Mayer of the United States Circuit Court, to avert bankruptcy. The plan agreed upon provided for a reduction of the 7 per cent lease of the elevated lines of the Manhattan Railway to 3, 4 and 5 per cent, the elimination of $114,000,000 of securities of the Interborough Consolidated Corporation and its complete divorce from the Interborough Rapid Transit Company, and a provision for the election of the board of directors of the Interborough Rapid Transit Company by groups, nine by the Interborough stockholders, three by the Interborough bondholders, three by the Manhattan stockholders and three by public authority. Under the agreement the dividend rate on Interborough stock is to be restricted to a maximum of 7 per cent, with no dividends at all to be declared for the next five years.

In an opinion in which Chairman George McAneny and General John F. O'Ryan, the other members of the commission, concurred Commissioner LeRoy T. Harkness reviewed the steps which led up to the agreement for the reorganization. Mr. Harkness said that outside of earnings, $18,112,500 would be provided for the company, of which $7,612,500 would come from the postponement of sinking fund payments on Interborough bonds accruing during the three and one-half years from July 1, 1922, and $10,500,000 from the sale of the new 6 per cent notes. In commenting upon the plan Mr. Harkness said:

> In addition, the earnings available for service and proper corporate purposes will largely be increased by the elimination of the present 7 per cent Manhattan dividend rental. The extension of the Interborough 7 per cent notes for ten years will relieve the company of its present embarrassment of having this heavy matured debt hanging over its head and give time for the resumption of more normal conditions when complete and adequate refinancing may be effected. The Interborough directorate is to contain responsible representation of all groups (including the city) having large financial interests in the properties operated by the company.
>
> It is by a comparison of these results with the existing conditions of the Interborough Company that the beneficial results of the plan are apparent. Furthermore, the only alternative of the plan would seem to be a receivership, which would be the source of incalculable damage to security holders and the public as well. In the formulation of the plan and the remarkable success in securing the assent of thousands of widely scattered security holders, and thus avoiding receivership and probable disintegration, Judge Mayer and those associated with him have performed a service not only to the security holders, but to the public as well.

Sale of Millers Falls Branch Authorized

The Massachusetts Supreme Court has authorized D. P. Abercrombie, receiver for the Connecticut Valley Street Railway, Greenfield, Mass., to sell the property comprised by the Millers Falls division, on which service was discontinued recently. The division had a total mileage of 9 miles, consisting of a 5-mile stretch from Turners Falls to Lake Pleasant and branches of 2 miles each extending to Millers Falls and Montague. The lines to Lake Pleasant and Millers Falls were built in 1895 and the one to Montague several years later. It is understood that the property will be disposed of soon at public sale to the highest bidder.

Certificates of Valuation Issued to Two Pennsylvania Companies

Altoona & Logan Valley Electric Railway Valued at $6,600,000, and Southern Pennsylvania Traction Company at $6,700,000

UNDER the public service commission law of Pennsylvania, public utilities can apply to the commission for certificates of valuation. Recently two of the electric railways have received these certificates of valuation from the Public Service Commission; the Altoona & Logan Valley Electric Railway Company being valued at $6,600,000 and the Southern Pennsylvania Traction Company at $6,700,000. Both of these companies are controlled by the American Railways Company of Philadelphia.

In arriving at these figures the commission had before it inventories and valuations made by A. L. Drum & Company, consulting engineers, Chicago and Philadelphia. In the case of the Altoona property the engineers submitted valuations made on two bases, viz., prices current on Dec. 31, 1919, and average prices for the years 1914-1919, inclusive. A summary of the cost to reproduce new the property of the Altoona company (including the Home Electric Light & Steam Heating Company) under the two bases noted is reproduced herewith. In addition to the two bases used on the Altoona property a valuation based on unit prices as of Jan. 1, 1922, was made for the Southern Pennsylvania Traction Company. A table showing the summary of these three bases is printed herewith.

For both companies the amount of depreciation was determined on each of the bases, representing the amount of existing depreciation due to wear or mechanical deterioration ascertained by field inspection and measurement.

The Altoona property consists of a 53-mile electric railway system in Altoona with two interurban lines, one to Lakemont Park and Hollidaysburg, and the other to Bellwood and Tyrone,

SUMMARY OF COST OF REPRODUCING AND DEVELOPING THE PROPERTY OF THE ALTOONA & LOGAN VALLEY ELECTRIC RAILWAY, INCLUDING THE HOME ELECTRIC LIGHT & STEAM HEATING COMPANY AS OF DEC. 31, 1919

	Basis No. 1	Basis No. 2	
	Prices Current Dec. 31, 1919	Average Prices Years 1914-1919, Inclusive	Per Cent of 1919
Physical Property:			
Land	$68,585	$54,868	80.00
Track	1,877,266	1,379,476	73.48
Bridges	217,953	167,154	76.69
Paving	640,348	399,950	62.46
Electrical distribution system	388,730	355,938	91.56
Rolling stock	1,041,870	735,160	70.56
Power station equipment	457,335	340,601	74.48
Shop machinery and shop tools	52,186	42,532	81.50
Buildings	361,030	263,268	72.92
Furniture and fixtures	9,114	8,102	88.89
Stores, tools and miscellaneous equipment	126,920	118,128	93.76
Expenditures not apparent in inventory	41,044	41,044	100.00
Engineering and superintendence	244,936	181,497	74.10
Administration, organization and legal expense	231,339	231,339	100.00
Taxes during construction	15,114	15,055	99.60
Interest during construction	461,902	303,388	65.68
Working capital	59,000	59,000	100.00
Cost of financing	314,733	234,825	68.72
Total	6,609,405	4,931,325	74.61
Lakemont Park	408,137	297,236	72.83
Total physical property	$7,017,542	$5,228,561	74.51
Developmental Costs:			
Expenditures for obsolete equipment and construction	$323,218	$323,218	100.00
Cost to unify system	100,000	100,000	100.00
Loss of interest during operation	491,228	365,999	76.54
Total development costs	$914,446	$789,217	86.31
Total cost of reproducing and developing the property	$7,931,988	$6,017,777	75.87
Home Electric Light & Steam Heating Company	$925,887	$714,375	77.16
Grand total	$8,857,878	$6,732,152	76.00
Cost new less depreciation	$8,077,427	$6,163,700	76.31
Certificate of valuation issued by Public Service Commission of Pennsylvania, Aug. 7, 1922	.....	$6,600,000	

COMPARATIVE SUMMARY OF COST OF REPRODUCING AND DEVELOPING THE PROPERTY OF THE SOUTHERN PENNSYLVANIA TRACTION COMPANY AS OF DEC. 31, 1919

Basis No. 1—Prices Current Dec. 31, 1919
Basis No. 2—Average Prices Years 1914 to 1919, Inclusive
Basis No. 3—Prices Current Jan. 1, 1922

	Basis No. 1	Basis No. 2		Basis No. 3	
	Prices Current Dec. 31, 1919	Average Prices Years 1914-1919 Inclusive	Per Cent of 1919	Prices Current Jan. 1, 1922	Per Cent of 1919
Physical Property:					
Land	$94,766	$75,812	80.00	$94,766	100.00
Track	1,984,829	1,449,612	73.03	1,671,775	84.23
Bridges	83,920	61,541	71.42	71,931	85.71
Paving	758,280	546,536	72.08	747,254	98.55
Electrical distribution system	418,443	382,009	91.29	300,115	71.72
Rolling stock	1,182,914	842,294	71.21	1,219,280	103.07
Power station equipment	454,851	340,851	74.94	379,017	83.33
Substation equipment	58,634	42,032	71.69	60,031	102.38
Shop machinery and shop tools	14,014	11,422	81.50	12,410	88.55
Buildings	277,942	208,003	74.84	238,727	85.89
Furniture and fixtures	6,080	5,405	88.90	3,952	65.00
Stores, tools and miscellaneous equipment	94,803	84,469	89.10	102,380	107.99
Expenditures not apparent in inventory	125,613	125,613	100.00	125,613	100.00
Engineering and superintendence	249,324	186,665	74.87	219,176	87.91
Administration, organization and legal expense	241,805	241,806	100.00	241,806	100.00
Taxes during construction period	9,065	9,159	101.04	8,744	96.46
Interest during construction	484,423	369,058	76.19	439,758	90.78
Working capital	69,000	69,000	100.00	62,700	90.87
Cost of financing	326,985	249,114	76.19	296,837	90.78
Total cost of physical property to reproduce new	$6,935,691	$5,300,401	76.42	$6,296,272	90.78
Developmental Costs:					
Expenditures for obsolete equipment and construction	$464,535	$464,535	100.00	$464,535	100.00
Cost to unify system	100,000	100,000	100.00	100,000	100.00
Loss of interest during operation	485,499	372,445	76.71	440,739	90.78
Total developmental costs	$1,050,034	$936,980	89.23	$1,005,274	95.73
Total cost of reproducing and developing the property as of Dec. 31, 1919	$7,985,725	$6,237,381	78.11	$7,301,546	91.43
Cost new less depreciation	$7,068,944	$5,554,859	78.58	$6,481,706	91.69
Value of power contract	$265,033	$265,033	100.00	$265,033	100.00
Certificate of valuation issued by Public Service Commission of Pennsylvania, July 11, 1922	.....	.....	.....	$6,700,000	

and it also controls the Home Electric Light & Steam Heating Company, which does a general light and power business in the boroughs of Tyrone and Bellwood and intermediate settlements and territory.

The Southern Pennsylvania Traction Company property consists of 54 miles of electric railway in the city of Chester and suburbs, and suburban lines to Media, Eddystone and Darby and lines connecting with the electric railways in the cities of Philadelphia, Pa., and Wilmington, Del. This company is a subsidiary of the Wilmington & Philadelphia Traction Company.

In addition to the inventory of the existing physical property, the engineers submitted a report on the developmental costs of the properties, which is divided into three heads:

(a) Expenditures for obsolete equipment and construction.

(b) Cost to unify system.

(c) Loss of interest during early years of operation.

This method of computing developmental costs obviates reporting an estimated percentage of total physical property by submitting a tangible statement of capital invested in the property actually superseded owing to the development in the art of transportation (and in order to bring the property to its present state of efficiency). The amount included for superseded property was the depreciated value of the property at the time of supersession.

It may be interesting to note that in the case of the Southern Pennsylvania Traction Company approximately 16 per cent of the mileage was superseded before it had been used ten years, and in the case of Altoona approximately 10 per cent was superseded before it had been used ten years.

In no case is a general contractors' profit included in either valuation. In lieu of contractors' profit and overhead expenses there is substituted the necessary plant acquired and expenses incurred by the company that it may do the work itself and save the item of contractors' profit. These items are storeroom and material yard expenses, construction tools, contingencies and omissions, loss and waste, liability insurance, special supervision and engineering and superintendence.

Tax Exemption Up Again

Adoption of the pending resolution proposing a constitutional amendment putting an end to the issuing of tax-exempt securities will be urged upon Congress at its short session, it was stated on Oct. 23 by high fiscal officers of the Administration. They declared the question of tax-free bonds was the most important, not alone of the national tax problem, but of some of the industrial ones as well.

It was indicated that the proposed legislation would have the full support of the Administration. President Harding was expected to renew in his annual message to Congress in December his recommendations for such a change in the organic law. Secretary Mellon and other treasury officials also were prepared to reiterate their support of the resolution.

Aside from the proposal to end the issuing of non-taxable securities, recommendations with respect to taxation to be made to Congress by Secretary Mellon in his forthcoming annual report were expected to be few and to deal largely with such changes in the existing law as have been found to be desirable through its application.

It was indicated that no general revision of the law, such as was made a year ago, was contemplated. Re-enactment of the excess profits tax has its advocates in both branches of Congress, but this is opposed generally by the Administration, as is also the proposition to tax undivided surpluses of corporations.

Financial News Notes

Balance Shown.—The stabilizing fund of the Community Traction Company, Toledo, Ohio, showed a balance of $10,414 for the month of September.

Nine Months Net $971,166.—For the nine-month period ended Sept. 30, 1922, the Market Street Railway, San Francisco, Calif., reports a railway operating revenue of $7,093,838 with expenses amounting to $5,143,215. The net income was $971,166.

Preference Stock Offered.—Stone & Webster are offering $1,300,000 of the 7 per cent cumulative prior preference stock of the Puget Sound Power & Light Company, Seattle, Wash. The par value is $100, redeemable at $110. The price is $105 and accrued dividend to yield 6.65 per cent.

Net Income $772,186.—For the three months ended Sept. 30, 1922, the Brooklyn (N. Y.) Rapid Transit Company reports a total operating revenue of $9,136,132 against $8,700,386 for the same period in 1921. The operating expenses increased from $5,625,956 in 1921 to $5,994,057 for the same three months of 1922. The net income was $772,186 for the 1922 period against $702,362 for the three months ended Sept. 30, 1921.

Increase in Balance Reported.—The Republic Railway & Light Company and subsidiaries, Youngstown, Ohio, have reported gross earnings of $7,643,551 for the twelve months ended Sept. 30, 1922, against $7,727,960 for the same period in 1921. The balance for depreciation, dividends and surplus amounted to $563,761 for the twelve months ended Sept. 30, of this year, an increase of $291,314 over the balance for the same period a year ago.

Offering of Gold Bonds Announced.—H. T. Holtz & Company, Central Trust Company of Illinois and Hamilton & Company are offering $2,500,000 of the Southwestern Gas & Electric Company's general mortgage 6 per cent gold bonds, series of November, 1922. The bonds are dated Nov. 1, 1922, and are due Nov. 1, 1957. The price of the bonds is 90 to yield 6.75 per cent. The Southwestern Gas & Electric Company operates the electric railway system in Texarkana, Ark.

Traffic and Transportation

Commissioner's Advice Ignored

Toledo Council Votes Against Use of One-Man Cars Despite Proof of Their Value

One-man cars tested for three months on the Bancroft Belt line and three days on the East Broadway and Cherry Street lines have been eliminated from Toledo by vote of City Council. This action followed the disapproval of the cars by the railroads and telegraphs committee at a previous meeting.

There was practically no complaint from citizens other than a lobby of street railway employees and union officials who had approved them when the wage agreement was made in March.

Street Railway Commissioner W. E. Cann was unable to present much of his argument to the committee because of the prejudiced views of the members before the hearing. In fact the members paid very little attention to the actual results of operation.

Investigation Committee Voted Down

Councilman B. J. Dalkowski, who led the opposition, offered to have a committee appointed to investigate the cars after Council's action. He was voted down eighteen to two. He was told that technically there wouldn't be any cars to investigate.

Commissioner Cann said the equipment would be immediately turned back into two-man service.

From the results of the Bancroft Belt line he had figures to show that costs of operation were cut 21.9 per cent while actual service was increased 6 per cent.

Comparing months of May and August, the cars turned in 34,875 car-miles in the former month as against 36,635 car-miles for the one-man equipment in the latter month. This increase of 2,060 car-miles is 6 per cent gain.

Actual wages paid to motormen and conductors in May amounted to $3,265, as against $2,378 in August to one-man operators, showing a saving of $887 for the one month. The additional car mileage would require $112 for power and $61 additional maintenance allowance, leaving a net saving of $713, or 21.9 per cent.

Accident Record Good

Comparing periods of June 24 to 30 and Oct. 1 to 7 it is shown that passenger revenue increased 6.77 per cent on the Bancroft Line as compared with 2.09 per cent over the entire system.

In the face of these almost unbelievable figures of economy the Council took its action to forestall the use of one-man cars on any of the lines.

It was also shown from the accident report sheet that nearly nineteen out of twenty accidents on the line were merely bumping or scraping of automobiles or other motor vehicles and not attributable to the one-man cars. Not more than three door accidents were experienced in all the operation and those are not all to be blamed on the structure of the one-man car, in the commissioner's opinion.

Following Council's action Commissioner Cann asked the body where he stood when as technical adviser to the Council in such matters they wouldn't take any of his advice. No member rose to define his position. He said he might refer schedules and other details of the work to that body as well as major questions if they desired to do all the work.

Rate Reductions Effect Saving of $20,350,000

A review of rate reductions of the past year by the Railroad Commission of California has established the fact that an annual saving of $20,350,000 in rates and fares to the public of the state has been effected. Computed upon an annual basis the aggregate saving is made up as follows: electric rates, $6,000,000; gas rates, $2,900,000; railroad rates, $10,450,000; express rates, $1,000,000. In the words of H. W. Brundige, president of the commission, this annual saving has been brought about notwithstanding the fact that utility rates have been maintained at all time at levels distinctly below "cost of living" figures compiled by the federal government. The commission is of the opinion that this annual saving in rates and fares marks the swing of public utility charges toward normal levels.

Violators of Jitney Ordinance Sentenced

Four drivers of jitneys in Kansas City, Mo., were sentenced to jail for contempt of court through violation of injunctions against operation, and have served sentences. Two served three days, and two served six days. This is the first real action of the kind ever taken locally.

A Kansas City ordinance requires jitney operators to secure the consent of a majority of "front footage" on routes covered, preliminary to operation. The Circuit Court of Jackson County upheld this ordinance in April this year, and issued an order restraining operation contrary to the ordinance. Many jitneys ceased running at that time. Complaints of contempt of court for violation of the injunction were filed against several, and after delays, they were recently brought to trial and the above sentences meted out. No operator has secured the necessary consents, and few jitneys are being run, except those in interstate traffic.

Traffic Regulations Changed

Street Cars No Longer to Be Permitted to Fit in with Moving Traffic in Los Angeles

Operation of street cars at curves in the downtown section of Los Angeles has been ordered changed by the City Council as part of an extensive readjustment of traffic regulations.

Heretofore cars have started around curves against the traffic signal. For instance, a car turning from west to south would start when the signal opened north and south bound traffic and would fit in with the moving line of vehicles. Under the new plan, cars making such a turn will start when east and westbound traffic is open. The old plan was ordered several years ago by the police department to avoid squeezing automobiles between street car and the curb in narrow streets.

The Los Angeles City Council made a move toward keeping the car tracks reasonably clear of automobiles, when, in the same program, it authorized an ordinance against automobiles or trucks stopping anywhere than against the curb unless halted by a blockade or by traffic signal.

Second line parking has been one of the first causes of the congestion and delaying street cars in the downtown Los Angeles. Merchants have pleaded that they have not had a chance to make deliveries, as passenger cars monopolize all the curb parking space. Under the new traffic plan, the curb will be marked into 20-ft. and 30-ft. spaces, the former to be used by passenger cars for forty-five minutes, and the latter to be used by commercial vehicles for fifteen minutes. A passenger car may load and unload in a commercial vehicle zone, but must not stand more than one minute.

Efforts will be made to compel pedestrians to move with the traffic officer and to curb "jay-walking."

The greater part of this program was presented by the Greater Los Angeles Traffic Commission, made up of men and firms interested in the proper handling of traffic.

Houston Agrees to Curb Jitneys

An agreement has been reached between the Houston Electric Company and City Council in connection with the problem of jitney competition. At one time this matter threatened to reach a climax in higher fares by the electric company in order to guarantee earnings allowed by the Federal Court and meet interest on bonds sold locally. The city was all prepared to ask the voters to decide whether jitneys should be abolished or retained.

The city has now agreed to cut down the number of jitneys in operation from about 300 to 250 by Jan. 1. These are to be on the lines reached by street cars. The company had discontinued all improvements pending some action by the city, but has now resumed its extensions, paving, and other work, promised to be carried out when it raised funds from local investors.

Saginaw's Fate Up

People Will Decide Whether Franchise Providing Motor Coach Extensions Is to Be Adopted

One of the most strenuous campaigns in the history of Saginaw is drawing to a close, and on Nov. 7 the people will know whether electric railway service is to be resumed with motor coach extensions. At the general election on that day the electors will vote on a franchise that was submitted by the Council after it had been presented with signers numbering thousands. While the measure has had its opponents, it has not lacked for support, and as the opposition grew, the support did likewise. An educational campaign through the press and public meetings has been going on for the last two weeks and will continue up until Monday, Nov. 6.

The Exchange Club, one of the city's many luncheon organizations, has backed the citizens' committee that succeeded in having the franchise initiated and has gone to the extent of blocking the entire city and on election day will have workers in every voting precinct. This organization has left nothing undone to have the measure adopted.

The opposition centers with the United Club. This organization months ago attempted the financing of a locally-owned motor coach system and succeeded in getting $5,000 in cash and $20,000 in subscriptions for a $400,000 company. After it failed nothing was again heard of the organization until the franchise was submitted to the Council, and with the slogan of "On the job" they started knocking the franchise at meetings throughout the city.

Provision Made for Electric Cars

While it is impossible to make a prediction at this time as to the success of the franchise, many who have in the past opposed grants to public utilities are unwilling at this time to say that the measure will be defeated.

The franchise provides for street cars on lines formerly owned by the Saginaw-Bay City Railway Company, in bankruptcy since August, 1921, and motor coach extensions. The period of the grant is twenty-five years. The rate of fare is twenty tickets for $1; 10-cent cash fare; four tickets for 25 cents, free transfers. This rate of fare is to extend over a period of two years, after which the Public Utilities Commission is to fix it.

The company is to be relieved of all paving and repaving but is to keep the pavement between its tracks and one foot outside in repair and pay for all necessary cost of extra foundation required because of its tracks being in the streets. New tracks are to be laid in several streets during 1923.

At least two-thirds of the board of directors will be Saginaw men, and Otto Schupp, trustee of the bankrupt railway, has been asked to accept the presidency of the new company if the franchise carries. Mr. Schupp, to whom the franchise is to be granted, has promised the people that he will not assign the contract until the new company deposits $400,000 with which to make the improvements and rehabilitate the property and names the Saginaw officers. The company is not to be connected in any way with any of the local utilities controlled by the Commonwealth Power, Railway & Light Company.

All competition is to be eliminated, and the same legislation is provided to stop competition on interurban traffic that use the company tracks as a means of egress and ingress from and to the business district.

The contract also provides that when the utilities commission fixes the new rate of fare, the franchise given the new company is not to be capitalized, no consideration is to be given if during the first two years there has been a loss because of the rate of fare as established, and the stock and bonds of the Saginaw-Bay City Railway Company, are not to be included in fixing the value of the property upon which it will be permitted to earn a profit.

Transportation News Notes

Elimination of Skip-Stop Tabled.—For the time at least the effort started in the Fort Wayne, Ind. City Council to make the Indiana Service Corporation cut out its skip stops and stop at every street intersection has been discontinued.

New Service Started.—The Northern Texas Traction Company, Fort Worth, Tex., has begun operation of cars on the recently constructed South Adams spur of the Hemphill Street line. A new residential district with several thousand persons is served by this extension.

Refuses Lower Fare Request.—The Georgia Public Service Commission has denied a petition by citizens of Rome, Ga., requesting a reduction in fares. The present fare on the lines of the Rome Railway & Light Company is 6 cents, while in nearly all other Georgia cities the fare is 7 cents.

Go to Theater on Half Fare.—The Northwestern Ohio Railway & Power Company, Oak Harbor, Ohio, has cut its rates from Port Clinton to Toledo for the 5:30 and 6:30 p.m. cars. This is done to give Port Clinton people a theater car at prices equal to the regular half-fare rate.

Denies Petition.—The Georgia Public Service Commission has denied a petition by the Atlanta Board of Education requesting half fares for school children. The contention of the Georgia Railway & Power Company that such reduction would be discriminatory, has been upheld by the commission in its decision. The commission voted four to one to reject the petition, which was originally filed several months ago. The existing fare in Atlanta is 7 cents.

Motor Cars at Chattanooga.—The motor-driven railroad car has made its appearance in Chattanooga. It is a gasoline propelled combination passenger and baggage car, on the Tennessee, Alabama & Georgia Railroad. The cars will displace steam propelled trains now used on certain schedules. It accommodates forty passengers.

Demands Lower Charges.—The East St. Louis City Council on Oct. 24, unanimously passed a resolution demanding a reduction in utility charges and requesting the Illinois Commerce Commission to make an investigation. The resolutions declare there has been a reduction in the cost of material and labor, which it is stated are now only 36 per cent above the average in July 1913. The present fare on the lines of the East St. Louis & Suburban Railway in East St. Louis is 8 cents.

Defends Skip-Stop Plan.—The Memphis (Tenn.) Street Railway will defend before the Public Utilities Commission the use of the skip-stop system. The company claims a saving of $100,000 a year is effected on account of this method of operation, besides a saving in fuel. The railway in its defense also says that since the establishment of this system average car-miles have been increased. The skip-stop system was installed as a war-time measure in the four largest cities of Tennessee, Knoxville, Nashville, Chattanooga and Memphis. Nashville and Chattanooga have since abolished it.

Mail Service Established. — After seventeen years of ineffectual discussion with the federal postoffice officials the first traction mail service between Fort Wayne and Garrett has been started. Thirty square feet of mail space has been alloted the Fort Wayne postoffice on the Fort Wayne & Northwestern Railway running between Fort Wayne and Garrett. It has taken twenty-four to forty-eight hours for letters mailed in Fort Wayne to reach Garrett because of Garrett's location away from railroads running through Fort Wayne which have a federal mail service and the change will, of course, cut out all this delay.

Will Repeal Ordinance.—Legislation enacted by ordinance at Johnstown, Pa., requiring that every trolley car be "manned by a motorman and conductor," will be repealed by the City Commissioners in order that one-man cars can be operated in the city by the Johnstown Traction Company. With the repeal of the old ordinance, the City Council is stipulating, under a new ordinance, a reduction in trolley fares to school children. The new bill has already passed first reading, and provides for a 5-cent fare to students. Mayor Joseph Cauffiel opposed the repealer and also the new bill, claiming that the trolley company should be made to give a 4-cent rate. twenty-eight tickets for $1 to school children. The passenger rate in the city is now 7 cents.

Personal Mention

Mr. Worley at Michigan

New York Engineer Selected to Become Professor of Transportation at Wolverine University

John S. Worley of Thompson & Worley, New York, has been selected by the board of regents of the University of Michigan to fill the position of professor of transportation and railroad engineering there. The position was created by the board of regents of the university at a meeting on Oct. 27. Mr. Worley will retain his interest in the firm.

Mr. Worley was born in Jackson County, Missouri, on April 19, 1876. He attended Odessa (Mo.) College and the University of Missouri, from 1895 to 1897. He received the degree of B. S. and M. S. from the University of Kansas in 1904. From 1903 to 1904 he was assistant engineer of construction of the St. Louis & Northern Arkansas Railway, and for the following five years was principal assistant engineer of Riggs & Sherman Company, Toledo, Ohio. During those five years he was also chief engineer of the Marion & Bluffton Interurban Railway of Indiana in charge of constructing 38 miles of that road. He was the senior member of the firm of John S. Worley, later Worley & Black, from 1909 to 1913. Mr. Worley also was associated with M. W. Thompson, New York City, from 1910 to 1913 in making appraisals and reports on railway properties and conducting railway litigation.

Mr. Worley has been a member of the engineering board of the Interstate Commerce Commission since 1913, and from 1920 to 1921 was the commission's consulting valuation engineer.

He was admitted to the Missouri bar in 1919, and is now a junior member of Thompson & Worley, financial experts, New York City. He is a member of the American Society of Civil Engineers.

A. D. Flinn to Direct Engineering Foundation

Alfred D. Flinn has been elected director of the Engineering Foundation, which is fostering organized industrial research on a nation-wide scale. Mr. Flinn is the first incumbent of the new post, created by the Foundation's governing board, composed of the four founder societies of civil, mining, mechanical and electrical engineers, to meet the expanding activities of the Foundation.

Mr. Flinn will retire as chairman of the Engineering Division of the National Research Council, a position which he has held since October, 1921, but will continue as secretary of the United Engineering Society in order that the Foundation may continue intimate relations with the founder societies. Mr. Flinn has been secretary of this society and of the Foundation since January, 1918, and is widely known by engineers throughout the country.

C. E. Taylor has been appointed chief engineer of power stations of the Wilmington & Philadelphia Traction Company, Wilmington, Del. G. T. Bromley was previously chief engineer of this department.

J. E. Carey, who has been assistant purchasing agent of the St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., has been appointed purchasing agent. F. E. Henderson, who formerly held the position, is now superintendent of railways.

C. H. Andrews, former manager of the North Carolina Public Service Company at Greensboro and later general superintendent of the Southern Utilities Company of Florida, has been attached to the operating department of the Carolina Power & Light Company of Raleigh.

R. S. Hecht, chairman of the board of directors of the New Orleans (La.) Public Service Corporation, has sailed for Rio Janeiro as the official representative of the American Bankers' Association, members of which will meet in the city during the Brazilian Centennial Exposition. He holds commissions also from various other American associations.

W. P. Guinan, who has been manager of the business department of the Montgomery Light & Water Company, Montgomery, Ala., has been transferred to the Dominion Gas Company, Hamilton, Ont. Mr. Guinan was formerly associated with the Danbury & Bethel Gas & Electric Company, Danbury, Conn. He has been with the Doherty Company for the past fifteen years, and in that time has been stationed with the properties in Denver, Col., Joplin, Mo., and Mount Vernon, Ill., under the management of the Doherty interests.

E. F. Gould, assistant general manager Aurora, Elgin & Chicago Railroad, resigned at the time the property was recently sold and reorganized under the name of the Chicago, Aurora & Elgin Railroad. Mr. Gould served in this capacity during the two and one-half years the line was in receivership. He had been connected with the property as electrical engineer and as consulting electrical engineer for the several properties controlled by Mandelbaum, Wolf and Lang, Cleveland, for several years prior to the receivership. Altogether his connection in various capacities with the Aurora, Elgin & Chicago Railroad extended through eighteen years. Mr. Gould graduated from Worcester in 1899 and was with the General Electric Company for five years after that.

Sir Henry Thornton Elected President of Canadian Company

Sir Henry Worth Thornton, manager of the Great Eastern Railway of England, who before going to England was general superintendent of the Long Island Railroad and president of the Northwestern Railway, Meadville, Pa., has been elected president of the Canadian National Railways. He will assume active charge within a month. He is relinquishing his connections with the English railway.

In 1914 Sir Henry joined the English company after three years association with the Long Island Railroad as assistant general superintendent and general superintendent. Much of his previous work had been with the Pennsylvania Railroad as draftsman, topographer, assistant in the engineers corps of the Pittsburgh division, supervisor of yards at Columbus, Ohio, assistant engineer of the Cincinnati division, engineer of maintenance of way of the Erie & Ashtabula division of the Northwest system, superintendent of the Mariette division of the Northwest system, and superintendent of the Erie & Ashtabula division of the Northwest system. He was also for a time during this period, from 1894 to 1911, connected with the Cleveland & Marietta Railway and the Cleveland, Akron & Columbus Railway.

Sir Henry's work in England has been conspicuous. He received the rank of colonel during the European war and was advanced to brigadier-general in appreciation of his work as director of the Channel transports. In 1919 he was raised to the knighthood for his service during the war as general manager of the Great Eastern Railway.

C. D. Baker, who for some time has been assistant general superintendent of the Long Island (N. Y.) Railroad, is now general superintendent. W. E. Canning has been moved up to the office of superintendent from the post of superintendent of freight, and Ralph Peters, Jr., has been made assistant superintendent.

R. M. Harding, since 1919 local manager of the Columbus Electric & Power Company, Columbus, Ga., has been elected a vice-president. The company is a consolidation of the Columbus Power Company, the Columbus Railroad and the Gas Light Company of Columbus, which was effected on June 1. Norman W. Mumford, Harry H. Hunt and Henry G. Bradlee, all of Boston, Mass., were also elected vice-presidents.

Percy L. Radcliffe, formerly superintendent of fare collections of the Detroit (Mich.) United Railway, has been made assistant general superintendent, reporting to Harry Bullen, general superintendent. H. F. Rech is acting as assistant superintendent of power, J. M. Mude as chief engineer, W. J. Vaugh as superintendent of distribution, Hugh Savage as superintendent of shops and W. M. Spaulding as general timekeeper. R. G. Skeman is filling the post of auditor, formerly held by Irwin Fullerton.

E. H. Sharpe, special representative of the executive department of the Pacific Electric Railway, Los Angeles, Calif., and in charge of the lately-created bureau of news, has resigned to be connected with the shippers' committee against dismemberment of the Southern Pacific-Central Pacific systems. Mr. Sharpe will assist in putting matters pertaining to this issue before the public. The shippers' committee against dismemberment, E. C. Thomas, general agent of the passenger department, has been transferred to the executive department to assume the duties formerly handled by Mr. Sharpe. Mr. Thomas has heretofore been in charge of advertising. George H. Blyth, chief clerk to the passenger traffic manager, was promoted to the position vacated by Mr. Thomas, and will henceforth be advertising anager of the company.

John Harry Stedman Dead

John Harry Stedman, Rochester, N. Y., secretary and a director of the Ohmer Fare Register Company, Dayton, Ohio, died in Rochester Oct. 28.

Mr. Stedman was well known in electric railway circles. For many years he was a regular attendant at conventions, where his cheerful manner, fund of humor and attractive personality made him extremely popular. He was prominent in many ways in his own city.

Mr. Stedmand was active in church work, was a member of many clubs, and was sought extensively as an after dinner speaker. He was also a verse writer of no mean ability. In his active days he had numerous business interests and at the time of his death was still a director in a number of corporations. He did much to develop the modern form of street railway transfer.

In commenting on his death the Rochester *Democrat and Chronicle* said in part:

> The world would be a brighter place to live in if it contained more men of the type of J. Harry Stedman. He showed the possibilities of enrichment of human intercourse, and by example taught the lesson that life need not be the dull and drab affair that so many of us make it by traveling in a single rut.

Mr. Stedman had not been in good health for some time and among the resolutions adopted at the Chicago convention of the American Electric Railway Association was one sending greetings of the members to him and the hope that he would live for many years. This resolution reads as follows:

> Whereas for many years J. Harry Stedman was a regular attendant at the conventions of this association, always willing to do his part in making the convention a success, always cheerful himself and cheering others with his wit and humor; and
>
> Whereas during the last few years he has been unable, because of poor health, to attend the meetings of this association, now, therefore, be it
>
> *Resolved*, That the members of this association send their best wishes to him, regretting that he is unable longer to attend their meetings, but hoping that he will live many years and that each will be full of the great joy which he deserves because of the pleasure he has given others.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Terminal Contract Let for $163,000

The contract for building the new joint terminal station of the Salt Lake & Utah Railroad and the Bamberger Electric Railroad, on the site of the present building, has been let to Jacobsen & Hodgson, Salt Lake City, for $163,000. Construction is to begin immediately. The firm of Young & Hansen, Salt Lake City, is in charge of the architectural work. T. E. Thomas, Ogden, was awarded the contract for plumbing and heating work, his figure being $21,300. The contract for the electrical work was let to the Salt Lake Electric Supply Company for $9,494.

The terms of the contract stipulate that the new building shall be completed and be ready for occupancy within 150 working days.

The new structure will be two stories high. It will have a frontage on South Temple Street equal to that of the present building, plus the distance from the east side of the building to the corner of West Temple and South Temple Streets, with a considerable frontage on West Temple Street.

Plan to Build Railway in Iceland

Besides Albania, the island of Iceland is the only country in Europe without any railway. It has now been decided to build an electric railway to connect the capital of the island, the town of Reykjavik, with the important agricultural districts of Arnes and Rangarvalli in the east of the country. According to its size Iceland is, in available water power, the richest land on earth. The line will be of 1 meter gage and about 100 km. long.

Conference in Geneva

There is to be a meeting of the rating committee of the International Electrotechnical Commission in Geneva, Switzerland, beginning on November 18. The member delegates from the United States to the meeting are expected to include representatives from the American Institute of Electrical Engineers, the Power Club, the National Electric Light Association, and other societies interested in electrical standardization. Dr. C. O. Mailloux of New York is president of the United States Committee of the Commission and also of the International body. The chief work to be taken up at Geneva will be to secure final agreement on the basis of rating of all classes of electrical machinery.

In addition to C. O. Mailloux, Clayton H. Sharp, H. M. Hobart, C. E. Skinner, Schuyler Skaats Wheeler, Gen. George H. Harries, Frank V. Magalhaes and Clarence L. Collens have been made delegates to the meeting.

ELECTRIC RAILWAY MATERIAL PRICES—OCT. 31, 1922

Metals—New York

Copper, electrolytic, cents per lb.	13.81
Lead, cents per lb.	6.62
Nickel, cents per lb.	39.00
Zinc, cents per lb.	7.45
Tin, Straits, cents per lb.	37.00
Aluminum, 98 to 99 per cent, cents per lb.	20.50
Babbitt metal, warehouse, cents per lb.:	
Fair grade	35.00
Commercial	25.00

Bituminous Coal

Smokeless mine run, f.o.b. vessel, Hampton Roads	$7.125
Somerset mine run, Boston	3.75
Pittsburgh mine run, Pittsburgh	3.25
Franklin, Ill., screenings, Chicago	2.625
Central, Ill., screenings, Chicago	1.87
Kansas Screenings, Kansas City	2.50

Track Materials—Pittsburgh

Standard Bessemer steel rails, gross ton	$40.00
Standard open hearth rails, gross ton	40.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	2.80
Tie plates (flat type), cents per lb.	2.42
Angle bars, cents per lb.	2.75
Rail bolts and nuts, Pittsburgh base, cents, lb.	4.17
Steel bars, cents per lb.	2.10
Ties, white oak, Chicago, 6i n. x 8 in. x 8½ ft.	1.40

Hardware—Pittsburgh

Wire nails, base per keg	2.90
Sheet iron, (28 gage), cents per lb.	2.90
Sheet iron, galvanized, (28 gage), cents per lb	3.90
Galvanized barbed wire, cents per lb.	3.55
Galvanized wire, ordinary, cents per lb.	2.60

Waste—New York

Waste, wool, cents per lb.	15.00
Waste, cotton, (100 lb. bale), cents per lb.:	
White	14.00
Colored	12.00

Paints, Putty and Glass—New York

Linseed oil, (5 bbl. lots), cents per gal.	75.00
White lead, (100 lb. keg), cents per lb.	11.50
Turpentine, (bbl. lots), per gal.	$1.64
Car window glass, (single strength), first three brackets, A quality, discount*	84.0%
Car window glass, (single strength), first three brackets, B quality, discount*	86.0%
Car window glass, (double strength, all sizes, A quality), discount*	85.0%
Putty, 5 lb. tins, cents per lb.	6.75

*These prices are f.o.b. works, boxing charges extra.

Wire—New York

Copper wire base, cents per lb.	15.625
Rubber-covered wire, No. 14, per 1,000 ft.	6.50
Weatherproof wire base, cents per lb.	16.00

Paving Materials

Paving stone, granite, 4 x 8 x 4, f.o.b. Chicago, dressed, per sq.yd.	$3.35
Common, per sq.yd.	3.10
Wood block paving 3½, 16 treatment, N. Y., per sq.yd.	2.34
Paving brick, 3½ x 8½ x 4, N. Y. per 1,000 in carload lots	50.00
Crushed stone, ¼-in., carload lots, N. Y., per cu.yd.	1.75
Cement, Chicago consumers net prices, without bags	2.20
Gravel, ¼-in., cu.yd., N. Y.	2.00
Sand, cu.yd., N. Y.	1.00

Old Metals—New York

Heavy copper, cents per lb.	12.50
Light copper, cents per lb.	11.25
Heavy brass, cents per lb.	8.25
Zinc, old scrap, cents per lb.	4.25
Yellow brass, cents per lb (heavy)	7.50
Lead, heavy, cents per lb.	5.50
Steel car axles, Chicago, net ton	$19.25
Old car wheels, Chicago, gross ton	16.50
Rails (short), Chicago, gross ton	21.25
Rails (relaying), Chicago, gross ton	30.00
Machine turnings, Chicago, net ton	11.25

60,000 Hp. Added to Steam Plants

The Southern Power Company, Charlotte, N. C., through Vice-President and Chief Engineer W. S. Lee, has announced plans for the immediate construction of additions to steam plants to be completed by Sept. 1, 1923, with a generating capacity aggregating 60,000 hp. Contracts for practically all of the equipment have been let and construction work will be begun immediately.

The new additions will be at the steam plant at Mount Holly, where equipment will be installed to generate 40,000 hp., and at the Eno steam plant at University Station, N. C., the capacity of which will be increased 20,000 hp. The Southern Power Company has under construction at present two hydro-electric plants. Of these, Dearborn plant, at Great Falls, S. C., is expected to be ready for operation by next March. The Mountain Island station, near Mount Holly, N. C., will probably be ready for operation in August of next year.

The two steam plants and one hydro-electric plant in North Carolina, and the Dearborn plant in South Carolina, all to be completed within less than a year, will have an aggregate generating capacity of 200,000 hp. Even with this enormous amount of power in sight, however, the Southern Power Company has been compelled to withdraw from the power market.

The company began signing contracts for power in anticipation of new developments immediately after contracts were let for the Mountain Island and Dearborn stations. Applications for more than 35,000 hp. were already on file, and since work has started the demands for prospective power have been so active that the company has sold all the power it dares sell against its new developments, so that the power situation today is approximately what it was a year ago, that is to say, there is no power in prospect beyond the amount which is already under contract.

The Southern Power Company has at present generating capacity in its hydro-electric and steam plants very nearly totaling 400,000 hp. The new developments, including both steam and hydro, will give it a maximum generating capacity of approximately 600,000 hp.

Approve Extension on Bueter Road

The County Commissioners of Fort Wayne, Ind., have approved a franchise petition of the Indiana Service Corporation to extend street railway tracks on Bueter Road to the International Harvester Company property.

The corporation is prepared to begin work on this important extension at once. Service to the Harvester company is to be made possible by running city cars on the Lewis Street line to the city limits and then on the tracks of the Fort Wayne, Van Wert & Lima traction line as far as Bueter Road. The new line will be placed along Bueter Road running south to the Harvester plant.

The present arrangement is made to fulfill an agreement made by the Indiana Service Corporation with the Harvester company to provide street railway service to the plant. The new plant is rapidly nearing completion and car service is imperative. Two former routes proposed by the traction company for the line were turned down. The franchise is for two years.

Rolling Stock

Savannah Electric & Power Company, Savannah, Ga., on Oct. 3 replaced the single-truck cars on the Battery Park line with large double-truck cars.

Great Northern & Piccadilly Railway, London, England, early in October placed a contract with the Metropolitan-Vickers Electrical Company for rolling stock at a price of £159,767.

Lincoln (Neb.) Traction Company has followed up a trial installation of twenty Economy meters with an order of thirty-one more, with which to equip completely all safety and single-truck cars. These meters are of the car inspection dial type.

Quebec (Can.) Railway has planned to install two gasoline railway motor cars for service on its line between Levis and St. George. The new cars, which will be built by a Canadian firm, will have accommodations for about thirty passengers and a compartment for baggage.

Track and Roadway

Tiffin, Fostoria & Eastern Electric Railway, Tiffin, Ohio, has practically completed the Columbus Avenue improvement in Fostoria.

Columbus, Delaware & Marion Electric Company, Columbus, Ohio, on Oct. 16 started work on the new right-of-way from north of Worthington into Columbus. It is thought the project will not be completed before the spring of 1923.

Los Angeles (Cal.) Railway will lower the track between Pimiento Street and Redondo Boulevard to conform to the new grade and will reconstruct and pave. The work of ballasting and paving the tracks on Whittier Boulevard is well under way.

Dallas (Tex.) Railway will commence a $500,000 line extension on Haskell and Lindsley Avenue. Delay has been caused by plans for paving these streets. Richard Meriweather is general manager and in charge of the work for the company.

Indiana Service Corporation, Fort Wayne, Ind., has put in operation the new extension to the Hoffman Street line. This extension is serving a large part of the Bloomingdale section of the city which has been without car service. The company has also recently opened up the newly built extension to the Lakeside line.

Power Houses, Shops and Buildings

Altoona & Logan Valley Electric Railway, Altoona, Pa., is constructing an addition to the power plant at Sixth Avenue and Thirty-second Street, the addition to be of brick and concrete with steel trusses, size 63 ft. x 70 ft. The basement will have a height of 10½ ft. and main floor 24 ft. A new 1,500-kw. generator, with 3,500-hp. engine will be installed, along with a new surface condenser.

Cumberland County Power & Light Company, Portland, Me., will soon put into operation its new 10,000-kw. power station, located on the tidal flats at the South Portland end of the Portland-South Portland bridge. The building itself is 45 ft. high, of brick and steel construction. It contains three boilers of 700 hp. each and two 5,000-kw. turbines. The construction has involved the use of 250 tons of steel and 500,000 brick.

Trade Notes

Johns-Pratt Company, Hartford, Conn., manufacturer of Noark fuses and protective devices, vulcabeston packing and insulation, and Johns-Pratt molded products, announces the appointment of George W. Mapother as New York district sales manager for the electrical division. Mr. Mapother will make his headquarters at the New York office of the company, located at 41 East Forty-second Street.

H. P. Hevenor has joined the staff of Dwight P. Robinson & Company, Inc., as consulting engineer. He was until recently a member of the firm of Engel & Hevenor, Inc., where he specialized in track construction, taking part in numerous large projects in the East, Middle West and South. Mr. Hevenor is a member of the A.S.M.E., Brooklyn Engineers' Club, New England Street Railway Club, the A.E.R.A., and other associations. He has been identified in the past with several concerns prominent in the track construction field.

New Advertising Literature

Root Spring Scraper Company, Kalamazoo, Mich., has published a nineteen-page booklet describing the root spring scrapers, lifeguards and accessories.

The J. G. Brill Company, Philadelphia, Pa., has issued Catalog No. 266. It is a twenty-three page illustrated booklet descriptive of its light-weight cars for city, surburban and interurban service.

Link-Belt Company, Chicago, Ill., announces the completion of a new general catalog, No. 400, which embraces its entire line. It contains 832 pages, is cloth bound and can be obtained from any Link-Belt branch office. This catalog not only includes the complete Link-Belt line, but also the products of the H. W. Caldwell & Son Company plant of that company.

Bankers and Engineers

DAYTON

What happens when a moving body hits an immovable body?

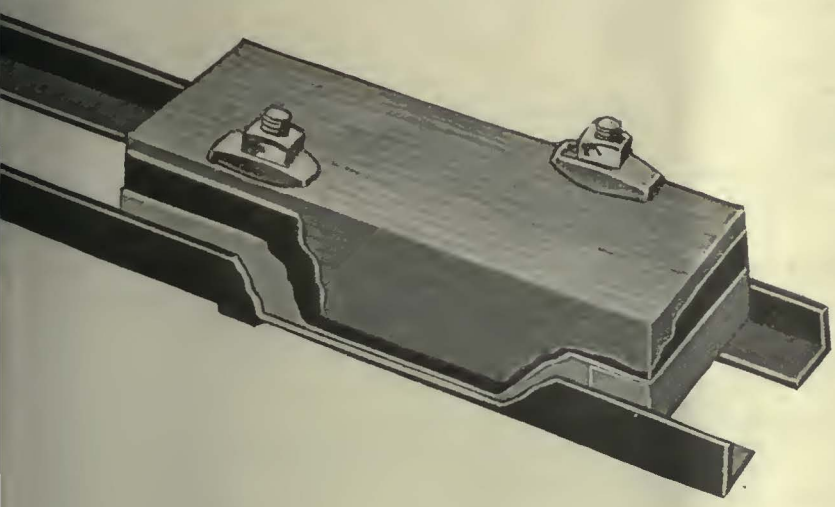
It's a toss-up whether the rolling stock or the track foundation is the first to go to pieces.

Concrete furnishes the best and most durable track foundation if you provide a shock absorber. Without it concrete pulverizes from the hammer blows of traffic.

The asphalt cushion of the Resilient Railway Tie gives an *unvarying deflection* to the rail under the weight of the cars.

The resilient joint tie provides additional support for the rail ends, which prevents broken down joints and battered rail ends.

Furthermore the blend of steel, concrete, wood and asphalt used in the Dayton Resilient Tie makes for a quiet, easy riding, permanent track.



SAVE from $2000 to $6000 a mile

Resilient ties not only provide a superior grade of track, but their use actually entails a saving over the old-fashioned wood tie construction.

THINK of *saving* $6000 a mile over wood ties laid in concrete foundation or a saving of $2000 a mile over wood ties laid in ballast.

Is it any wonder that more and more railway men are turning each year to the *permanent, low cost construction made possible by Resilient Ties?*

WRITE TODAY and have the *facts* about lower and better track construction laid before you—no obligation

Resilient TIE®

THE DAYTON MECHANICAL TIE CO.

707 Commercial Building, Dayton, Ohio

Canadian Representative:

Lyman Tube and Supply Co., Ltd., Montreal, Quebec

Another Lifer in the Boyerized Family

Here's a turnbuckle that is as much better than the ordinary turnbuckle as Boyerized pins and bushings are in comparison with the untreated sort.

Instead of a big, coarse-threaded jam nut that needs a two-fisted wrench for application and yet won't stay put, you require only a pocket-size wrench that is applied at a convenient angle.

What's the secret?

The jam-nut idea is replaced by a split clamp with a spring power that just won't be loosened once the little nut you see at one side has been tightened.

The split of this clamp is lined with felt, serving a double purpose: First, to act as an oil feed; second, to keep the oil from working out of the oil pocket which keeps the threads lubricated *always*.

That isn't all, either. The end of the McArthur turnbuckle is so arranged that each half is cut at a different angle, exposing a cross-section of one full tooth. This tooth acts like a cutting tool in shearing off any ice or snow from the threads, as the latter feed into the turnbuckle for adjustment.

The McArthur Turnbuckle

For Trucks with Inside-hung Brakes and Motors

The McArthur Turnubuckle is exceptionally valuable. Here with the turnbuckle rods coming directly over the rails there is not enough clearance for a pitman to make a handy turn with the large wrenches needed on jam nuts. With the McArthur, a little wrench calls the turn and calls it right.

Keep a McArthur well bushed and it will

LAST AS LONG AS THE TRUCK

Bemis Car Truck Company

Electric Railway Supplies

Springfield, Mass.

REPRESENTATIVES:

Economy Electric Devices Co., Old Colony Bldg., Chicago, Ill.
F. F. Bodler, 903 Monadnock Bldg., San Francisco, Cal.
W. F. McKenney, 54 First Street Portland, Oregon.
J. H. Denton, 1328 Broadway, New York City, N. Y.
A. W. Arlin, 772 Pacific Electric Bldg., Los Angeles, Cal.

Other Members of the Boyerized Family

Brake Hangers	Center Bearings
Brake Levers	Side Bearings
Pedestal Gibs	Spring Post Bushin
Brake Fulcrums	Spring Posts

Bolster and Transom Chafing Plates

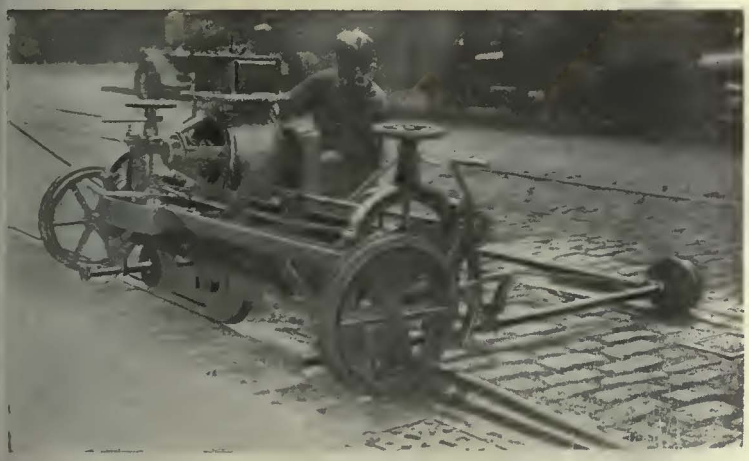
AJAX Electric Arc Welder

Do More

Welding and Grinding

It Adds to Life of Track and Cars

Vibrations and shocks cause rapid disintegration of track structures, car trucks and bodies. By a little constant attention to the condition of special work, joints and rail surface, a smooth running track is secured at trifling expense and vibrations and shocks are thereby eliminated.



ATLAS Rail Grinder

RECIPROCATING Track Grinder

AJAX
Electric Arc Welder

Highest capacity, lightest weight resistance type arc welder. At 600 volts its output is 333 amperes, at 300 volts it gives 200 amperes. Weighs but 155 lbs.

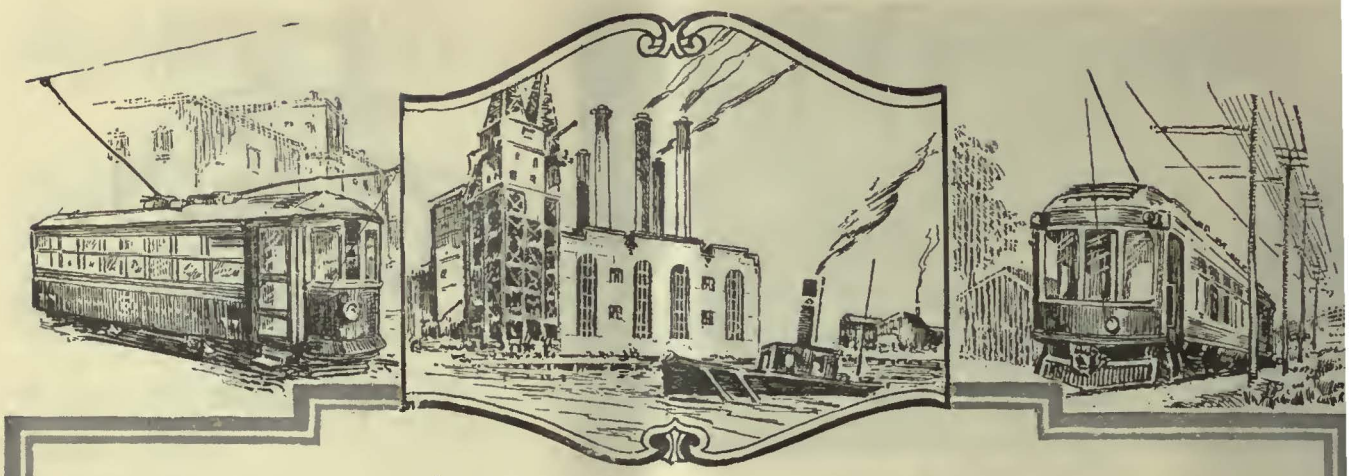
ATLAS
Rail Grinder

An efficient, light-weight rail grinder at an attractively moderate price. Especially adapted for grinding off surplus metal after welding.

RECIPROCATING
Track Grinder

A class by itself for removing corrugations and irregularities from rail-head. Should be used at the first sign of corrugation.

Railway Track-work Co.
3132-48 E. Thompson St.,
Philadelphia, Pa.



How many dollars did you spend this year to keep your cars running ?

There's food for thought in that question!

* * * * * * *

It's a challenge.

Doesn't it suggest—

1—How many dollars will you spend next year—

2—What are you going to do about it—

Find the answers in this booklet, which you may have for the asking.

16 pages, easy to read—very readable; as a matter of fact RE-readable.

We wrote it, we printed it, we're giving it away—but you won't find the name "TEXACO" till you get half way down the 12th page.

Nor does it waste your time making *"Claims."* It goes to work stating *Facts* about operating costs and lubrication, and lets you draw your own conclusions.

Then, too, there's an important questionnaire on the back page. Every Street Railway official ought to fill it out for himself. It will give him a good slant on an important question—and we believe it will incline him toward TEXACO.

We've opened up the pot; you can call it with a two cent stamp—and your road will be the gainer!

There is a TEXACO Lubricant for every purpose.

TEXACO

THE TEXAS COMPANY

DEPT. R-J · 17 BATTERY PLACE · NEW YORK CITY

HOUSTON · CHICAGO · NEW YORK

OFFICES IN PRINCIPAL CITIES

TEXACO

When You Make a Sale

RECORD IT

Any retail business is liable to failure unless care is used in recording the amount of each sale at the time the sale is made.

The OHMER FARE REGISTER provides the retailer of electric railway transportation with a detailed printed sales record of the business done each day in each car.

Hours	Minutes A.M.&P.M.	Direction In Out	7¢	4¢	Transfer	Ticket	Pass	Register Number	Date	Inspector No. 8
*	* *	I.	1448	1222	1282	1181	1357	3108	MAR 14	INS8
4	3 5P	I.	1448	1222	1282	1181	1357	3108	11 9	28
3	4 5P	O.	1440	1217	1280	1179	1356	3108	11 8	28
2	4 4P	I.	1437	1215	1270	1177	1353	3108	10 7	28
1	3 6P	O.	1429	1210	1267	1174	1352	3108	9 6	28
12	2 4P	I.	1414 34	1199 23	1262 20	1163 18	1348	3108	9 5	28
12	2 4P	I.	1414	1199	1262	1163	1348	3108	9 5	15
11	2 7A	O.	1394	1192	1250	1152	1346	3108	9 4	15
10	3 4A	I.	1380	1190	1243	1149	1344	3108	7 3	15
9	2 3A	O.	1371	1183	1236	1143	1342	3108	7 2	15
8	3 3A	I.	1353	1175	1231	1137	1337	3108	7 1	15
*	* *	I.	1353 61	1175 24	1231 31	1137 26	1337	3108	MAR 14	INS8
			95	47	51	44	20			

Divisions over which car operated — Trip Numbers — Conductors No. 15 & 28

OHMER FARE REGISTER CO.

Dayton, Ohio

The three big electrifications

British Electric Railway Prospects

FROM OUR LONDON NEWS REPRESENTATIVE

IN AN article by the present writer which was published in the ELECTRIC RAILWAY JOURNAL of Jan. 1, 1921, an outline was given of what has been done in the past in the way of converting steam railways in England to electric traction and there was appended an indication of the existing schemes for further electrification. Since that time no further work of the kind has been put in hand, though the conversion of the London & North Western Railway suburban lines has been brought nearer completion. The condition of the high rate of interest and additional

The status and outlook for British electric railways, as outlined by Mr. McCallum, may be summarized as follows:

Railway electrification is greatly needed and the roads are ready with plans, but work is being held up by high interest rates. Some rapid transit improvements are under way. Tramways will do little new construction till prices fall. New routes are being operated by buses. Some reductions in tramway fares are being made. [illegible] ations are being conducted [illegible] reduce the weekly gu[illegible]

should be made for the purpose of insuring that the future electrification of railways should be carried out to the best advantage in regard to the interchange of electric locomotives and rolling stock, and whether any regulations should be made to limit the develop[illegible] potential in [illegible]

326 "Tool Steel" Gears
387 "Tool Steel" Pinions
} But for the new eqipt.

-tion and weeding out will be required.

THE ELECTRIFICATION SCHEMES GIVEN IN DETAIL

The proposals which have been made public, but for only a few of which (so far as is known) have applications for guarantee been made, may be briefly indicated. The main reasons for the proposals are that they would increase the capacity of congested railways, reduce the time of running and produce economical operation. The London, Brighton & South Coast Railway, which already [illegible] electrically on the single-phase high-tension system, possesses Parliamentary powers to electrify the remainder

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373 "Tool Steel" Gears
429 "Tool Steel" Pinions
} Used

[illegible]e to be sought.

Other schemes which are still awaiting development and in regard to which nothing immediate is promised are the London & South Western Railway extension of electric traction involving 45 miles of route, the construction of the Wimbledon and Sutton authorized electric rail[illegible] the authorized electrification of the L[illegible]

366 "Tool Steel" gears
350 "Tool Steel" pinions
} Bot on the new eqipt.

Since 1913 these have made over 400,000 miles and still are barely polished. No measurable wear 275 H.P. motors.

They are all delighted with their purchase — So are you if you have tried "Tool Steel"

The Tool Steel Gear & Pinion Company
Cincinnati, Ohio

THE map above shows the location of the 49 foundries in the United States and Canada, represented by the Association of Manufacturers of Chilled Car Wheels.

Chicago, 3	Sayre, Pa.
St. Louis, 2	Berwick, Pa.
Buffalo, 4	Albany
Pittsburgh, 2	Toronto
Cleveland, 2	New Glasgow, N. S.
Amherst, N. S.	Madison, Ill.
Montreal	Huntington, W. Va.
Mich. City, Ind.	Wilmington, Del.
Louisville	Houston, Tex.
Mt. Vernon, Ill.	Hannibal, Mo.
Ft. Wayne, Ind.	Reading, Pa.
Birmingham	Baltimore
Atlanta	Richmond, Va.
Savannah	Ft. William, Ont.
Boston	St. Thomas
Detroit	Hamilton
St. Paul	Ramapo, N. Y.
Kansas City, Kan.	Marshall, Tex.
Denver	Los Angeles
Tacoma	Council Bluffs

Rochester, N. Y.

American Railroad Association Standards

650 lb. wheel for 60,000 Capacity Cars
700 lb. wheel for 80,000 Capacity Cars
750 lb. wheel for 100,000 Capacity Cars
850 lb. wheel for 140,000 Capacity Cars

The Standard Wheel for Seventy-One Years

CHILLED IRON WHEELS

CHILLED IRON WHEELS
for railway and street car service. Capacity 20,000 per day. 25,000,000 in service.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
1847 McCormick Bldg., Chicago

SEARCHLIGHT SECTION

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

Proposals, 40 cents a line an insertion.

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

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

E. R. J.

POSITIONS VACANT

EASTERN interurban wants capable chief dispatcher or trainmaster; must be familiar with steam railroad dispatching and be able to handle men. State experience and salary expected. P-474, Elec. Railway Journal, 10th Ave. at 36th St., New York City.

WANTED a good secretary also superintendent of a hydro-electric interurban railway company. This is said to be the second best iron mining district in the United States. Don't lose time but come at once. Room 1, First National Bank Bldg., Iron River, Mich.

POSITIONS WANTED

ENGINEER of way and structures, eight years in present position in charge of design, maintenance and construction, also electric welding work with fully up-to-date company operating electric, railway and gas utilities; age 40, married; best references. PW-472, Elec. Ry. Journal, Old Colony Bldg., Chicago, Ill.

SUPERINTENDENT with successful record as statistician and operating head, experienced in interurban, safety car and bus operation, can get desired results, satisfactory relations with present employer, personal reasons for desiring change. Address, PW-469, Electric Railway Journal, Leader-News Bldg., Cleveland, O.

POSITIONS WANTED

MR. MANAGER—This is the age in which practical experience is of vital importance in the Electric Railway Industry. Are you in need of a capable, practical experienced superintendent of transportation who is capable of taking over details and handling same in a manner that would be a credit to your property? Successful in public relations and recognized as an economical operator. At present with a large property but desire a change on account of personal reasons. Very successful in handling labor and have made a study of safety work. A proven record of 18 years on city, surburban and interurban properties with high grade references from leading men in railway field is back of this ad. Would prefer a large city and suburban property that requires careful attention. PW-470, Electric Railway Journal, Leader-News Bldg., Cleveland, Ohio.

New Motor Repair Parts

IMMEDIATE SHIPMENT

We have in stock virtually every piece necessary to complete all of the types of non-interpole motors. They are new and were manufactured by either the Westinghouse Company or the General Electric Company. They may be purchased at 25 per cent less than the manufacturers present prices.

Send your orders to us and deduct 25 per cent from the current quotations.

What have you for sale?

TRANSIT EQUIPMENT CO.
Cars—Motors
501 Fifth Avenue, New York.

FOR SALE

STREET CAR HEATERS

50—No. 10 Jewell, in good repair. Exceptional bargain. Immediate delivery.

GRAND RAPIDS RAILWAY COMPANY
42 Ionia Ave., N. W., Grand Rapids, Mich.

FOR SALE

ANGLE BARS

400 pair, 34-in., 70-lb. ASCE, 6-hole. New Drilling 3½-6-5-5.

EASTERN WISCONSIN ELECTRIC CO.
Oshkosh, Wisconsin.

FOR SALE

20—Peter Witt Cars

Weight Complete, 33,000 lbs.

Seat 53, 4—G. E. No. 258-C Motors, K-12-H Control, West. Air Taylor Trucks, R.H. Type. Complete.

ELECTRIC EQUIPMENT CO.
Commonwealth B'dg., Philadelphia, Pa.

The "Searchlight" Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

THE BEST PROOF

of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or services, by its readers, the market place which these advertisements represent could not exist for any length of time.

Are *you* using the Searchlight Section?

0318

Advertising, Street Car
Collier, Inc., Barron G.
Air Receivers, Aftercoolers
Ingersoll-Rand Co.

Anchors, Guy
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.
Armature Shop Tools
Elec. Service Supplies Co.
Automatic Return Switch Stand
Ramapo Ajax Corp.
Automatic Safety Switch Stands
Ramapo Ajax Corp.

Axle Straightenera
Columbia M. W. & M. I. Co.
Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Cambria Steel Co.
Midvale Steel & Ord. Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.
Babbitt Metal
More-Jones B. & M. Co.
Babbiting Devices
Columbia M. W. & M. I. Co.
Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Bankers and Brokers
Coal & Iron National Bank
Batteries, Dry
National Carbon Co.
Nichols-Lintern Co.
Bearings and Bearing Metals
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
General Electric Co.
A. Gilbert & Sons B. F. Co.
More-Jones Br. & Metal Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Stucki Co., A.
Bearings, Roller
Stafford Roller Bearing Car Truck Co.
Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Consolidated Car Heating Co.
Elec. Service Supplies Co.
Benders, Rail
Ry. Track-work Co.
Watson-Stillman Co.
Boilers
Babcock & Wilcox Co.
Edgemoor Iron Co.

Boiler Tubes
Cambria Steel Co.
Edgemoor Iron Co.
Midvale Steel & Ord. Co.
National Tube Co.

Bond Testers
Amer. Steel & Wire Co.
Elec. Service Supplies Co.
Rail Welding & Bonding Co.
Bonding Apparatus
Amer. Steel & Wire Co.
Elec. Ry. Imp. Co.
Elec. Service Supplies Co.
Indianapolis Switch & Frog Co.
Ohio Brass Co.
Railway Track-work Co.
Rail Welding & Bonding Co.

Bonds, Rail
Amer. Steel & Wire Co.
Elec. Railway Imp. Co.
Elec. Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Rail Welding & Bonding Co.
Westinghouse Elec. & M. Co.

Brackets and Cross Arms (See also Poles, Ties, Posts, etc.)
American Bridge Co.
Bates Exp. Steel Truss Co.
Creaghead Eng. Co.
Elec. Ry. Equip. Co.
Elec. Service Supplies Co.
Hubbard & Co.
Ohio Brass Co.
Brake Adjusters
Nat'l Ry. Appliance Co.
Westinghouse Tr. Br. Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Taylor Electric Truck Co.
Wheel Truing Brake Shoe Co.
Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
Safety Car Devices Co.
Taylor Electric Truck Co.
Westinghouse Tr. Br. Co.
Bridges & Buildings
American Bridge Co.
Brooms, Track, Steel and Rattan
Amer. Rattan & Reed Mfg. Co.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Le Carbone Co.
Morganite Brush Co.
National Carbon Co.
Westinghouse Elec. & M. Co.
Brushes, Graphite
Morganite Brush Co.
National Carbon Co.
Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Brushes, Wire Pneumatic
Ingersoll-Rand Co.
Bunkers, Coal
American Bridge Co.
Buses, Motor
Brill Co., The J. G.
Bushings
Nat'l Fibre & Insulation Co.
Bushings, Case Hardened and Manganese
Bemis Car Truck Co.
Brill Co., The J. G.
Cables (See Wires and Cables)
Cambric Tapes, Yellow & Black Varnish
Irvington Varnish & Ins. Co.
Carbon Brushes (See Brushes, Carbon)
Car Lighting Apparatus
Elec. Service Supplies
Car Panel Safety Switches
Consolidated Car Heating Co.
Westinghouse Elec. & M. Co.
Cars, Dump
Differential Steel Car Co., Inc.
Cars, Passenger Freight Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire Cummings Mfg. Co.
Midvale Steel & Ord. Co.
National Ry Appliance Co.
Wason Mfg. Co.
Witt, Peter
Cars, Second Hand
Electric Equipment Co.
Cars, Self-Propelled
General Electric Co.
Castings, Brass, Composition or Copper
Anderson Mfg. Co., A & J. M.
Columbia M. W. & M. I. Co.
More-Jones Br. & Metal Co.
Castings, Funnel
Wharton, Jr., & Co., Inc. Wm.
Castings, Gray Iron and Steel
American Bridge Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Wharton Jr., & Co., Inc., Wm.
Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Catchers and Retrievers Trolley
Earll, C. I.
Electric Service Sup. Co.
Ohio Brass Co.
Wood Co., Chas. N.
Catenary Construction
Archbold-Brady Co.
Ceiling, Car
Pantasote Co., The
Circuit Breakers
General Electric Co.
Westinghouse Elec. & M. Co.
Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equip. Co.
Elec. Service Supplies Co.
General Electric Co.
Hubbard & Co.
Westinghouse Elec. & M. Co.
Cleaners and Scrapers, Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.
Clusters and Sockets
General Electric Co.
Coal and Ash Handling (See Conveying and Hoisting Machinery)
Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Coils, Armature and Field
Columbia M. W. & M. I. Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Coin-Counting Machines
International Register Co. The
Johnson Fare Box Co.
Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Commutator Truing Devices
General Electric Co.
Commutators or Parts
Cameron Elec'l Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Compressors, Air
Allis-Chalmers Mfg. Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Tr. Br. Co.
Compressors, Air Portable
Ingersoll-Rand Co.
Compressors, Gas
Ingersoll-Rand Co.
Concrete Products
Massey Concrete Products Corp.
Concrete Reinforcing Bars
Cambria Steel Co.
Midvale Steel & Ord. Co.
Condensers
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Elec. & M. Co.
Condensor Papers
Irvington Varnish & Ins. Co.
Conduits, Underground
Std. Underground Cable Co.
Connectors, Solderless
Westinghouse Elec. & M. Co.
Connectors, Trailer Car
Consolidated Car Heating Co.
Elec. Service Supplies Co.
Ohio Brass Co.
Controllers or Parts
Columbia M. W. & M. I. Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Controller Regulators
Electric Service Supplies Co.
Controlling Systems
General Electric Co.
Westinghouse Elec. & M. Co.
Converters, Rotary
General Electric Co.
Westinghouse Elec. & M. Co.
Conveying and Hoisting Machinery
American Bridge Co.
Columbia M. W. & M. I. Co.
Copper Wire
Anaconda Copper Mining Co.
Cord Adjusters
Nat'l Fibre & Insulation Co.
Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roeblings Sons Co., John A.
Samson Cordage Works
Silver Lake Co.
Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.
Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Westinghouse Tr. Br. Co.
Cross Arms, (See Brackets)
Crossings
Ramapo Ajax Corp.
Crossing Foundations
International Steel Tie Co.
Crossing Frogs and Switches
Ramapo Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.
Crossings, Manganese
Indianapolis Switch & Frog Co.
Ramapo Ajax Corp.
Crossing Signals. (See Signals, Crossing)
Crossings, Track. (See Track, Special Work)
Crossings, Trolley
Ohio Brass Co.
Culverts, Pipe, Concrete
Massey Concrete Products Corp.
Culverts
Canton Culvert & Silo Co.
Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.
Morton Mfg. Co.
Pantasote Co., The
Dealers' Machinery
Electric Equipment Co.
Transit Equipment Co.
Derailing Switches, Tee Rail
Ramapo Ajax Corp.

Destination Signs
Columbia M. W. & M. I. Co.
Creaghead Eng. Co.
Electric Service Supplies Co.
Detective Service
Wish Service, P. Edward
Dogs, Lathe
Williams & Co., J. H.
Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Doors and Door Fixtures
Brill Co., The, J. G.
General Electric Co.
Safety Car Devices Co.

Doors, Folding Vestibule
National Pneumatic Co., Inc.
Draft Rigging. (See Couplers)
Drills, Rock
Ingersoll-Rand Co.
Drills, Track
American Steel & Wire Co.
Electric Service Supplies Co.
Ingersoll-Rand Co.
Ohio Brass Co.
Dryers, Sand
Electric Service Supplies Co.
Ears
Ohio Brass Co.
Electric Grinders
Railway Track Work Co.
Electrodes, Carbon
Indianapolis Switch & Frog Co.
Railway Track Work Co.
Electrodes, Steel
Indianapolis Switch & Frog Co.
Railway Track Work Co.
Electrical Wires and Cables
American Elec. Works
Roeblings Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Allison & Co., J. E.
Archbold-Brady Co.
Arnold Co., The
Beeler John A.
Byllesby & Co., Inc., H. M.
Day & Zimmerman, Inc.
Dodd, J. N.
Drum & Co., A. L.
Feustel, Robert M.
Ford, Bacon & Davis
Hemphill & Wells
Holst, Engelhardt W.
Jackson, Walter
Kelly, Cook & Co., Inc.
Parsons, Klapp, Brinkerhoff & Douglas
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Sangster & Mathewa
Smith & Co., C. E.
Stone & Webster
Witt, Peter

Engines, Gas, Oil and Steam
Ingersoll-Rand Co.
Westinghouse Elec. & M. Co.
Expansion Joints, Track
Wharton Jr., & Co., Inc., Wm.
Fare Boxes
Cleveland Fare Box Co.
Economy Elec. Devices Co.
Johnson Fare Box Co.
Nat'l Ry. Appliance Co.
Ohmer Fare Register Co.
Fences, Woven Wire and Fence Posts
Amer. Steel & Wire Co.
Cambria Steel Co.
Midvale Steel & Ordnance Co.

Fenders and Wheel Guards
Brill Co., The, J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Sup. Co.
Star Brass Works
Fibre and Fibre Tubing
Nat'l Fibre & Insulation Co.
Westinghouse Elec. & M. Co.
Field Coils. (See Coils)
Flaxlinum Insulation
Nat'y Ry. Appliance Co.
Floodlights
Electric Service Sup. Co.
Floor Plates
Amer. Abrasive Metals Co.
Flooring, Composition
American Mason Safety Tread Co.
Forgings
Cambria Steel Co.
Columbia M. W. & M. I. Co.
Midvale Steel & Ordnance Co.
Williams & Co., J. H.
Frogs & Crossings, Tee Rail
Ramapo Ajax Corp.
Frogs, Track. (See Track Work)
Frogs, Trolley
Ohio Brass Co.
Fuses and Fuse Boxes
Columbia M. W. & M. I. Co.
Consolidated Car Heating Co.
General Electric Co.
Westinghouse Elec. & M. Co
Williams & Co., J. H.
Fuses, Refillable
Columbia M. W. & M. I. Co.
General Electric Co.
Gaskets
Westinghouse Tr. Br. Co.
Gas-Electric Cars
General Electric Co.
Gas Producers
Westinghouse Elec. & M. Co.
Gasolene Torches
Economy Elec. Devices Co.

Gates, Car
Brill Co., The, J. G.
Gear Blanks
Cambria Steel Co.
Midvale Steel & Ord. Co.
Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Westinghouse Elec. & M. Co.
Gears and Pinions
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Nat'l Ry. Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.
Generators
English Electric Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Goggles, Safety
Indianapolis Switch & Frog Co.
Gongs (See Bells and Gongs)
Graphite
Morganite Brush Co.
Greases. (See Lubricants)
Grinders and Grinding Supplies
Indianapolis Switch & Frog Co.
Railway Track-work Co.
Grinders, Portable
Railway Track Work Co.
Grinders, Portable Electric
Railway Track Work Co.
Grinding Blocks and Wheels
Railway Track-work Co.
Guards, Cattle
American Bridge Co.
Guard Rail Clamps
Ramapo Ajax Corp.
Guard Rails, Tee Rail & Manganese
Ramapo Ajax Corp.
Guards, Trolley
Electric Service Sup. Co.
Ohio Brass Co.
Hammers, Pneumatic
Ingersoll-Rand Co.
Harps, Trolley
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Sup. Co.
More-Jones Br. & Metal Co.
Nuttall Co., R. D.
Star Brass Works
Helmets, Welding
Indianapolis Switch & Frog Co.
Headlights
Electric Service Sup. Co.
General Electric Co.
Ohio Brass Co.
Headlining
Pantasote Co., The
Heaters, Car (Electric)
Consolidated Car Heating Co.
Economy Electric Devices Co.
Gold Car Heating & Lighting Co.

Nat'l Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Electric Service Sup. Co.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Ford Chain-Block Co.

Hoists, Portable
Ingersoll-Rand Co.

Hose, Bridge
Ohio Brass Co.

Houses, Station & Watchmen's Concrete
Massey Concrete Products Corp.

Hydraulic Machinery
Watson-Stillman Co.

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
Electric Service Sup. Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Insulating Cloth, Paper and Tape
Anchor Webbing Co.
General Electric Co.
Hope Webbing Co.
Irvington Varnish & Ins. Co.
National Fibre & Insulation Co.
Westinghouse Tr. Br. Co.

Insulating Compounds & Varnishes
Sterling Varnish Co.

Insulating Machinery
Amer. Ins. Machinery Co.

Insulating Silk
Irvington Varnish & Ins. Co.

Insulation. (See also Paints)
Anderson M. Co., A. & J. M.
Electric Ry. Equipment Co.
Electric Service Sup. Co.
General Electric Co.
Irvington Varnish & Ins. Co.
Westinghouse Elec. & M. Co.

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Creaghead Engineering Co.
Electric Ry. Equipment Co.
Electric Service Sup. Co.
Irvington Varnish & Ins. Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Insulator Pins
Electric Service Sup. Co.
Hubbard & Co.

Insulation Slot
Irvington Varnish & Ins. Co.

Insulating Varnishes
Irvington Varnish & Ins. Co.

Insurance, Fire
Marsh & McLennan

Inventions Developed and Perfected
Peters & Co., G. D.

Jacks. (See also Hoists and Lifts)
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
Electric Service Sup. Co.
National Ry Appliance Co.
Watson-Stillman Co.

Journal Boxes
Bemis Car Truck Co.
Brill Co., The, J. G.

Labor Adjusters
Corporation Service Bureau, The

Lamp Guards and Fixtures
Anderson M. Co., A. & J. M.
Electric Service Sup. Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Lamps, Arc and Incandescent (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Nat'l Elec. Specialty Co.
Westinghouse Elec. & M. Co.

Lamps, Signal and Marker
Nichols-Lintern Co.

Lanterns, Classification
Nichols-Lintern Co.

Lathe Attachments
Williams & Co., J. H.

Leather Cloth
The Standard Textile Products Corp.

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Sup. Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold-Brady Co.
Columbia M. W. & M. I. Co.
Creaghead Mfg. Co.
Electric Ry. Equipment Co.
Electric Service Sup. Co.
English Electric Co.
General Electric Co.
Hubbard & Co.
More-Jones Br. & Metal Co.
Westinghouse Elec. & M. Co.

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

Locomotives, Electric
General Electric Co.
McGuire Cummings Mfg. Co.
Westinghouse Elec. & M. Co.

Lubricating Engineers
Galena-Signal Oil Co.
Texas Co.
Universal Lubricating Co.
Vacuum Oil Co.

Lubricants, Oil and Grease
Borne, Scrymser Co.
Galena-Signal Oil Co.
Texas Co.
Universal Lubricating Co.
Vacuum Oil Co.

Lumber. (See Poles, Ties, etc.)

Machine Tools
Columbia M. W. & M. I. Co.
Watson-Stillman Co.

Manganese Steel Guard Rails
Ramapo Ajax Corp.

Manganese Steel, Special Track Work
Indianapolis Switch & Frog Co.
Wharton, Jr. & Co., Inc., Wm.

Manganese Steel Switches, Frogs and Crossings
Ramapo Ajax Corp.

Meters, Car Watt-Hour
Economy Elec. Devices Co.

Motor Buses (See Buses, Motor)

Motormen's Seats
Brill Co., The, J. G.
Electric Service Sup. Co.
Wood Co., Chas. N.

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

Motor and Generator Sets
General Electric Co.

Nails
Cambria Steel Co.
Midvale Steel & Ord. Co.

Nuts and Bolts
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Oils (See Lubricants

Packing
Electric Service Sup. Co.
Westinghouse Tr. Br. Co.

Paints and Varnishes for Woodwork
National Ry. Appliance Co.
Sterling Varnish Co.

Pavement Breakers
Ingersoll-Rand Co.

Paving Material
Amer. Br. Shoe & Fdry Co.

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

Pinion Pullers
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Wood Co., Chas. N.

Pinions. (See Gears)

Pins, Case Hardened, Wood and Iron
Bemis Car Truck Co.
Electric Service Sup. Co.
Ohio Brass Co.
Westinghouse Tr. Br. Co.

Pipe
National Tube Co.

Pipe Fittings
Watson-Stillman Co.
Westinghouse Tr. Br. Co.

Planers. (See Machine Tools)

Plates for Tee Rail Switches
Ramapo Ajax Corp.

Pliers, Rubber Insulated
Electric Service Sup. Co.
Rubber Insulated Metals Corp.

Pneumatic Tools & Accessories
Ingersoll-Rand Co.

Pole Line Hardware
Ohio Brass Co.

Pole Reinforcing
Drew Elec. & Mfg. Co.
Hubbard & Co.

Poles, Metal Street
Bates Expanded Steel Truss Co.
Electric Ry. Equip. Co.
Hubbard & Co.

Poles and Ties, Treated
International Creosoting & Construction Co.

Poles, Posts & Pilings, Concrete
Massey Concrete Products Corp.

Poles, Ties, Posts, Piling and Lumber
International Creosoting & Construction Co.
Nashville Tie Co.
Southern Cypress Mfrs. Assn.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
National Tube Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Elec. Ry. Equip. Co.
Electric Service Sup. Co.
National Tube Co.

Power Saving Devices
Economy Electric Devices Co.
Nat'l Ry. Appliance Co.

Pressure Regulators
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Pumps
Ingersoll-Rand Co.
Watson-Stillman Co.

Pumps, Vacuum
Ingersoll-Rand Co.

Punches, Ticket
Bonney-Vehslage Tool Co.
International Register Co., The
Wood Co., Chas. N.

Punching Machinery
Watson-Stillman Co.

Rail Braces & Fastenings
Ramapo Ajax Corp.

Rails
Cambria Steel Co.
Midvale Steel & Ord. Co.

Rail Joints
Rail Joint Co., The

Rail Joints, Welded
Indianapolis Switch & Frog Co.

Rail Grinders. (See Grinders)

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

Rail Welding. (See Welding Processes)
Ry. Track-work Co.
Rail Welding & Bonding Co.

Rattan
Amer. Rattan & Reed Mfg. Co.
Brill Co., The J. G.
Electric Service Sup. Co.
McGuire Cummings Mfg. Co.

Registers and Fittings
Brill Co., The, J. G.
Electric Service Sup. Co.
International Reg. Co., The
Ohmer Fare Register Co.
Rooke Automatic Reg. Co.
St. Louis Car Co.

Reinforcement, Concrete
Amer. Steel & Wire Co.

Repair Shop Appliances. (See also Coil Banding and Winding Machines)
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Repair Work. (See also Coils)
Columbia M. W. & M. I. Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Replacers, Car
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Resistance, Grid
Columbia M. W. & M. I. Co.

Resistance, Wire and Tube
General Electric Co.
Westinghouse Elec. & M. Co.

Resistances
Consolidated Car Heating Co.

Retrievers, Trolley. (See Catchers and Retrievers, Trolley)

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

Roofing, Car
Pantasote Co., The

Roller Bearings
Stafford Roller Bearing Car Truck Co.

Sanders, Track
Brill Co., The, J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Nichols-Lintern Co.
Ohio Brass Co.

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

Scrapers, Track. (See Cleaners and Scrapers, Track)

Screw Drivers, Rubber Insulated
Electric Service Supplies Co.
Rubber Insulated Metals Corp.

Seating Materials
Brill Co., J. G.
Pantasote Co., The
Standard Textiles Products Corp., The

Seats, Car. (See also Rattan)
Amer. Rattan & Reed Mfg. Co.
Brill Co., The, J. G.
Heywood-Wakefield Corp.
Peters & Co., G. D.

Second-Hand Equipment
Electric Equipment Co.

Secret Service
Corporation Service Bureau, The

Securities Electric Railway
Bonbright & Co.

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

Shovels
Hubbard & Co.

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

Signals, Car Starting
Consolidated Car Heating Co.
Electric Service Supplies Co.
Nat'l Pneumatic Co., Inc.

Signals, Indicating
Nichols-Lintern Co.

Signal Systems, Block
Electric Service Supplies Co.
Nachod Signal Co., Inc.
Union Switch & Signal Co.
U. S. Electric Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod Signal Co., Inc.
U. S. Electric Signal Co.

Slack Adjusters. (See Brake Adjusters)

Sleet Wheels and Cutters
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Ry. Equip. Co.
Electric Service Supplies Co.
More-Jones Br. & Metal Co.
Nuttall Co., R. D.

Smokestacks, Car
Nichols-Lintern Co.

Snow-Plows, Sweepers and Brooms
Amer. Rattan & Reed Mfg. Co.
Brill Co., The, J. G.
Columbia M. W. & M. I. Co.
Consolidated Car Fender Co.
McGuire Cummings Mfg. Co.

Soldering and Brazing. (See Welding Processes and Apparatus)

Spikes
Amer. Steel & Wire Co.

Special Adhesive Papers
Irvington Varnish & Ins. Co.

Splicing Compounds
Westinghouse Elec. & M. Co.

Splicing Sleeves. (See Clamps and Connectors)

Springs, Car and Truck
Bemis Car Truck Co.
Brill Co., The, J. G.
Taylor Electric Truck Co.

Sprinklers, Track and Road
Brill Co., The, J. G.
McGuire Cummings Mfg. Co.

Steel and Steel Products
Cambria Steel Co.
Midvale Steel & Ord. Co.
Morton Mfg. Co.

Steps, Car
Amer. Abrasive Metals Co.
American Mason Safety Tread Co.
Morton Mfg. Co.

Stokers, Mechanical
Babcock & Wilcox Co.
Westinghouse Elec. & M. Co.

Storage Batteries. (See Batteries, Storage)

Strain Insulators
Ohio Brass Co.

Strand
Roeblings' Sons Co., J. A.

Structural Steel
Cambria Steel Co.
Midvale Steel & Ord. Co.

Superheaters
Babcock & Wilcox Co.

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

Switch Stands
Indianapolis Switch & Frog Co.
Ramapo Ajax Corp.

Switches, Selector
Nichols-Lintern Co.

Switches, Tee Rail
Ramapo Ajax Corp.

Switches, Track. (See Track, Special Work)

Switches and Switchboards
Anderson Mfg. Co., A. & J. M.
Electric Servivce Sup. Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Tampers, Tie
Ingersoll-Rand Co.

Tapes and Cloths. (See Insulating Cloth, Paper and Tape)

Tee Rail, Special Track Work
Ramapo Ajax Corp.

Telephones and Parts
Electric Service Sup. Co.

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

Thermostats
Consolidated Car Heating Co. Co.
Gold Car Heating & Lighting Co.
Railway Utility Co.
Smith Heater Co., Peter

Thread-Cutting Tools
Wiliams & Co., J. H.

Ticket Choppers and Destroyers
Electric Service Supplies Co.

Ties, Mechanical
Dayton Mechanical Tie Co.

Tie Plates
Cambria Steel Co.
Midvale Steel & Ord. Co.

Ties and Tie Rods, Steel
American Bridge Co.
Barbour-Stockwell Co.
International Steel Tie Co.

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

Tongue Switches
Wharton, Jr., & Co., Inc., Wm.

Tool Holders
Williams & Co., J. H.

Tool Steel
Cambria Steel Co.
Midvale Steel & Ord. Co.

Tools, Track and Misc.
Amer. Steel & Wire Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Hubbard & Co.
Railway Track-work Co.

Tools, Thread Cutting
Williams & Co., J. H.

Towers and Transmission Structures
American Bridge Co.
Archbold--Brady Co.
Bates Expanded Steel Truss Co.
Westinghouse Elec. & Mfg. Co.

Track Grinders
Railway Track Work Co.

Track, Special Work
Barbour-Stockwell Co.
Indianapolis Switch & Frog Co.
New York Switch & Crossing Co.
Ramapo Ajax Corp.
Wharton, Jr., & Co., Inc., Wm.

Transfer Issuing Machines
Ohmer Fare Register Co.

Transfer Tables
American Bridge Co.

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

Treads, Safety, Stair, Car Step
Amer. Abrasive Metals Co.
Amer. Mason Safety Tread Co.
Morton Mfg. Co.

Trolley Bases
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Nat'y Ry. Appliance Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
More-Jones Br. & Met. Co.
Nat'y Ry. Appliance Co.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Buses
Brill Co., The, J. G.
General Electric Co.
Westinghouse Elec. & M. Co.

Trolley Materials
Electric Service Supplies Co.
Ohio Brass Co.

Trolley Materials, Overhead
More-Jones Brass & Metal Co.

Trolley Shoes
Miller Trolley Shoe Co.

Trolleys and Trolley Systems
Ford Chain-Block Co.

Trolley Wheels. (See Wheels, Trolley)

Trolley Wheel & Harps
More-Jones Brass & Metal Co.

Trolley Wheel Bushings
More-Jones Brass & Metal Co.

Trolley Wire
American Elec'l Works
Amer. Steel & Wire Co.
Anaconda Copper Mining Co.
Roeblings Sona Co., J. A.

Trucks, Car
Brill Co., The, J. G.
Bemis Car Truck Co.
McGuire Cummings Mfg. Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Tubing, Steel
National Tube Co.

Tubing, Yellow & Black Flexible Varnishes
Irvington Varnish & Ins. Co.

Turbines, Steam
General Electric Co.

Turnstiles
Damon-Chapman Co.
Electric Service Supplies Co.
Perey Mfg. Co., Inc.

Turntables
Indianapolis Switch & Frog Co.

Upholstery Materials
Amer. Rattan & Reed M. Co.

Valves
Ohio Brass Co
Westinghouse Tr. Br. Co.

Varnished Papers
Irvington Varnish & Ins. Co.

Varnished Silks
Irvington Varnish & Ins. Co.

Varnishes. (See Paints, etc)
Ventilators, Car
Brill Co., The, J. G.
National Ry. Appliance Co.
Nichols-Lintern Co.
Railway Utility Co.
Vises, Pipe
Williams & Co., J. H.
Water Tube Boilers
Edgemoor Iron Works
Welded Rail Joints
Indianapolis Switch & Frog Co.
Ohio Brass Co.
Ry. Track-work Co.
Rail Welding & Bonding Co.
American Steel & Wire Co.
Welding Processes and Apparatus
Elec. Ry Improvement Co.
General Electric Co.
Indianapolis Switch & Frog Co.
National Ry Appliance Co.
Ohio Brass Co.
Rail Welding & Bonding Co.
Railway Track Work Co.
Westinghouse Elec. & M. Co.
Welding Steel
Indianapolis Switch &Frog Co.
Welders, Portable Electric
Electric Ry. Imp. Co.
Indianapolis Switch & Frog Co.
Ohio Brass Co.
Ry. Track-work Co.
Rail Welding & Bonding Co.
Wheel Guards (See Fenders and Wheel Guards)
Wheel Grinders
Wheel Truing Brake Shoe Co.
Wheel Presses (See Machine Tools)
Wheels, Car, Cast Iron
Assn. of Mfrs. of Chilled Car Wheels
Griffin Wheel Co.
Wheels, Car, Steel and Steel-Tired
Cambria Steel Co.
Midvale Steel & Ordinance
Wheels, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Copper Products Forging Co.
Electric Ry. Equip. Co.
Elec. Service Supplies Co.
General Electric Co.
More-Jones Br. & Metal Co.
Nuttall Co., R. D.
Star Brass Works
Whistles, Air
General Electric Co.
Ohio Brass Co.
Westinghouse Tr. Br. Co
Wire Rope
Amer. Steel & Wire Co.
Roebling's Sons Co., J
Wires and Cables
Amer. Electrical Works
Amer. Steel & Wire Co.
Anaconda Copper Min. C
Cambria Steel Co.
General Electric Co.
Indianapolis Switch & Fro Co.
Kerite Insulated Wire & Cable Co.
Midvale Steel & Ord. Co.
Roebling's Sons, Co., J.
Westinghouse Elec. & M. C
Wrenches
Williams & Co., J. H.

ALPHABETICAL INDEX TO ADVERTISEMENTS

BANGOR, MAINE

Light-Weight Double-Truck Cars

The tendency to eliminate unnecessary weight and to take advantage of low operating and maintenance costs of light-weight double-truck cars, particularly for suburban and interurban service, has led to the introduction of many interesting types of rolling stock.

The cars built by the Wason Manufacturing Company a few months ago for the Bangor Railway & Electric Company, Maine, weigh complete ready to run 28,660 lb., seat 52 passengers and measure 40 ft. 3 in. over all. They are of standard Safety Car construction, with continuous T-shaped side posts from side sill to side sill, and are mounted on Brill 77-E-1 Low Level Trucks, 5 ft. 4 in. wheelbase and 26-in. diameter wheels.

These cars are equipped with four (4) standard Safety Car motors and full safety device equipment. On account of climatic conditions double floor, sash and track scrapers are included.