

# Electric Railway Journal

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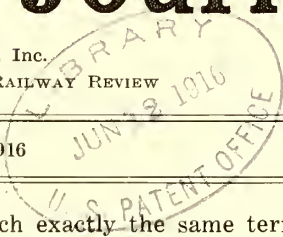
**PUTTING PERSONALITY INTO THE CORPORATION** The old saying that corporations have no souls has been used many times to characterize their alleged heartlessness. It has not been as often understood to constitute a handicap to them, but there is no doubt that a corporation suffers a disadvantage, and a serious one, in business, even if it is only founded on sentiment, as compared with an individual, because it has no personality. This lack it is the duty of the management to supply as far as can be through utilizing the individuality of the officers. Of two electric railways which are giving good service, that one will enjoy the greatest public favor in which the personality of the management enters. Such a situation often occurs in the case of run-down properties which have been taken over by new managers and successfully rejuvenated. Here the public can give credit where credit is due, and it usually does so. But with the older and long-established company the task is a little more difficult though none the less important. So long as the patrons of a railway look upon it merely as a transportation-producing machine, with no personality behind it, a friendly attitude is impossible. One cannot be friendly with a machine. On the other hand, if the service appears to be the expression of a real desire to serve them, the case is radically different. It is perfectly natural, therefore, that the popular electric railways should, as a rule, be those which make an effort to develop this individuality or personality through their leading executive officers.

**TRAFFIC INTERCHANGE WITH STEAM ROADS** One source of freight revenue which certainly has not been developed to the limit of its possibilities is that of interchange traffic with steam roads. The equipment and methods of operation used on electric roads have largely been developed with the fundamental idea of handling a "gathering and distributing" type of traffic. On the other hand, steam road methods are well adapted to long-haul service. It would seem logical, therefore, that effective co-operation between steam and electric roads would work out for the benefit of all concerned. That some companies are doing this is shown by several articles on electric freight traffic in recent issues of this paper. In all of these cases the functions of the two classes of roads are markedly distinct, so that each benefits by the interchange traffic arrangement, which extends the zone of influence of each and tends to stimulate traffic on both. We believe that even paralleling steam and electric roads would find such arrangements profitable, because they neces-

sarily do not reach exactly the same territory or have the same facilities for all kinds of freight. If such roads would forget their passenger traffic animosities long enough to work out a business-like scheme of co-operation in the handling of freight, we feel that the results would be much more satisfactory to both themselves and the public at large than those usually obtained.

**OVERHEAD CRANES VERSUS DROP PITS** In the present formative stage in electric locomotive design a decided advantage would be gained for the future if the repair-shop buildings constructed in the near future could be planned along lines that would prevent them from being made obsolete by changes in practice during the next few years. The main reason standing in the way of this possibility is that electric locomotive repair shops at present display no definite tendency either toward the "overhead" type, with traveling cranes to handle heavy parts, or toward the drop-pit type, where the heavy work is all done from below the engine. The latter type of shop is unquestionably the least expensive to construct, since the framework may be of the lightest construction or, at most, of sufficient strength to support a very light crane. Its high efficiency is exemplified by the Harmon shops of the New York Central Railroad, for years noted for the low cost and excellence of the work that they have turned out. With the drop-pit type of shop, however, there is a weak point in that it is not suitable for all types of locomotives in use even to-day, the Pennsylvania type of engine, for example, requiring a crane of considerable capacity for the removal of its main motors. On the other hand, with overhead cranes of sufficient size, any type of locomotive, apparently, can be successfully dismantled or assembled, and for this reason the overhead type of shop seems to have a decided advantage in view of the fact there is no telling what the morrow will bring forth in locomotive design.

**THE PIONEER ELECTRIFICATION** Until the titanic electric units of the past year or two revolutionized conceptions of electrification, the history of heavy electric traction might well be said to have been exemplified in its entirety by the pioneer installation at Baltimore. When this electrification began operation, twenty-one years ago, it was characterized by an overhead contact system in which the necessity for large contact area for low-voltage current was recognized. But this method of operation did not provide for a number of conditions, such as the





exaggeration of sidewise movements of the collector that were inseparable from such a plan, and its subsequent abandonment and the substitution of a third-rail came as a forerunner to the several contact systems of the latter type that have been installed in this country. In the same way the earliest locomotives to be used were built in two four-wheel sections with gearless motors, and, although they are entitled to an important place in the development of the art, their costliness and hard-riding qualities prevented their perpetuation. The rigid wheelbase locomotives which followed them were typical of the influence that appeared so strongly in steam locomotive design some twelve or fourteen years ago, and these, in turn, were improved upon by engines with the articulated trucks that characterize all designs of the present day. Even from the standpoint of power supply, the installation has changed from the use of a small isolated power station—necessary in the days when electricity was a novelty—to the purchase of energy from the large, economical station of a local power company, so that in the parallelism of the B. & O. installation to the tendencies prominent in the general development of heavy electric traction, almost the only missing feature is a return to an overhead conductor with high voltage.

#### COUPLED DRIVERS FOR ELECTRIC LOCOMOTIVES

There is food for thought in the article by F. H. Shepard on locomotive drives which appears elsewhere in this issue. Among the various comments which he advances in explanation of the complication that appears in some of the most recent locomotive designs, the most interesting one, perhaps, is that on the weight-shifting effect of drawbar pull. The phenomenon is simple, and it has been recognized for years on steam railroads, as it is well known that the old "American" type of steam locomotive, which has a four-wheeled leading truck and two pairs of drivers at the rear, is capable of pulling an appreciably greater load when running forward than when running backward. The reason is that, for forward motion, the drawbar pull, which is exerted at a height of nearly 3 ft. above the rail, establishes a couple that tends to tip the engine over backwards. In consequence, a not inconsiderable part of the total weight is transferred from the leading truck wheels to the drivers, giving the latter more adhesion and adding to the tractive effort of the engine. When the locomotive is running backward, the reverse of this action takes place, weight being shifted from the drivers to the truck, and the loss of effective adhesive weight makes the engine "slippery." With the electric locomotive, which may be constructed in a series of articulated trucks, the effect of the phenomenon may be magnified because of the relatively short wheelbase of each truck. A case might be cited, for example, in which each truck had only a 6-ft. wheelbase. Under such circumstances the couple set up by the drawbar pull would have an arm one-half as long as that opposing it, and if the drawbar pull was 30 per cent of the total weight, some 15 per cent of the weight

on the front drivers would be shifted to the rear pair. Therefore, without independent control of each pair of drivers, or side rods coupling them together, the tractive effort of the whole engine would be measured by the most lightly loaded pair of drivers and would be reduced by 15 per cent. This is, of course, an extreme case, but it demonstrates that side rods, with all their objectionable features, have a very definite value.

#### A COINCIDENCE IN LOCOMOTIVE REPAIR COST

The cost of electric locomotive maintenance at Baltimore displays a somewhat remarkable agreement with the cost on the later tunnel electrifications at Detroit and Port Huron. In all three cases the charges approximate 5 cents per locomotive-mile, although the weight of the average Detroit engine is 25 per cent greater than the average at Baltimore, and that at Port Huron is 25 per cent less. From this it would seem that the Detroit engines should cost the most for repairs and the Port Huron engines least, with the Baltimore machines in between. There are, in addition, several circumstances surrounding operation at the three locations which tend further to produce a difference in the existing figures. For one thing the annual mileage per locomotive differs materially, being 35,000 at Port Huron, 21,000 at Baltimore and only 18,500 at Detroit.

Of still more importance as a factor in maintenance cost is the item of tire wear. Since the engine has to be practically dismantled when tire work is done, the procedure is materially expensive and may exert a marked influence on the cost per mile if the mileage between turnings is low. At Detroit, conditions seem to be exceptionally bad for tire wear because the mileage between turnings is reported to range between 12,000 and 15,000. At Baltimore the tires on the later engines approximate 70,000 miles and on the older ones 35,000, an average of, say, 50,000 miles for all classes, while the mileage for the Port Huron engines apparently exceeds 80,000.

Comparing operation at Baltimore with that at Detroit, since these two installations are of the low-voltage, direct-current type, it will be found, from the record published upon another page of this issue, that the Baltimore engines are worked very much harder than those at Detroit. This condition is reflected in the armature failures which are reported from Baltimore, while Detroit absolutely escapes this form of trouble. The effect is displayed also in the fact that at Baltimore the electrical repairs cost more than the mechanical repairs, although experience indicates that normally the electric apparatus should cost only about one-half as much as the maintenance of the mechanical equipment of an electric locomotive. Here, then, there appears on the one hand harder work for the locomotives as an offset to lighter engines and a higher mileage between tire turnings, and as it is conceivable that these conditions would balance each other, the cost of 5 cents per locomotive mile for these installations seems to be nothing more than a coincidence.



### LOAD FACTOR IN ELECTRIC OPERATION

The influence of load factor on steam railroad operating costs may be said, in general, to be of subordinate importance, and for this reason the term does not appear in the railroad operator's terminology. The reason is that the investment in rolling stock and its appurtenances is but a small fraction, say one-fifth, of the total cost of the whole road. The major part of the investment is tied up in the roadway, and since this has no definite maximum capacity, there is no method of establishing its load factor, while the minor character of the investment in rolling equipment hardly warrants the expression of a relation between its possible capacity and the actual work that it does. As a matter of fact, load factors for railroad equipment are astonishingly low when judged by standards common in electric working, a steam locomotive, for example, doing something like 5 per cent of the work that it could do if operated to rated capacity all of the time and under best conditions.

Under electric operation, however, this lack of consideration of load-factor values in steam railroad statistics has worked and undoubtedly will work for some time to come a serious hardship, because electrification may introduce equipment costing fully half as much as the original roadway and requiring continuous operation to earn its fixed charges. Unfortunately, electrical engineers cannot expect a steam railroad to revolutionize its practice and turn its schedules topsyturvy for the sake of electrifying, since the new form of power must show a saving under existing conditions before it can supplant the old. Eventually, no doubt, the economies that are measured by high load factors will be recognized, but in the meantime electrical equipment must be designed to move trains whenever and however the operating department sees fit to run them, regardless of the effect they may have upon the load curve.

Consideration of the steam locomotive brings out the fact that there are two very obvious causes for the distressingly low load factor under which it operates, and both of these are avoided to a large extent by the electric machine. One of them is the large amount of time spent at the engine house or its equivalent, during which intervals the steam locomotive has to have its fire cleaned and its tender resupplied with coal and water, and then has to be set in the roundhouse for the minor repairs and replacements inevitably required after every trip. It has been found that as much as fourteen hours out of the twenty-four are devoted to such operations, leaving only ten hours during which a road engine is actually available for service. On this hourly basis then, the steam engine starts with a daily load factor of only 42 per cent while the electric locomotive is ready for service practically all of the time, or, at worst, allowing an hour out of the twenty-four for inspection, has a daily load factor of 96 per cent on the basis of time ready for service.

The other one of the two most obvious characteristics that reduce the relation between the possible

capacity of the steam locomotive and its actual performance lies in its practical inability to handle temporary overloads. The ruling grade on a division establishes its tonnage rating, and elsewhere during its run the engine is underloaded. In one respect this might be considered as an advantage, because the directly-opposite characteristic of the electric locomotive, due to its higher adhesion, leaves it open to abuse. However, the fact that the latter machine can exert a greatly increased drawbar pull for short intervals gives it a chance to get its train over a ruling grade without having to operate at less than capacity throughout the balance of the run, and this tends definitely to raise the load factor of the electric locomotive when its operations are considered in their entirety.

### CARELESS FEDERAL LEGISLATION

The carelessness with which many congressional bills are drawn is illustrated in the "hours of service" bill (H. R. 9216) to which the committee on federal relations of the American Electric Railway Association has called attention, as mentioned in last week's issue. The circumstances indicate that this bill was intended merely to amend the present hours of service act by shortening from nine to eight hours the maximum hours of service of train dispatchers, but as the bill is worded it makes eight hours the maximum permissible working day for the motormen and conductors of electric inter-urban railways, while permitting the engineers and conductors of steam railroads to work sixteen hours.

It would seem necessary only to have attention called to this gross discrimination to secure a change, but there is serious danger that the law will get on the statute books unless individual electric railway companies awake to the importance of protest, as the bill has been favorably reported with its present amendments by the House committee on interstate and foreign commerce. As Mr. Brady says in his memorandum to the members of the House committee, a conductor or motorman is no more disqualified physically or otherwise at the end of eight hours from perceiving and understanding an order by telephone than is an engineer or conductor on a steam railroad train at the end of the same period disqualified from receiving and understanding a written order. This fact should be made clear to the members of the House.

The committee on federal relations of the American Electric Railway Association has also called the attention of association members to another bill (H. R. 9047, introduced on Jan. 14, 1916, by Mr. Decker), in which provisions intended evidently to apply purely to steam railroad trunk-line conditions are so worded as to include electric railways also. This is a common oversight in proposed legislation on interstate carriers, but the effect is nevertheless serious to the electric railways if the error should not be discovered until after the passage of the bill. Here also an expression by member companies to their Congressman of their views in relation to this legislation would be helpful in the circumstances.



# Operation on the Baltimore & Ohio Electrification

Detailed Statistics Show That the Electric Locomotives in This Service Through the City of Baltimore Are Being Operated for Some 40 Cents per Locomotive-Mile, of Which Power Comprises More than Half Owing to the Heavy Grades—The Maintenance Cost Approximates 5 Cents

THE Baltimore & Ohio electrification has always been looked upon with interest as the pioneer installation of electric traction in steam railroad service in the United States. It is not generally known, however, that with the great increase in train weights due to the development during recent years of more powerful steam motive power equipment, it has been necessary to reconstruct or to replace practically all of the original installation. As this is probably the only instance where heavy electric traction has undergone such extensive changes, an account of the improvements made and the effect on operation and maintenance will no doubt be of interest.

## PHYSICAL CHARACTERISTICS

The electrified section of the Baltimore & Ohio Railroad is its main line through the city of Baltimore, extending from Camden station on the west to Waverly interlocking tower on the east. The length of electrified section is 3.7 miles, the maximum grade, 1.52 per cent, the average through grade, 0.9 per cent, and the maximum curvature, 10 deg., 16 min. The line was constructed during the early nineties to furnish a direct rail connection between the main line west of Baltimore and that east, and one of the requirements of the ordinance governing the construction through the city was that trains be operated electrically. In addition, the number and lengths of the tunnels necessitated spe-

cial means for reducing the amount of locomotive smoke and gases, for which electrification undoubtedly offered the most satisfactory solution. The first trip of an electric locomotive was made on June 27, 1894, but the line was not opened for traffic until May 1, 1895.

Regular service with a total of three electric locomotives was begun on Aug. 1, 1895. An overhead distribution system was originally installed, but as it never proved satisfactory it was replaced in 1902 by a third-rail system. Four electric freight locomotives were purchased in 1903 and another of the same type in 1906. With increasing traffic and weight of trains the capacity of the power plant and feeder capacity became inadequate, with the result that in 1909 a contract was entered into with the Consolidated Gas, Electric Light & Power Company of Baltimore for purchasing current, and a synchronous converter substation was built for supplying service. Between 1910 and 1912 a total of four locomotives of a more powerful type were placed in service, the original three being retired. Plans are now under consideration for remodeling the last four locomotives to increase their capacity, and for the provision of additional synchronous converter equipment in the substation.

The direct-current system is used, 675 volts being maintained at the d.c. bus. Originally all power was supplied directly from a power plant located at the west end of the electrified zone. In this were five 500 kw.,



B. & O. ELECTRIFICATION—TWO ELECTRIC LOCOMOTIVES OF 1910 TYPE HAULING FREIGHT TRAIN AND ITS STEAM LOCOMOTIVE

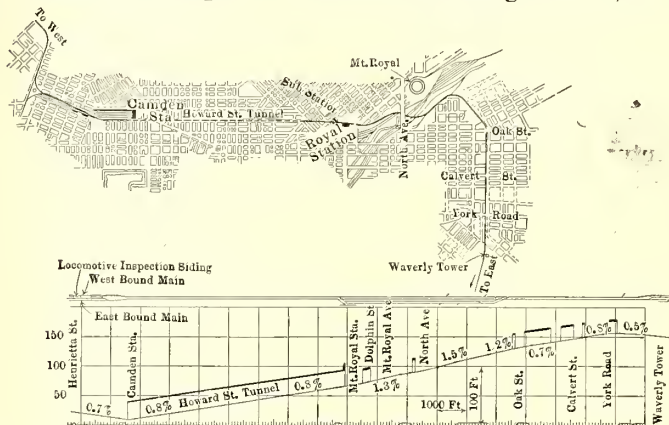


700-volt, direct-current generators, direct-connected to tandem-compound, non-condensing, Corliss-type engines. A large proportion of the plant output, however, was used for the railroad shops and other purposes. But one train at a time was handled through the electrified zone, and the load was of an intermittent and high peak character. To obtain more economical operating conditions as well as to improve the voltage on the line a storage-battery substation was subsequently installed near the Mount Royal passenger station, 1¾ miles from the power house. A booster system of control was used which included a booster located in the power house, thus permitting a reduction of generating voltage to 550 in order that current could be used for industrial purposes. This limited the power house output to 900 kw. for traction purposes which, with the battery, was sufficient to handle simultaneously one freight train of 1600-ton weight, including electric locomotive, and one light passenger train.

When the Consolidated Gas, Electric Light and Power Company began to furnish power in the form of 13,000-volt, three-phase, 25-cycle current, a synchronous converter substation was built by the railroad adjoining the Mount Royal battery station. Three 1000 kw., 650-volt, synchronous converters with the necessary auxiliaries were installed. The battery, which is of 3200 amp.-hr. capacity, at the eight-hour rate, was retained for peak work, being controlled by a special booster in conjunction with the Electric Storage Battery Company's carbon pile regulator system. The power plant was operated in parallel with the substation until it was shut down in November, 1914, when purchased electric service was extended to cover all the electrical requirements of the railroad for light and power in Baltimore. Plans are now under consideration for increasing the capacity of the substation by the installation of a 2000 kw. synchronous converter and for abandoning of the storage battery. The extension of use of electric service with consequent improvement in load factor and the purchasing of current under a new contract have rendered the operation of the battery unnecessary and uneconomical under the existing conditions. With the proposed increased capacity of the sub-

station it will be possible to handle simultaneously through the electric zone two freight trains each of maximum weight of 2840 tons.

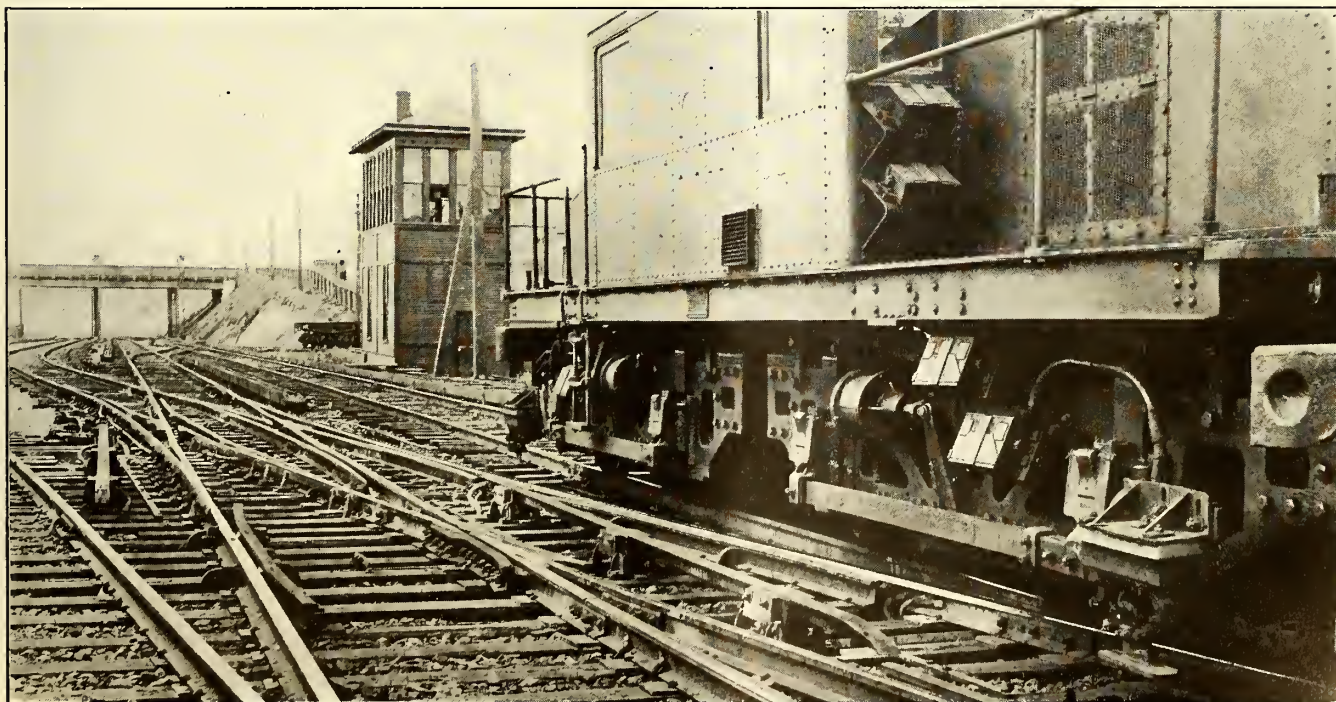
The original overhead system of power distribution provided a contact conductor of two "Z" bars so arranged as to form a box-like structure with a slot in the bottom. Outside of the tunnels this was supported from towers by a catenary construction and in the tunnels by direct hangers. In this overhead structure the collector shoe, attached to the locomotive by pantagraph, was allowed to slide. As would be expected, from the present knowledge of methods of collecting current, the



B. & O. ELECTRIFICATION—MAP AND PROFILE OF ELECTRIFIED LINE

system was unsatisfactory, while the presence of gases from steam locomotives resulted in high maintenance cost. In 1902 the overhead conductors were replaced by third-rail system, the larger part of which is still in service. A special form of protection has been provided on account of flush platform construction at passenger stations. As a further safety measure automatic sectionalizing switches were installed, but these proved unsatisfactory and were discontinued.

To provide a continuous supply of current to the locomotives at double slip switches where the gaps are too great to be spanned by the third-rail shoe, a special ar-



B. & O. ELECTRIFICATION—MOVABLE SECTIONS OF THIRD-RAIL AT CROSS-OVERS



rangement of movable third-rail is used to avoid the necessity for overhead conductors. These consist of structural T-irons located inside the crossing tracks and at such other points where the standard third-rail would be fouled by trains using the cross-over. In the operating position these rails are level with the top of third-rail but normally are lowered to the track rail level, in which position current is automatically cut off. The rails are controlled from the signal tower and are properly interlocked with the switch levers.

After ten years of service the third-rail in the Howard Street tunnel became so badly corroded, due to action of the locomotive gases and electrolysis, as to require its complete renewal, at which time the type of insulators and guard board support were redesigned to overcome certain faults in the original construction. This new design has been adopted as standard for future replacement.

In general there is a continual demand for greater drafts of power. The last lot of locomotives to be purchased are of the Michigan Central type and are used for both passenger and freight service. But to increase their hauling capacity it is now planned to increase their gear ratio from 3.25 to 4.27 and the weight to 120 tons. Shunt-field control will be provided to permit obtaining higher speeds with light-weight trains. This feature will be semi-automatic in operation in that with the controller in full running position the fields will be shunted only when the motor current is less than a fixed predetermined value. The principal data pertaining to the electrical and mechanical features of the various types of locomotives are given in Table I and the general features of their design are illustrated by the accompanying photographs.

OPERATING FEATURES AND COSTS

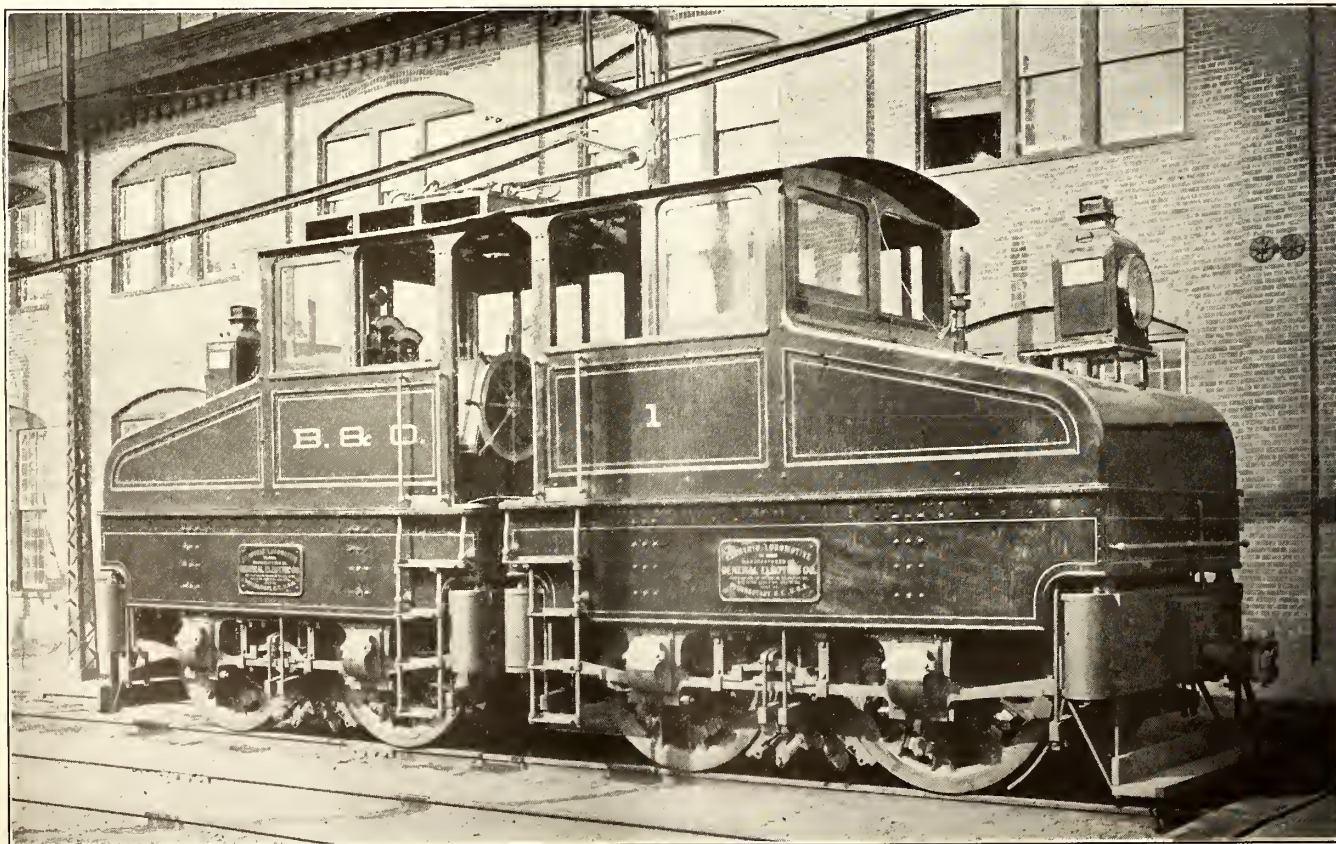
Electric operation is used only in the up-grade (east-bound) direction, the electric locomotives returning

TABLE I—ELECTRIC LOCOMOTIVE DATA, BALTIMORE & OHIO RAILROAD

Year built.....	1894	1903 and 1906	1910	1912	Proposed Remodeled
Type.....	Eight Wheel Two Section	Eight Wheel Rigid Base	Eight Wheel Articulated	Eight Wheel Articulated	
Number.....	3	5	2	2	4
Rigid wheelbase.....	6 ft. 10 in.	14 ft. 6¾ in.	9 ft. 6 in.	9 ft. 6 in.	9 ft. 6 in.
Total wheelbase.....	22 ft. ¾ in.	14 ft. 6¾ in.	27 ft. 6 in.	27 ft. 6 in.	27 ft. 6 in.
Length over all.....	33 ft. 10 in.	29 ft. 7 in.	39 ft. 6 in.	39 ft. 6 in.	39 ft. 6 in.
Total weight.....	190,000	160,000	185,000	200,000	240,000
Number of motors.....	4	4	4	4	4
Type.....	AXB 70	GE 65 B	GE 209	GE 209	GE 209
Output of motor, hp.....	270	200	275	275	275
Gear ratio.....	Gearless	81-19	73-24	78-24	83-19
Amperes input.....	292	400	400	400	400
Diameter drivers.....	62 in.	42 in.	50 in.	50 in.	50 in.
Tractive effort, pounds.....	23,000	35,000	26,000	26,000	33,800
Tractive effort, momentary.....	49,000	40,000	46,000	50,000	60,000
Speed, m.p.h.....	17.5	8.5	16.4	16.4	12.2
Number of locomotives normally operated together:					
Freight.....	Obsolete	3	2	2	2
Passenger.....	1	.....	1	1	1

NOTE: Motor ratings on one hour basis.

light, because the grade west-bound traffic operates through the zone without requiring power from the steam locomotives except for starting. Trains, including steam locomotives are hauled intact as received from the adjoining division. The electrified service is very similar to helper locomotive service except that the road locomotives furnish no assistance. The ruling grade in the zone is 1.52 per cent while that of the remainder of the steam locomotive division is but 0.8 per cent. This requires the electric locomotive to be able to develop twice the tractive effort of the Mikado type of steam locomotives operated on this division, not only on account of the heavy grade but also because of the additional weight of the steam locomotive. Tests have shown that the resistance of steam locomotives when being moved by outside power is very large, amounting to 38 lb. per ton on a level tangent track. On the ruling grade the steam locomotive requires a drawbar pull that would handle nearly twice its weight in freight cars, or about 430 tons.



B. & O. ELECTRIFICATION—FIRST LOCOMOTIVE OF 1894 TYPE, NOW OBSOLETE, EQUIPPED WITH OVERHEAD SHOE-COLLECTOR





B. & O. ELECTRIFICATION—TWO 80-TON LOCOMOTIVES OF 1903 TYPE

The annual traffic now handled electrically is approximately 20,000,000 tons, comprising both freight and passenger trains. Five 80-ton and four 92- and 100-ton General Electric locomotives in use. Three of the former type are always operated together and used in freight service exclusively, while the latter type are operated singly in passenger service with trains up to 800-ton weight and two together with heavy passenger trains and all freight trains. Whenever more than one locomotive is required the units are operated with but one crew, using multiple-unit control. Three operating crews are employed on both the day and night shifts. Under present traffic conditions the average annual mileage of the 80-ton locomotives is 20,000 miles and heavier locomotives 28,000 miles.

The maximum train weights now handled electrically are 2000 tons net, a total, including steam and electric locomotives, of 2450 tons. It is now contemplated to increase the train weights to a total of 2840 tons including steam and electric locomotives, which will require a maximum tractive effort on the ruling grade of 112,000 lb. to be developed by the electric locomotives with an input to the motors of approximately 3000 kw. A speed of 11 m.p.h. will be maintained on the maximum grade.

In Tables II and III are shown data on traffic handled and costs of operation and maintenance in dollars per 1000 ton-miles (including the weight of the electric locomotive) and in dollars per 100 locomotive-miles (including light mileage) for the past six fiscal years. As would be expected from the grade conditions and the fact that traffic is handled electrically in but one direction, the power consumption is very large with consequent very high cost for this item. The cost of cur-

rent at the d.c. bus comprises the cost of purchased current and substation operation and maintenance.

MAINTENANCE PRACTICE

Except when actually handling trains or returning light the locomotives are kept on a siding at the west end of the zone. Inspection and running repairs are made at this point, the facilities consisting of only a track inspection pit. The general arrangement of tracks makes impracticable the construction of any inclosed shed into which the locomotives could be run for inspection purposes. Supplies and material for light repairs are kept in a near-by building which is also used by the operating crews and locomotive maintenance force. This force consists of a foreman, two repairmen and two cleaners, who handle all necessary inspection, running repairs and cleaning for the nine locomotives. Some of the locomotives have been kept in service a year without necessity for placing them under cover for repairs, and even the painting is done in the open. All shop repairs, with the exception of heavy accident repairs, are made in the general electrical repair shop located near the locomotive siding but not accessible to the locomotives under their own power. The shop is used primarily for repairs to motors and other electrical equipment for the entire system, a track into the building and a drop pit having been provided for the locomotives. Motors as well as the wheels are removed by means of the drop pit, as no crane is available. Tires are turned and renewed at the main steam locomotive repair shops which are located in Baltimore. Spare sets of wheels and axles have been provided so that the locomotives are not kept out of service while the tires are being turned.

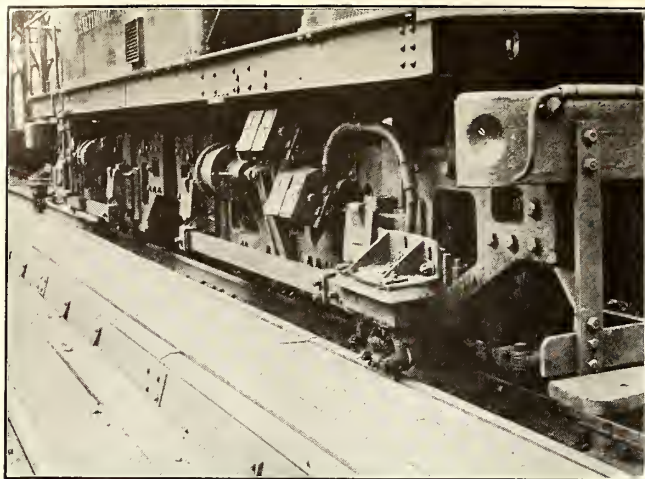
TABLE II—TRAFFIC DATA BALTIMORE & OHIO ELECTRIFICATION

Fiscal Year Ending June 30	1910	1911	1912	1913	1914	1915	July-Dec., 1915
Number of passenger trains handled.....	7,471	6,963	5,784	6,049	6,211	6,274	3,534
Number of freight trains handled.....	10,456	10,001	7,164	7,535	7,236	7,028	6,887
Mileage electric locomotives.....	183,493	213,366	192,774	191,124	183,434	190,000	111,322
Ton-miles, including electric-locomotive.....	49,224,569	53,652,332	55,286,817	57,099,821	54,169,376	58,539,501	33,881,050
Gross watt-hours per ton-mile.....	109	92	93	118	103	101	92.5
Cost of current per kilowatt-hour at d.c. bus.....	\$0.0185	\$0.0182	\$0.0143	\$0.015	\$0.0139	\$0.0126	\$0.0113

TABLE III—COST OF OPERATION AND MAINTENANCE OF ELECTRIC LOCOMOTIVE SERVICE, BALTIMORE & OHIO RAILROAD

	1910		1911		1912		1913		1914		1915		1916	
	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles	Per 1000 Ton-Miles	Per 100 Loco-motive-Miles
Trainmen's wages.....	\$0.34	\$9.15	\$0.336	\$8.43	\$0.328	\$9.40	\$0.325	\$9.68	\$0.327	\$9.67	\$0.308	\$9.50	\$0.260	\$7.88
Power.....	1.46	39.10	1.320	33.20	1.060	30.30	1.155	34.40	1.215	35.80	1.015	31.20	.785	23.80
Third-rail and feeder maintenance.....	.293	7.85	.109	2.74	.230	6.58	.205	6.12	.142	4.18	.137	4.20	.115	3.48
Oil and waste.....	.007	0.18	.007	.202	.006	.18	.007	.21	.007	.21	.007	.20	.005	.16
Miscellaneous supplies.....	.002	.05	.002	.048	.001	.02	.002	.06	.002	.06	.001	.03	.001	.03
Inspection, repairs and cleaning.....	.203	5.44	.201	5.05	.197	5.64	.213	6.35	.178	5.27	.170	5.24	.163	4.95
Totals.....	\$2.305	\$61.77	\$1.975	\$49.66	\$1.822	\$52.12	\$1.907	\$56.80	\$1.871	\$55.49	\$1.638	\$50.37	\$1.329	\$40.30





B. & O. ELECTRIFICATION—THIRD-RAIL PROTECTION AT PASSENGER STATION—INTERIOR OF MOUNT ROYAL SUBSTATION

The locomotives have been in very severe service. With the increase both in weight and number of trains handled it has been necessary to operate them considerably in excess of their rated capacity, as it is not always possible to proportion the motive power to the train weights. They have, however, withstood the severe demands remarkably well, the most serious trouble being a number of armature failures on the two latest types. Under heavy overloads, amounting to 700 amp. per motor, some trouble has also been experienced with the brush-holders and certain of the contactors, but otherwise this type of locomotive has given excellent satisfaction.

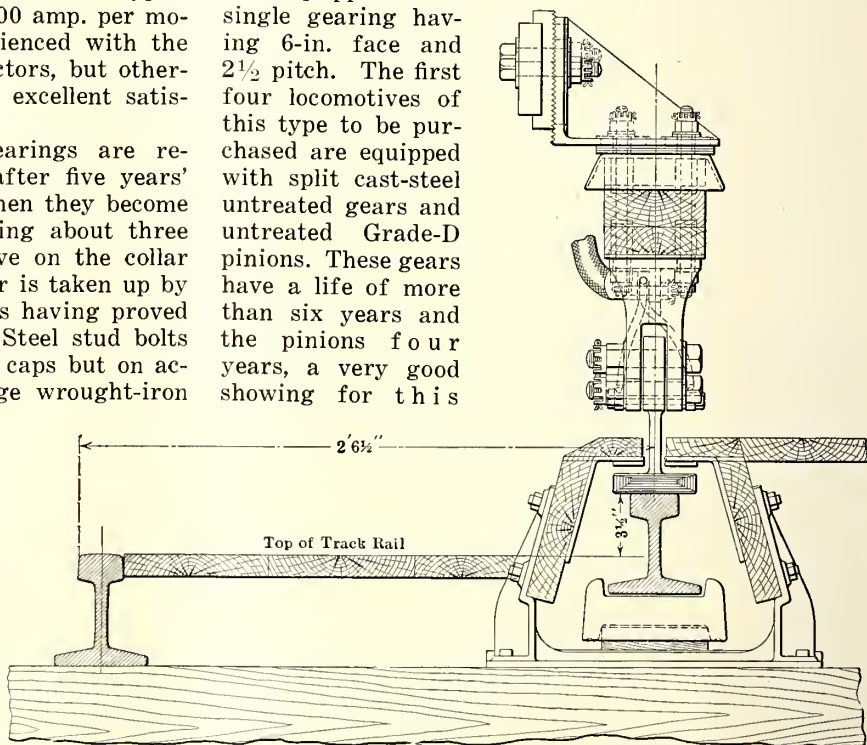
On the GE-209 motors, armature bearings are renewed when worn  $3/64$  in. large or after five years' service. Axle bearings are renewed when they become  $1/8$  in. large, which occurs after running about three years. Wear has been rather excessive on the collar end, and after reaching  $1/4$  in. this wear is taken up by building out the ends with babbitt, this having proved more satisfactory than brass collars. Steel stud bolts were originally used to secure the axle caps but on account of the rather frequent breakage wrought-iron studs have been substituted and these have eliminated the trouble.

The mechanical features of the two latest types of locomotive, except for some minor details, have given entire satisfaction. When the locomotives were first placed in service the cast-iron hub liners, which were used to take up the side play at the driving wheels, showed excessive wear, some lasting less than a day. They were replaced with bronze liners which are now lasting more than two years. Some trouble was experienced by breaking of equalizer hangers which was overcome by re-designing them. Tire wear on the first locomotive of the 1910 type was 50,000 miles before receiving the first turning. Flange oilers were applied with the result that with the original tires on the other locomotives of this type from 70,000 miles to 75,000 miles were obtained up to the first turning. However, somewhat less mileage has been secured subsequently. The older locomotives have also been equipped with flange oilers, but the average tire mileage between turnings is but 35,000, this difference being attributed to the poor riding qualities of the rigid wheelbase type of construction on this class of engine.

The 1910 and 1912 types of locomotive are equipped

with G. E. grade F twin gears and pinions. After six years of service under the severe operating conditions experienced, but very little wear has occurred on either gears or pinions and in no respect have they given any trouble. This has clearly demonstrated the advantage of the twin-gear type of drive for heavy, low-speed service. The locomotives of the 1903 type

are equipped with single gearing having 6-in. face and  $2\frac{1}{2}$  pitch. The first four locomotives of this type to be purchased are equipped with split cast-steel untreated gears and untreated Grade-D pinions. These gears have a life of more than six years and the pinions four years, a very good showing for this



B. & O. ELECTRIFICATION—THIRD-RAIL PROTECTION AT PASSENGER STATIONS

type of gearing in such heavy service. The life of both armature bearings and axle bearings is but about one-third of that of the bearings on the twin-gear motors. More or less trouble has also been experienced with hot boxes on armature bearings at the pinion end.

Table IV shows the mileage made by electric locomotives and cost of maintenance over a period of six years and also a statement showing the cost separated between electrical and mechanical repairs for the past calendar year. The maintenance of the 1910 and 1912 types is abnormal on account of the number of armature burn-outs. These were caused by overloading the motors while handling trains beyond their capacity. In addition the railroad has no facilities for repairing arma-



TABLE IV—COST OF MAINTENANCE OF ELECTRIC LOCOMOTIVES, BALTIMORE & OHIO RAILROAD

Fiscal Year Ending June 30	Number in Service	1910	1911	1912	1913	1914	1915
Class 1903—1906 mileage . . . . .	5	125,678	135,148	59,962	52,780	72,803	79,844
Cost per 100 locomotive-miles . . . . .		\$3.26	\$4.69	\$6.36	\$6.44	\$4.22	\$5.78
Class 1910 mileage . . . . .	2	12,669	64,464	50,060	53,362	47,952	55,014
Cost per 100 locomotive-miles . . . . .		\$4.15	\$3.90	\$5.95	\$4.66	\$4.40	\$4.59
Class 1912 mileage . . . . .	2	.....	.....	11,716	57,273	45,967	55,247
Cost per 100 locomotive-miles . . . . .		.....	.....	\$4.58	\$4.09	\$4.70	\$4.20

Detailed Statement of Cost of Repairs for Year Ending Dec. 31, 1915

Class 1903—1906	Cost per 100 Locomotive-Miles		Total
	Electrical	Mechanical	
Labor . . . . .	\$2.21	\$1.18	
Material . . . . .	.45	.77	
Total . . . . .	\$2.66	\$1.95	\$4.61
Class 1910—1912			
Labor . . . . .	\$1.76	\$0.80	
Material . . . . .	1.43	1.02	
Total . . . . .	\$3.19	\$1.82	\$5.01

tures of this size and the expense has been heavy although the total charges, considering the service, have been low.

Reconstruction of the various features of the Baltimore & Ohio electrification to meet conditions of modern traffic has been carried out under the direction of J. H. Davis, electrical engineer of the railroad.

## Making a Freight Agent of the Employee

A Personal Letter from E. H. Maggard to Employees Suggests Methods of Co-operation to Increase Freight Traffic

A CONSTRUCTIVE plan by which the railway employee becomes an agent for the development of reciprocal patronage between the local merchant and the local transportation company, has recently been evolved by E. H. Maggard, general manager Petaluma & Santa Rosa Railway, Petaluma, Cal., in the form of the following letter addressed to employees:

TO EMPLOYEES:

The Petaluma & Santa Rosa Railway is dependent entirely upon the business it transports for the money necessary to pay its employees.

Its success in all of its detail is coincidental with the quantity of freight and the number of passengers its facilities handle, and thus you can readily understand how much your individual success and the permanency of your efforts hangs upon the development of business.

What can you, and what will you, do to help? Are you interested in the matter? Does the situation suggest that you are in a position to assist in getting a greater volume of traffic for this line and thus make its operation more secure?

Some 200 persons are on the payrolls. Each is purchasing the articles necessary to a comfortable existence for himself and family. These articles are sold by merchants who must have the majority of them transported from field or factory. Why should they not be transported over the line in which you have an interest?

It would seem that the proprieties would not be violated if you in your patronage of the merchant or other business man, ascertained to your satisfaction that the merchant was in turn a patron of the institution you serve and which serves you.

Reciprocity is a legitimate element in commercial life—a business ethic. One gives return for what one receives, and to suggest within a reasonable degree that your regular and consistent patronage was entitled to a reciprocal return, would merely carry out this idea individually, and to suggest also that such reciprocal return be made to the company you serve, would indicate nothing more than a commendable desire to uphold the best interests of the employing concern.

The present depressed condition of trade has enforced many economies in all revenues of business, and this line, unfortunately, has not escaped the common lot. A united effort on the part of all of us may accomplish much good, and where we least expect it. As an experiment, the suggestion as above should prove interesting; as an adjunct to our soliciting force, we are satisfied that the result would be more than satisfactory.

Will you not consider these suggestions, and if they appeal to you as indicating a method whereby you can individually help the company that is enabling you to serve yourself and family, give the matter a trial, or, better still, adopt it as the permanent feature of your work?

Any information in regard to prospective movement of freight or passengers will be gladly received by any agent of the company or traffic department. A supply of cards to be used in this connection can be obtained from the general manager's office. Call or write for a few and let us get the good work started.

Sincerely yours,

E. H. MAGGARD, General Manager.

In order to give a more official character to the solicitation of patronage, agency cards like that reproduced in the accompanying illustration have been issued to the employees. Mr. Maggard reports that the employees have taken a deep interest in the matter. The day following the mailing of the letters more than twenty merchants called at his office for further information, stating that employees trading with them had requested

**PETALUMA @ SANTA ROSA RY. CO.**

**OVER NIGHT SERVICE**

— BETWEEN —

San Francisco, Petaluma, Sebastopol, Santa Rosa

**LIVE TOWNS** connected by **LIVE WIRES**

*We respectfully solicit your patronage.*

**INSTRUCT SHIPMENT BY**

**PETALUMA & SANTA ROSA RY.**

Presented by..... Employee

EMPLOYEE'S AGENCY CARD FOR SOLICITING PATRONAGE

that they patronize the companies, and were seeking information as to the best way to protect themselves against shippers disregarding their routeing instructions. It seems that in the past some Eastern dealers had been making a practice of ignoring routeing instructions furnished by consignees and that consignees were paying very little attention to this fact. The solicitation of the railway employees resulted in their giving the matter more careful consideration.

## Iron Ore Production in 1915

The iron ore mined in the United States in 1915 reached the great total of 55,526,490 gross tons, the greatest output made in any year except 1910 and 1913. The shipments in 1915, namely 55,493,100 gross tons, valued at \$101,288,984, were a little less than the quantity mined. The quantity mined in 1915 was an increase of 14,000,000 tons over the output in 1914. The increases in quantity and in value of iron ore shipped amounted to about 40 and 41 per cent, respectively. The average value per ton in 1915 was \$1.83, compared with \$1.81 in 1914. These figures, which are just made public by the United States Geological Survey, were prepared by E. F. Burchard, who states that the production of iron ore from the Lake Superior district alone in 1916 will possibly be 60,000,000 tons, and that there will probably be an increase in price of 70 cents to 75 cents a ton for this ore. Five states—Minnesota, Michigan, Alabama, Wisconsin and New York—which have in recent years produced the largest quantities of iron ore, occupy in 1915 their accustomed places. Only one of these states—New York, produced less than 1,000,000 tons in 1915.



# Heating Boilers for Electric Locomotives

The Type of Oil-Fired Boiler for Supplying Steam to Heat Passenger Trains Which Has Been Developed on the New York Central Railroad Evaporates 2200 Lb. of Water per Hour and Occupies a Floor Space 4 Ft. in Diameter

ALTHOUGH the problem of supplying steam heat for passenger trains on an electrified trunk-line railroad may seem to be a secondary feature in electric locomotive design, as a matter of fact it has frequently caused quite as much trouble, through lack of a satisfactory solution, as any of the primary considerations of electric operation. There has been practically nothing in the way of past experience to serve as an aid in arriving at a suitable equipment, because the question of steam supply for heating cars has never been raised in connection with the operation of railroad trains that are drawn by steam locomotives. Consequently, the improvements in steam heating boilers for electric locomotives have been made by slow and costly methods. On the New York Central Railroad's electric zone, however, these efforts have resulted in the development of an oil-fired boiler the performance of which is satisfactory, notwithstanding the restrictions of space and weight imposed upon its designers, and through the courtesy of E. B. Katté, chief engineer of electric traction New York Central Railroad, an outline of the various stages of the development has been made available for publication in the following paragraphs.

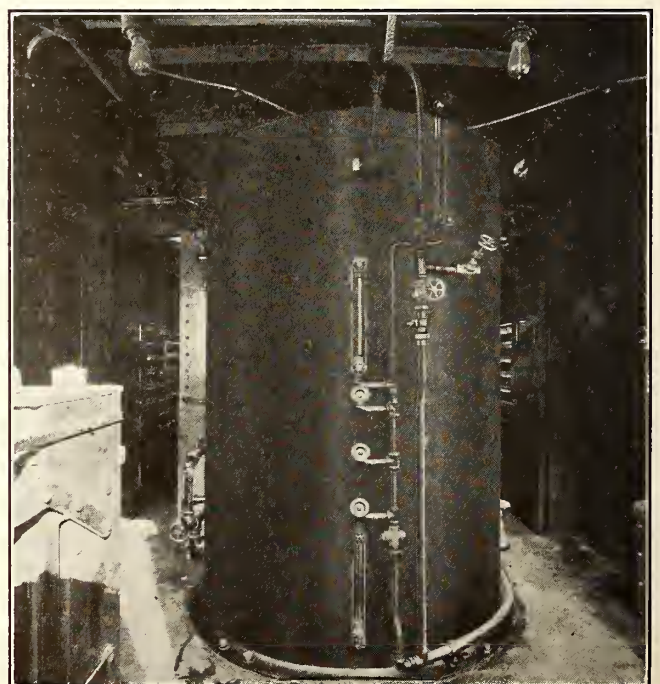
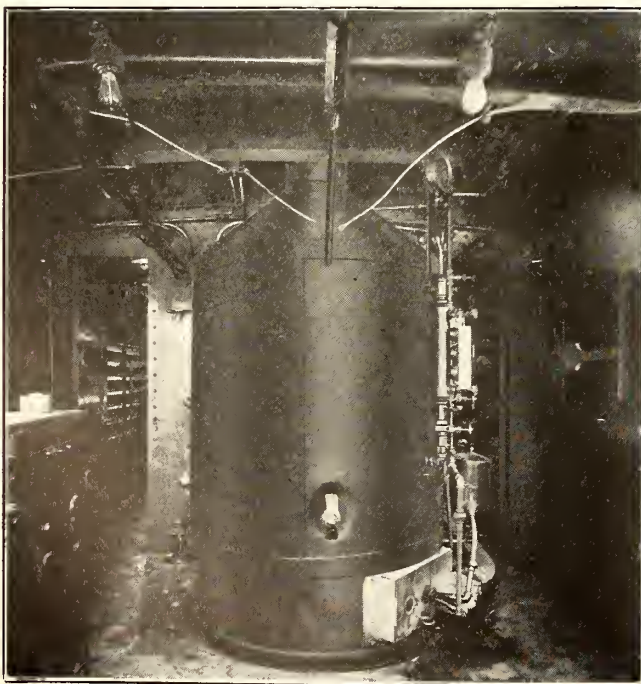
## EARLY DESIGNS

The type of boiler originally installed on the New York Central electric locomotives was approximately 22 in. in diameter and 16 in. high. It carried a pressure of 80 lb., had 130 sq. ft. of heating surface, and was rated at 400 lb. of steam per hour. This capacity was found to be quite inadequate, and as the necessity for providing heat for the train was a pressing one, an elaborate series of experiments was inaugurated by the railroad, with the idea of providing a remedy for the difficulty. Prominent among the

complications involved in the problem was the necessity for smokeless operation of the boiler, so that the first undertaking was to devise a burner by which the boiler capacity could be increased without making smoke. This was done by enlarging the steam-supply pipe to the burner so that ample high-velocity steam would be available at the burner nozzle and making other improvements mentioned in later paragraphs.

In this way the capacity was raised to 800 lb. of steam per hour, so that seven suburban coaches could be heated in average winter weather. To heat the through trains of steel cars, however, it was necessary to crowd the boiler to such an extent that the flame actually was carried up the stack. Owing to the fact that the boiler had a width of bridge between the tube of only  $\frac{3}{16}$  in., this forced evaporation caused the tubes to get very hot at both top and bottom, the upper part of the tube being surrounded only by steam and the bottom suffering from the exaggerated effect of the radiant heat upon the crown sheet or bottom flue sheet. Naturally, this resulted in leaking tubes, in addition to the lack of capacity in severe weather or with very long trains. Further mechanical troubles occurred because the absence of water legs at the bottom of the boiler permitted scale to accumulate around the lower portions of the tubes and because the seams in the boiler shell displayed a distinct tendency to leak on account of the strains which were set up by the sudden changes in temperature when the boilers were started up or shut down.

In consequence, a new design was developed. This had 266 sq. ft. of heating surface and produced an evaporation of 1600 lb. of water per hour, the design being purely experimental and appearing in only one boiler actually placed in service. With the new type, how-



STEAM HEAT BOILERS—INTERIOR VIEWS OF ELECTRIC LOCOMOTIVE CABS SHOWING HEATER AND STORAGE TANK

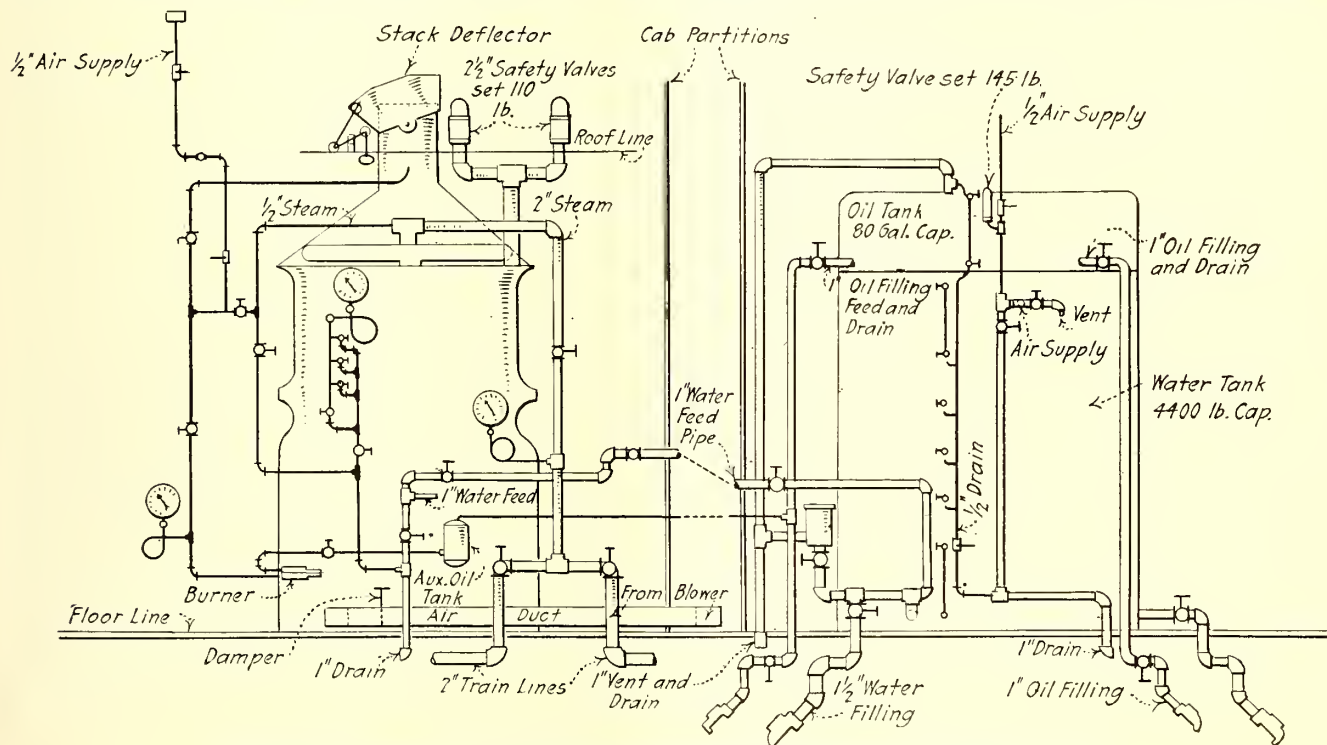


ever, there was obtained an idea as to the size of boiler needed to supply the demand for steam to heat the largest steel passenger coaches used on the railroad, this figure running as high as 250 lb. per car when the outside temperature approximated 10 deg. Fahr., and 200 lb. at 16 deg., so that a ten-car train might easily require 2000 lb. of steam per hour.

The experimental boiler suffered from several of the limitations of the original design in that the absence of water legs and the existence of very small bridges caused leaking tubes, while the straight sides of the boiler shell made trouble on account of expansion at the seams. These difficulties were, in fact, magnified over those that existed with the smaller boiler which had preceded the experimental design, and as a result the boiler used on main-line engines was designed. This has 436 sq. ft. of heating surface and it can actually evaporate 2200 lb. of steam per hour from feed water at about 55 deg. Fahr., the steam pressure being 110 lb. It has ample capacity to keep a train warm, but

diameter. They are placed upon  $\frac{7}{8}$ -in. centers, thus increasing the width of bridge to  $\frac{3}{8}$  in. Copper, it may be said, was used for the tube material in preference to steel because it had been found that the steel tubes pitted badly. The shell is lagged 4 in. thick around the main drum and 1 in. around the water leg, a Russia iron jacket covering the boiler up to the smokebox, which fits snugly over the whole. The lagging conceals the large joints in the shell and imparts a tank-like appearance to the boiler.

From this it will be seen that the boiler is really of the standard fire-engine type. The water level is such that approximately 1 ft. of the top of the tubes is exposed to steam and not to water, so that it acts as superheating surface. In addition, there is a dry plate fitting loosely on the tubes, and located  $2\frac{3}{4}$  in. below the top head of the boiler, to prevent sudden drafts of steam from carrying the water out of the boiler. Superheated steam is needed for two blowers in connection with the equipment, one of them being used as an atomizing



STEAM HEAT BOILERS—DIAGRAMMATIC ARRANGEMENT OF HEATER AND STORAGE TANK

of course it cannot be economically used to heat up a cold train. The evaporation works out to about 5 lb. of water per square foot of heating surface, with a ratio of  $8\frac{1}{2}$  lb. of water per pound of oil burned. The improvements in design in general, are the result of co-operative action on the part of the electrical department of the railroad company, J. F. Otis of the Oswego Steam Carriage Boiler Company, who designed all three of the above-mentioned types of boilers, and B. C. Dakin, special inspector, who is in direct charge of the maintenance and operation of the steam-heat boilers on the electric locomotives.

FINAL DEVELOPMENT

The present standard design is most prominently characterized by a water leg 18 in. deep and  $2\frac{1}{2}$  in. wide, as well as by two expansion joints in the length of the shell, the latter being formed in two parts, of which the ends are flanged outward and riveted to form a joint of the well-known bellows type. Inside of the shell are 1380 vertical copper tubes 30 in. long, these being of  $\frac{1}{2}$  in. outside diameter and  $\frac{7}{16}$  in. inside

jet for the fuel-oil burner, and the other being located at the base of the stack above the tubes so as to create a strong induced draft. They consume about 6 per cent of the steam made by the boiler. Most of the superheat for the steam discharge is effected by the exposure of the top portion of the tubes to steam, and a small additional amount is provided by a flattened casting provided with diaphragms in the middle and arranged in the form of a cross above the tubes to give a total length of 8 ft. Normally, about 15 deg. of superheat is obtained, but it may be said here that no burning has been in evidence at the top of the tubes notwithstanding the fact that they are not surrounded with water. A higher degree of superheat would obviously be undesirable because of the effect on the steam hose and couplers.

Since all of the boilers are washed out once each week, there have been provided three nipples so located in the shell that they direct the wash water onto the crown sheet. In addition, there are three handholes in the water leg. On the latest type of boiler, of which twenty-eight have been in operation for about

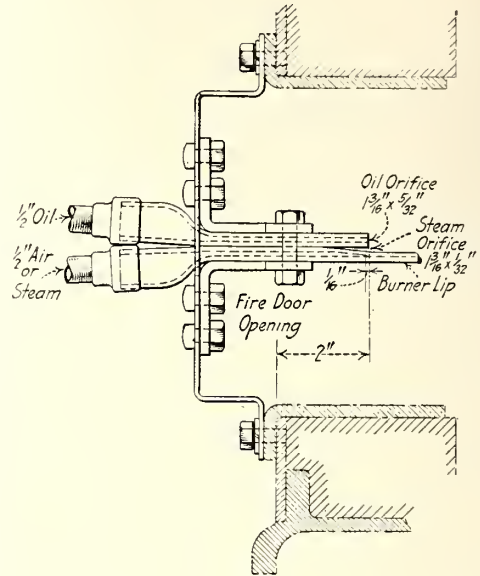


three years, only one copper tube has been replaced to date. There were, however, several sets of steel tubes which pitted and had to be removed. On the original boilers, tube replacements are quite common and these are effected by cutting off the top of the tube flush with the top tube sheet, then screwing a 1/2-in. tap into the lower end of the tube so that it holds firmly, and then driving the tube out through the bottom sheet by blows upon a steel rod run through the tube and resting against the tap that is screwed into the bottom, a light air hammer being used for this purpose. The whole operation takes about three minutes per tube, including installation of a new tube.

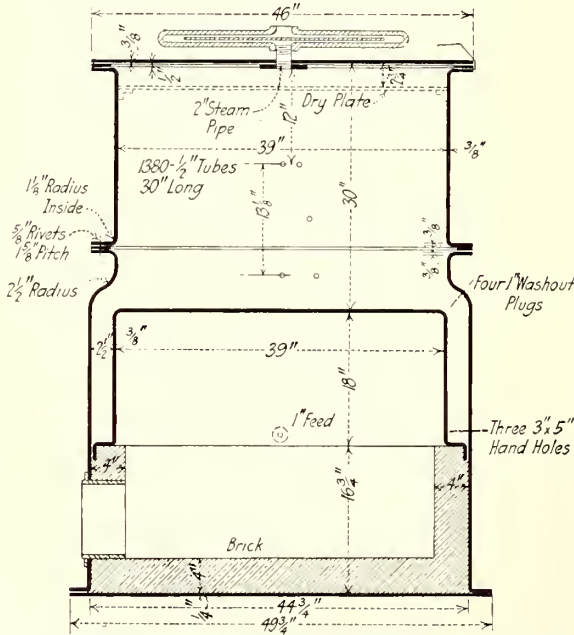
When tubes are inserted they are expanded only by driving a slightly tapered pin into the tube end and turning this by hand, the surface of the expander being oiled. Experience with the original boilers showed that, when the tubes began to get thin from being repeatedly expanded after leaking, an effective remedy could be applied in the form of steel thimbles inserted into the tube ends. These thimbles were 1/2 in. long and of a scant 1/2 in. outside diameter, being tapered at the end so that they could be inserted into the tubes. They were used only as a last resort before retubing, but were found to be sufficient to spring the copper outward enough to form a shoulder just inside of the tube sheet, thus holding the tube tightly in place and preventing leaking for some time. No thimbles have been installed in the new boilers up to the present time because of the practical elimination of difficulty with leaking tubes.

On top of the boiler, as installed in the locomotive, is a sheet-iron smokebox, or hood, which connects the boiler and the stack, and the design of this exerts a

This bonnet swings with the wind caused by the movement of the locomotive, and its presence makes at least 15 per cent difference in the evaporating capacity of the boiler by aiding the products of combustion to get out of the stack. The principle upon which it has been used is that, at very high speeds, the great disturbance of the air makes a blanketing effect across the top of the stack, choking off the outlet and tending to hold the gas in the boiler. The construction of this



STEAM HEAT BOILERS—FUEL-OIL BURNER



STEAM HEAT BOILERS—CROSS SECTION OF LATEST TYPE OF BOILER

marked influence upon the steaming capacity of the boiler. On the existing equipment the slope of the hood is approximately 45 deg., the slope beginning about 4 in. above the top flue sheet, since the tubes have to be blown out with compressed air after each round trip and it is advantageous to have ample room for the escape of the soot. The hood is lined on the inside with 1 in. of asbestos board, and no indications of burning have been in evidence.

Another feature of very material importance is the use of a deflector or bonnet on the top of the stack.

bonnet is shown in two of the accompanying line cuts, of which one shows the original form, in which the sides were left open, and the other shows the present form with the sides inclosed to protect against the action of side winds. The bonnet has an open top, and from the cut it will be seen that it protects the front edge of the stack orifice from wind pressure and tends to produce a vacuum at the opening to the rear when the train is moving fast. The movement of the bonnet to correspond with the direction of the engine may be effected by hand from the cab, but it swings automatically in accordance with the direction of the train whenever the wind pressure becomes high enough to move it.

Complete with storage tank and piping, but without water and oil the heater equipment weighs 5850 lb. To remove the boiler by lifting it through a hatchway that is provided in the cab roof involves about three hours work on the part of three men. Four men can reinstall it in about seven hours, this including testing and firing up. The boilers are left in place on the locomotives the year round, being removed only when heavy repairs are necessary. Two extra boilers are kept in stock to replace any of the twenty-eight large boilers in service if they need repairs.

OIL BURNING FACILITIES

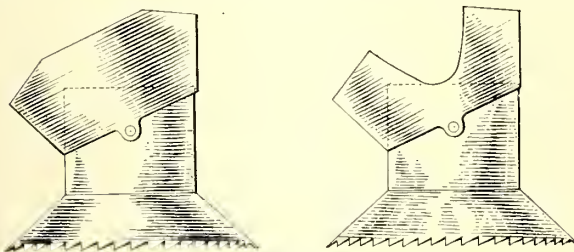
The burner for the oil fuel that is used with the boiler has been practically standard for several years, consisting of a pair of flattened pipes of which the upper one contains oil and the lower one steam. The openings in both cases are 1 3/16 in. wide, the oil opening being 5/32 in. high and the steam opening 1/32 in. high. Below the steam opening there is a lip about 2 in. long upon which surplus oil may flow and still be subject to the atomizing action of the steam jet, this lip being permitted because the burner is designed solely for use with Eastern oils having a paraffin base and a



thin consistency. Of course, with thick Western oils, which have an asphalt base, the use of this lip obviously would not be possible because of the chance of the oil piling up and interfering with the steam jet. In fact, it may be said in general that Western oil is so thick that it has to be heated in cold weather, whereas the paraffin-base oil for which the equipment in question is designed may be used in the coldest weather without any special arrangements to keep it in a fluid condition.

Originally, the burner was so designed as to extend into the firebox for several inches, the firebox door being left open. It was found, however, that there was need of a greater supply of air than that drawn in at the door, and in consequence provision was made to close the firebox door during operation and to apply forced draft through a 5-in. square duct from the casing of the fan which supplies air to ventilate the main propulsion motors of the locomotive. Also, since it was found that a long flame was preferable to a short one, the nozzle of the burner was moved back until the orifice was only 2 in. inside of the outside sheet. The limiting feature in the position of the orifice is the drip of oil upon the hearth.

The firebox is formed from a cast-iron base upon which the boiler rests. Height of combustion chamber is an important consideration, and the standard used with the type of boiler in question is 27 in. measured between the burner and the bottom flue sheet of the boiler. The burner itself is about 4 in. above the fire-



STEAM HEAT BOILERS—PRESENT TYPE AND ORIGINAL TYPE OF STACK DEFLECTOR OR BONNET

box floor which is insulated from the floor of the locomotive by a 4-in. lining of fire clay. The firebox sides are lined with 4 in. of fire-clay cement molded in a form and having an expanded-metal reinforcement of  $\frac{3}{4}$ -in. mesh that is located  $\frac{3}{4}$  in. from the inside surface. A single fire brick, which is, as a matter of fact, an arch brick from a steam locomotive, is set directly opposite the burner so that the flame will impinge upon it, this being 18 in. high and 10 in. wide. The distance from the burner to the back wall of the firebox is 38 in. and it is aimed to have all of the combustion take place within this space.

The fire door, as mentioned above, is normally kept closed during operation, the air for combustion being supplied by a forced draft opening 5 in. square which is connected to the main blower for the propulsion motors. In the duct is a gate which may be adjusted in any desired position to suit the air requirements, the arrangement consisting of a simple latch such as is commonly used upon passenger-car windows. The fire door is 9 in. by 18 in. in dimensions, so that if desired a man can get his shoulders into the firebox to repair any slight leaks which may occur in the flues, although in general most of the leaking appears at the top flue sheet. The door itself is lined with asbestos cloth  $\frac{1}{8}$  in. thick, together with a heavy cast-iron plate  $\frac{1}{2}$  in. thick, the whole being hung upon a door plate of sheet iron. A peep hole is provided at one side so that the condition of the flame may be seen without opening the door. The firebox lining, it may be said, lasts for ap-

proximately two years before renewal is necessary, although severe bumps between engines sometimes knock down the lining before that period has elapsed.

#### ARRANGEMENTS ON LOCOMOTIVE

On the locomotive the general arrangement is that the heater proper is located in the cab at one end of the locomotive, while a storage tank for oil and water, approximately the same size, is located in the cab at the opposite end. The storage tank is made up with welded joints, having a bumped bottom head and a crowned top, together with a crowned partition between the oil and the water. It contains 80 gal. of oil and 4400 lb. of water, the latter being kept under 135-lb. pressure from the air-brake system. This pressure acts in lieu of an injector or feed pump, these auxiliaries having been eliminated with the idea of attaining the utmost possible simplicity. The oil is not under pressure, but is located in the upper part of the storage tank so that it can drain by gravity to the burner at the other end of the locomotive. This gravity flow was adopted because pressure on the oil might cause it to be sprayed out at any small leak in the piping and thus offer a very material fire hazard. With the gravity feed nothing more than a slow drip can take place even at a large leak.

The oil tank is replenished with oil at locomotive terminals by means of an air-hose connection extending through the locomotive floor, this being connected to outside storage tanks which are under air pressure. For filling the water tank the same plan is followed, and in addition there is a connection in the cab which is made in a receptacle, this being provided with a drip to ground so that the cab may be kept dry at all times. The storage tank is held in position by turnbuckle guy rods to the cab frame. Other features of its equipment include a safety valve in the air line that supplies pressure to prevent dangerous results in case the pressure on the air-brake system should get away from the control of the air-pump governor, and there is also a check valve to keep water from backing into the air-brake system in case the tank should be overfilled. Two pop valves are connected to the boiler, one being set to blow at 110 lb. pressure, and the other at 115 lb. Both valves are located on the roof of the cab.

The water pipe from the storage tank at one end of the locomotive is extended to the boiler at the other and in a small air duct that has an electric heater at each end. When the locomotive is in motion, air travels through the duct from the rear to the front cab. For this reason the duct heaters are so connected with the cab heater circuits that the duct heater at the rear of the duct is in circuit with the cab heaters in the front cab. The latter rig was required because the space between the two cabs on the New York Central locomotives is normally at atmospheric temperature, and without a heated duct the water pipe between the two cabs might freeze. The duct is made slightly high in the center and a small ventilator is provided at that point so that circulation of the warmed air is always bound to take place even when the engine is stationary.

The oil supply is carried from the oil storage tank in a pipe located inside of a hand rail which guards the passageway between the two cabs at one side of the locomotive. As before mentioned, the paraffine-base oil that is used for fuel for the heaters on the New York Central Railroad does not become unduly thick during cold weather, and therefore no provisions for heating it are necessary. There is a small supplementary oil tank located alongside of the boiler, the object of this being to keep the burner from temporarily losing its oil supply when surges in the liquid that is contained in



the supply pipe are caused by sudden stops which may be made by the locomotive. These surges in the oil supply, it may be said, initially caused quite a little trouble because the flame would go out when the flow of oil was interrupted, and when it started again, a series of explosions would follow in rapid succession.

#### OPERATION

When the heater is being started up the first operation is to turn compressed air into the jet, or blower, that is located at the base of the stack to produce induced draft, compressed air from the main air reservoir being used for this purpose only during the starting period. Oil is then turned on at the burner, and immediately afterward compressed air is turned into the nozzle, which normally supplies the atomizing steam jet for the burner. The oil lights at once in the firebox, only a piece of burning paper being necessary to ignite it. These preliminary operations are made with the fire doors open, but as soon as the burner is operating in good shape, air from the motor-ventilating fan is turned into the firebox and the fire doors are closed. This cuts down the roaring noise that is a prominent feature of operation with the door open.

The extraordinary rapidity of action is indicated by the fact that it is possible to have 10-lb. steam pressure from cold water in four minutes, and 110 lb. of steam in ten minutes from the time of starting. When the steam pressure reaches approximately 80 lb., a change-over is made from air to steam for the burner and stack blower. The procedure is to drain the steam line and then to turn on a small amount of steam, subsequently turning off all of the air and then turning on all of the steam. It is customary to use a pressure ranging between 30 lb. and 50 lb. of steam at the burner, and it is also customary to turn on more oil after steam is substituted for air in the atomizing nozzle, apparently because the steam improves the jet capacity. The steam-jet blower at the base of the stack, which has a 3/16-in. opening with a flaring taper and which is also changed over from air when the boiler has become reasonably hot, has the pressure at the nozzle so adjusted by hand as to keep a moderate draft in the firebox at all times.

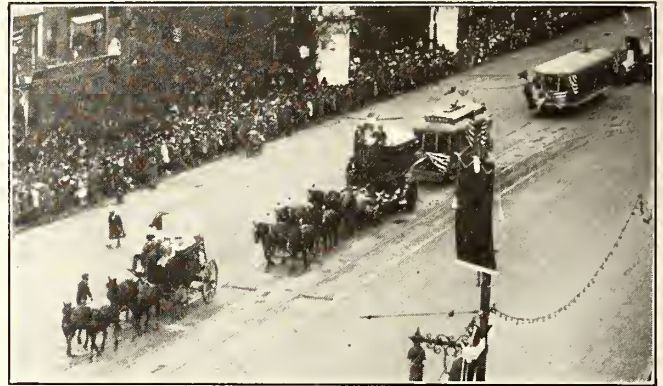
The appearance of the firebox, it may be said, affords a definite indication of the action of the burner. A dirty yellow flame in the firebox is invariably a sign of smoke at the stack, the desirable condition being an orange color with a tendency toward white. Too little oil involves a loss of capacity and is indicated by a white flame in the firebox and a series of explosions instead of a low roar. Too much oil always produces a dirty yellow flame in the firebox and causes smoke at the stack. Consequently, it is not necessary for the fireman to watch the stack to see whether or not it is smoking.

To shut the heater down the procedure is first to stop the supply of oil to the burner and then the supply of steam. The supply of low-pressure air to the firebox is then cut off, but the blower in the stack is kept on lightly for some minutes to keep out of the cab any smoke due to unburned oil in the firebox.

In the first eighteen months of the compensation law's operation in the State of New York there were 337,500 industrial accidents reported to the commission, resulting in 56,374 cases in which claimants were entitled to awards. The temporary total disability cases comprised 88½ per cent of all cases filed. The average medical cost for each injury reported was \$10.95. There were 1214 death cases, in 81 per cent of which there were dependents. In 9 per cent of the death cases there were alien dependents.

## Railway History Illustrated in Newark Celebration

There is at present in progress in Newark, N. J., an elaborate celebration of the 250th anniversary of the founding of the city. Pageants, parades and other forms of entertainment follow each other in rapid succession and will continue to do so all summer. Naturally the Public Service Railway is an important factor



TRANSPORTATION IN 1766, 1866, 1896 AND 1916, AS ILLUSTRATED IN NEWARK'S 250TH ANNIVERSARY CELEBRATION

in the celebration, and by a fortunate coincidence the new \$6,000,000 terminal was opened on the eve of the opening day.

On Founders' Day, the 250th anniversary day, a great parade was a central feature. In this the railway demonstrated the history of the industry by means of a series of vehicles representing transportation in 1666, 1766, 1866, 1896 and 1916 respectively. All but the first, an Indian vehicle, consisting of a pair of poles, each with one end carried by a horse and the other trailing on the ground, are shown in the accompanying illustration. The railway company spared no trouble in obtaining the "real thing" for this instructive exhibit.

## Ventilation Problem on New York Subway

Upon an opinion of Commissioner Henry W. Hodge, the Public Service Commission for the First District of New York, has decided the subway grating question in relation to the Broadway subway in Manhattan. The gratings were to be used for ventilating the subway, but business men and civic organizations objected to their use along the principal shopping and theatrical section of Broadway, and many suggestions for their elimination were made to the commission. As a result of the adoption of the opinion of Commissioner Hodge, all the sidewalk gratings will be eliminated between Twenty-ninth and Thirty-fifth Streets and between Thirty-ninth and Forty-sixth Streets. It was found impossible to eliminate the gratings from the sidewalks between Thirty-fifth and Thirty-ninth Streets, because of the long distance to the nearest ventilating chambers and the inability to pump air over these long stretches effectually. The gratings are now to be placed in park and other open spaces along the roadway in the stretches named. This solution of the grating problem relates to points where the subway work is not yet completed. Commissioner Hodge stated that he did not believe that completed work should be ripped up for the purpose of removing gratings. The commission has given a great deal of study to the grating problem, and it is hoped that the plan just adopted will work out successfully.



# Electric Locomotive Drives

The Author Discusses in Detail the Reasons for Using Quills on Driving Axles and Frame-Mounted Motors with Armatures of Increased Length, as Well as the Advantages Obtained from the Use of Gear Reductions and Side Rods

By F. H. SHEPARD

Manager Heavy Electric Traction Division, Westinghouse Electric & Manufacturing Company

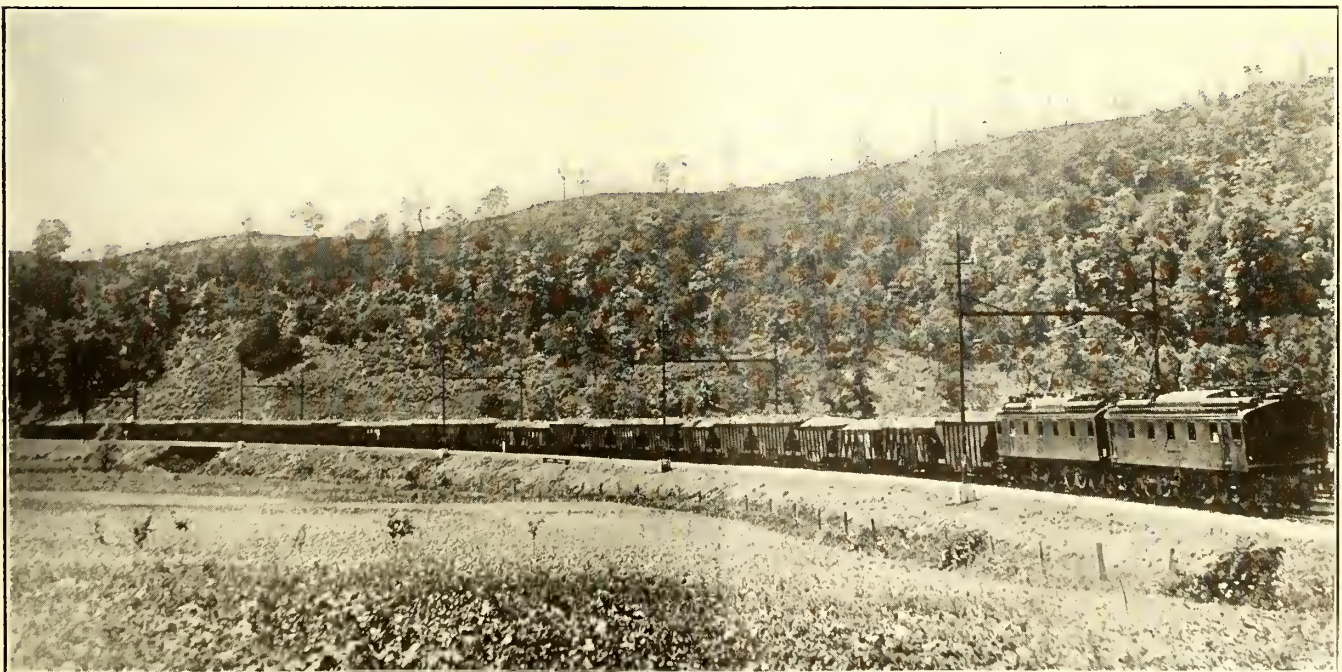
**T**HE drive for an electric locomotive, or that means whereby the torque of the motor is transmitted to the driving wheels, constitutes one of the most involved problems in electric locomotive design, although at first thought nothing appears to be simpler than the transfer of rotary motion between motors and driving wheels, which cannot be separated, because of the very nature of the locomotive construction, by more than a few feet. Nevertheless, the question is one that has been agitated for more than a decade, and even to-day radical innovations in design are in process of development.

The reasons for this condition are many. Indeed, they may even be traced back to the earliest history of steam railroading, wherein the practical standardization of rolling stock provided little latitude for broad features of general design. Since the clearances of trunk line railroads have been designed for steam locomotive use, and since these clearances have become established as a permanent standard, electric locomotives have to be constructed to suit them, even though the latter may be called upon to exceed any figures for capacity and speed that are possible of attainment with steam. This question of space limitation by standard clearance lines constitutes the first of the complications involved in the electric locomotive drive.

Another complication, of fully equal importance, is found in the fact that steam railroad track does not present to the passage of a train of cars the smooth, plane surface that it appears to have. Instead, it is a highly cushioned, yielding structure, capable of relatively great vertical movements under the enormous

strains imposed by modern rolling stock. It is really a marvel of security developed by years of experience, and the fact that it is able to carry trains safely across country under widely varying physical conditions and subject to violent temperature changes, although for whole seasons it cannot be touched because of a solidly-frozen sub-grade, is an extraordinary accomplishment. Primarily, the ability of steam railroad track to withstand modern traffic is due to its flexibility, and its development has been along lines wholly different from those followed in the development of a roadbed suitable for electric traction in its most commonly-known form.

Electricity for traction purposes has been used until comparatively recent years only in city streets, and the primary requisite of the track on which most electric cars run is to conform absolutely to the pavement surface. In the early days, when motors actually were mounted on the platforms of small horse car bodies, this was an easy matter, yet when the demand for increased seating capacity necessitated the use of motors under the floors, together with large and heavy car bodies, there were presented enormous difficulties in maintaining the track so perfectly rigid that its motion would not destroy the adjacent pavement. This principle of maintaining the track in an unyielding plane is entirely foreign to steam railroad practice. It permits relatively large non-spring-borne weights, but it involves prohibitive first cost and maintenance charges especially when viewed in the light of steam railroad conditions where hundreds of miles of track may have to be put down to serve a traffic of possibly less than a half-dozen trains daily. On interurban lines, where



ELECTRIC LOCOMOTIVE DRIVES—COAL TRAIN HAULED BY GEARED JACKSHAFT TYPE OF LOCOMOTIVE ON NORFOLK & WESTERN RAILWAY



electrical equipment is used for cars operating at higher speeds and having greater weights, the maintenance of the track, according to steam railroad experience, requires a surprising amount of attention.

In all electric car service, the weight of the car body is the predominating feature. The weight of the electrical equipment is really secondary, and this makes the electric car by no means a satisfactory basis for

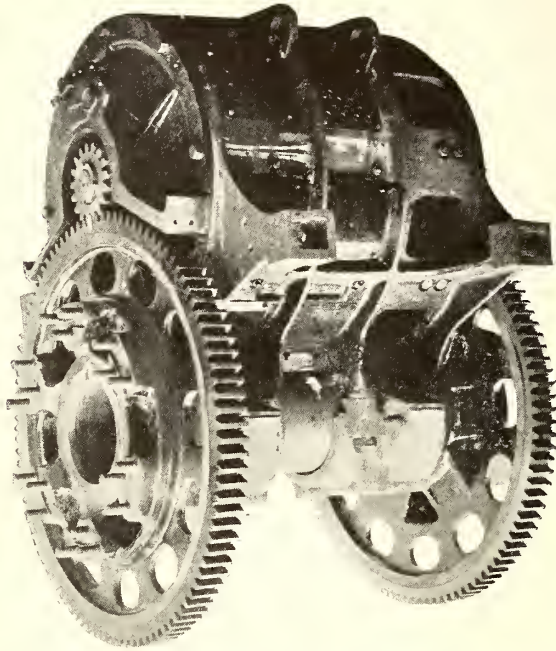
of the weight of the motor, the remainder being borne by springs on the truck frame.

This arrangement has the great advantage of directness, and to the popular mind, the idea of the direct drive has a strong appeal. In comparison, the electric locomotive of to-day frequently appears to be a structure quite as complicated as the steam locomotive, which requires the transformation of reciprocating motion at the cylinders to rotary motion at the driving wheels. Why such an apparent reversion in design should have taken place constitutes a very natural question.

#### FREE VERTICAL MOTION OF WHEELS A NECESSITY

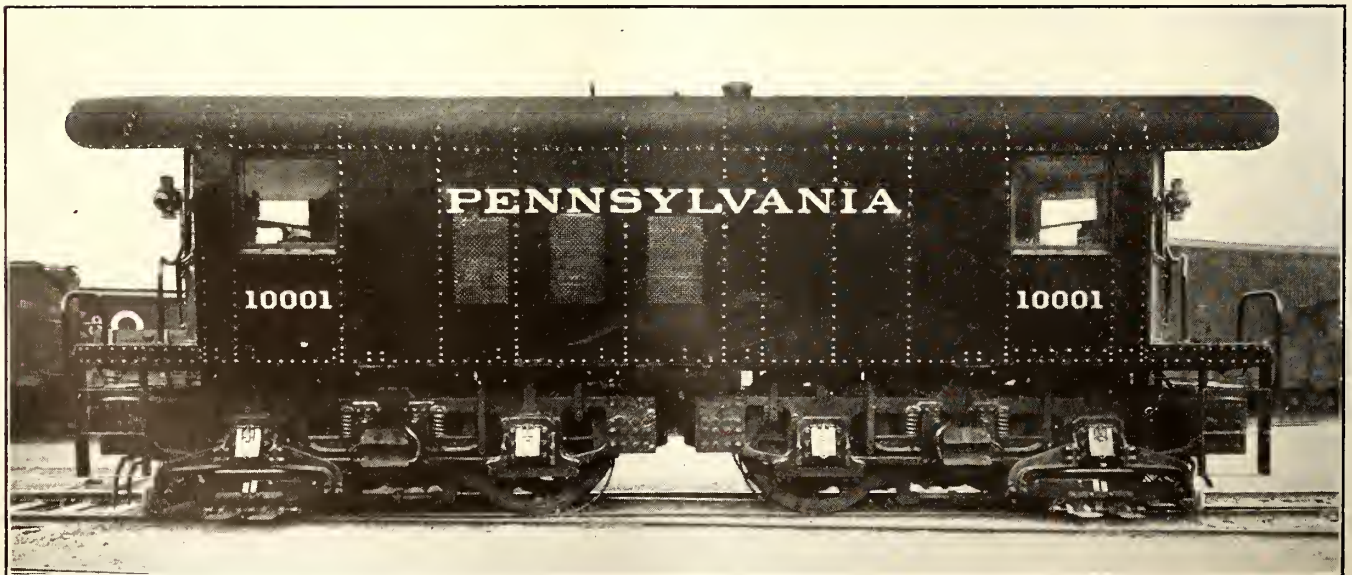
The first consideration responsible for this complication is that it is necessary to tie the mass of the locomotive together and yet to leave the wheels and axles as free as possible from restraint due to the connection of the motors to them. In other words, the wheels should be free to follow any inequalities in surface without shock and injury to the track, while the locomotive as a whole follows steadily along the general alignment of the roadway. In addition, a great effort has been made to introduce cushions between the driving motors and the wheels and axles which must be in actual contact with the rail. These devices are necessary to reduce the impact effect of inequalities in the track, and their effectiveness depends largely upon the extent of the variations in surface and alignment of the track. For perfect track almost any device is suitable, but otherwise great amplitude of movement must be taken up by the cushion.

It is to provide this cushioning effect that the various forms of "quill" drive have been developed. The first quill was brought out for the earliest locomotives on the Baltimore & Ohio Railroad, rubber pads being used to act as cushions between the quill and the wheels. A later type appeared in the original New Haven passenger locomotives, in which the drive was effected by quill arms acting through a nest of springs that were carried in pockets built within the wheels. In this design the amplitude of movement between the axle and the quill was small—only about  $\frac{3}{4}$  in. A later design on the same principle had the springs exposed between the wheel spokes, and this enabled more spring material to be used, thus increasing the amplitude to  $1\frac{1}{2}$  in. The drive for the later New Haven freight locomotives constitutes another example of this general form,



ELECTRIC LOCOMOTIVE DRIVES—SINGLE MOTOR MOUNTED ON QUILL WITH GEAR, SWITCH ENGINE TYPE

designing electric locomotives, where the weight of the electrical equipment exceeds that of any other part of the machine. If it were not for this fact the problem of the electric locomotive drive might not exist, because for electric cars a perfectly permissible means of connection between motor and driving wheel has been established through years of experience. This consists of a motor located between the wheels and provided with a single pinion which meshes with a gear directly mounted upon the axle, the latter carrying, through the medium of axle bearings, somewhat more than one-half



ELECTRIC LOCOMOTIVE DRIVES—EXPERIMENTAL LOCOMOTIVE WITH MOTORS DIRECT-GEARED TO AXLES DESIGNED FOR PENNSYLVANIA RAILROAD BUT NOT USED



as the gear is mounted on the quill while the twin motors whose pinions mesh with the gear are supported wholly upon the engine frame and all of the motor weight is spring-borne.

For track with greater irregularity in surface it is desirable to have still greater amplitude of movement than is provided in the above examples, and since the extent of the movement is limited only by the amount of spring material that may be introduced, there is indicated the desirability of large driving wheels for locomotives equipped with this type of drive, even when they are to be used in slow freight service. Obviously, as the driving wheel becomes larger, more space is provided for the introduction of spring material, and a greater amplitude of movement for the quill is permitted.

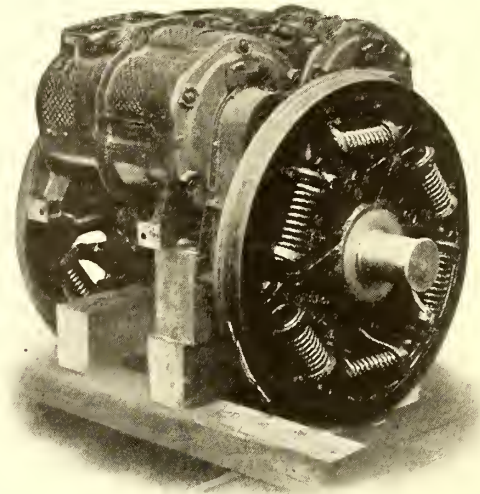
Flexibility between the mass of the engine and the wheels and axles may be obtained in another way by mounting the motors on the locomotive frame, so that they are wholly spring-supported, and by driving the wheels directly through horizontal main and side rods. This arrangement, however, lengthens the wheelbase unduly and imposes limiting dimensions and other difficulties in connection with the support of the motors. In practice, such a design is provided in modified form through the introduction of a jackshaft, so that the motor can be mounted directly over the driving axles. The 160-ton locomotives on the New York electric zone of the Pennsylvania Railroad constitute an excellent example of this type of drive. The arrangement is eminently desirable for service where very high speeds are the rule. The cost of maintenance is low and the limited number, accessibility and ruggedness of the moving parts, as well as the general simplicity of the design constitute extremely strong points in its favor.

NEED FOR GEAR REDUCTION

With this type of direct drive, however, it is necessary for low-speed motors to be used, because they can revolve only at the same speed as the drivers, and this involves excessive first cost. Economy in electric locomotive construction is secured for any given service by having the limiting speed of the engine coincide with the limiting peripheral velocity of the driving-motor armature or rotor, and this latter figure is, in general,

about a mile per minute. As an alternative to the direct drive, the motors may be geared to the jackshaft through a considerable gear reduction, and in this way the peripheral velocity of the motor may be raised to a point where the greatest economy is effected in the motor construction.

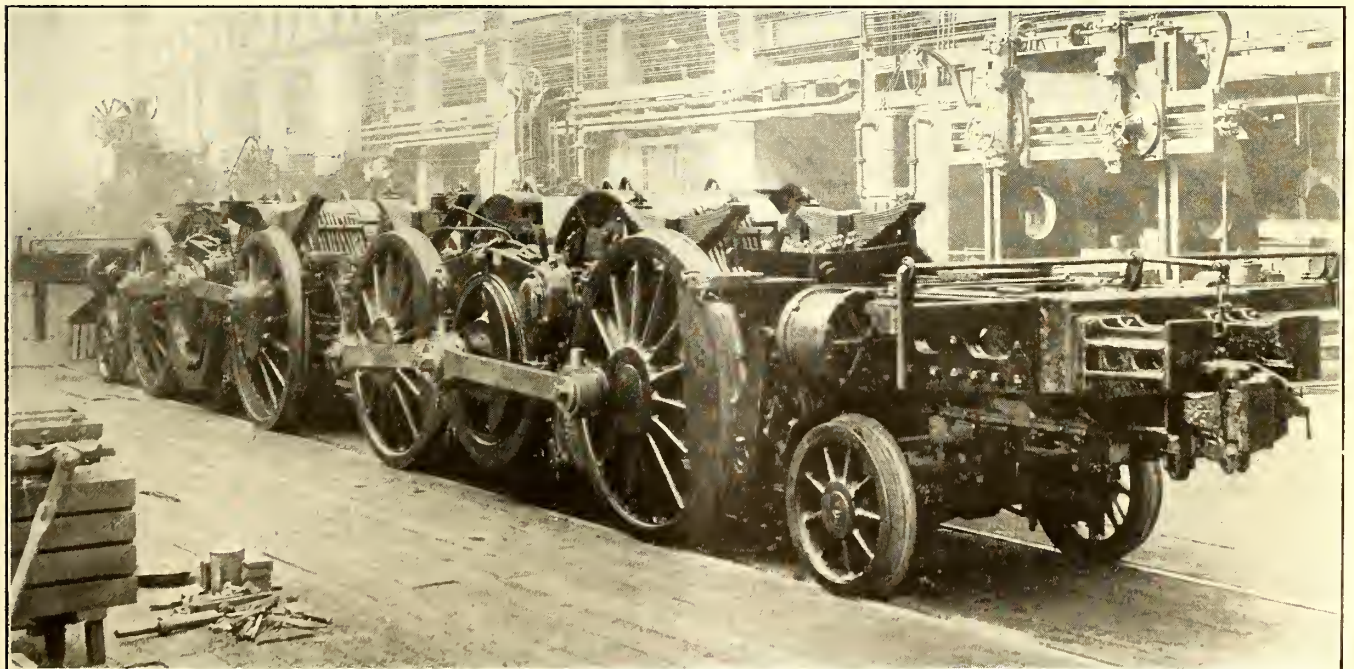
Generally speaking, if an engine is to be gear driven, the primary consideration is the speed limit for the locomotive. Frequently, however, a condition arises in



ELECTRIC LOCOMOTIVE DRIVES—TWIN MOTORS AND QUILL-SUPPORTED GEAR, NEW HAVEN RAILROAD TYPE

slow freight and switching service where the normal speed of the locomotive may be low but the speed limit relatively high. In this case, since no practicable speed-changing device is available, the motors cannot be designed economically for the low speed on account of the high speed-limitation, and here it is perhaps advisable to call attention to the fact that, for this reason, electric locomotive operation should be carried out at the highest practicable speed.

If the speed limit for a locomotive was set, for example, at 30 m.p.h., it might easily work out that a design which provided for normal operation at 10



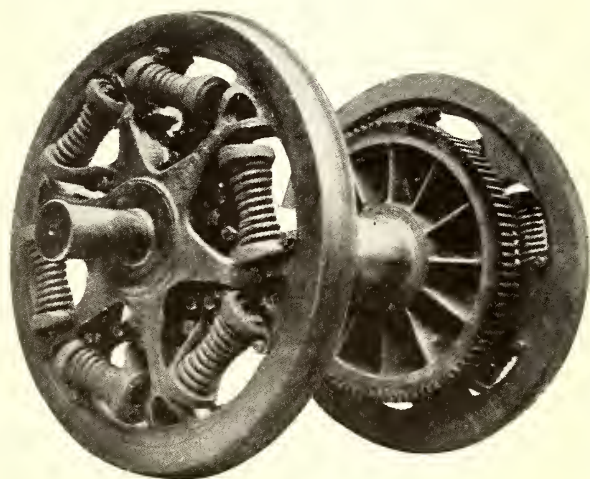
ELECTRIC LOCOMOTIVE DRIVES—RUNNING GEAR FOR GEARED JACKSHAFT TYPE OF LOCOMOTIVE FOR NORFOLK & WESTERN RAILWAY



m.p.h. would cost practically as much as one that delivered the same tractive effort at 20 m.p.h. The latter engine, therefore, would deliver twice the horsepower of the former and would do about twice as much work. Of course, the cost of the machine having double the horsepower would be somewhat larger than that having the lower working speed, on account of the necessity for larger cables, conductors, switches, etc., but on the other hand, the cost would not vary anywhere near in proportion to the horsepower that was delivered, and the use of the higher speed locomotive would be a very great economy.

#### LENGTH OF ARMATURE IMPORTANT

In general, the permissible peripheral velocity for railway motor armatures is of the order of 7000 ft. per minute, the limit depending somewhat upon the construction of the motor. It should be recognized that any motor is a composite structure, and that the action of the centrifugal force, which varies as the square of the speed, is bound to cause a certain amount of relative motion between the different component parts. If the centrifugal speed is excessive, these centrifugal



ELECTRIC LOCOMOTIVE DRIVES—QUILL-SUPPORTED GEAR USED WITH NEW HAVEN RAILROAD LOCOMOTIVES

forces will be productive of much greater relative movement than would normally exist, thus making certain the ultimate destruction of the insulation by abrasion and perhaps by mechanical disruption. There is, of course, no such thing as permanence in a composite machine, and in the case of railway motors especially, where the variable speeds cause variable forces, the influence of peripheral velocity on the motor life is an important one and cannot be neglected.

Therefore, for a locomotive operating within any given speed limit and delivering a given horsepower, the limit of peripheral velocity, approximately speaking, establishes an absolute limit to the rotative speed of the armature, and this, in turn, roughly establishes the physical size of the motor, which, of course, can be made to deliver the most power when the rotative speed is highest. Thus the most desirable condition is that permitting a long armature of small diameter which can turn at a high speed without going beyond the limiting peripheral velocity. Unfortunately, the space limitations determined by the standard railroad gage of 4 ft., 8½ in., impose a surprising number of obstacles to the use of such elongated armatures. When a motor is mounted between the wheels, space must be provided for the gear, the commutator, the bearings and the end windings, so that the core (that portion which is effective in producing torque) is frequently less than 12 in. and seldom as much as 15 in. in length.

The influence of this restriction may be exemplified by citing the fact that rated horsepower can be increased directly by lengthening the core and thereby exposing a greater length of conductor to the magnetic flux from the field pole. Horsepower can also be increased by an increase in diameter, but this adds to the cubical contents (as well as to the horsepower of the motor) as the square of the increase, and generally speaking, the cost and weight of a motor is somewhat on the order of the cubical contents. In other words, adding 5 in. to the length of a 15-in. core increases the horsepower of the motor 33 per cent, but increases the cubical contents of the motor only about 16 per cent, because the core length is only some 50 per cent of the total length of the motor between bearings. If on the other hand, the diameter should be increased 33 per cent, the cubical contents and the horsepower would be increased 77 per cent, and the cost and weight approximately in the same order, but at the same time the rotative speed would have to be reduced so that the final result would be an increase in power of only 33 per cent as opposed to the 77 per cent increase in cost and weight.

Thus the advantage gained by using an elongated armature is important, and it exerts a marked influence upon the design of the drive. In many cases, for example, gears are used at each end of the motor to limit the stresses upon the gear teeth. This may involve a handicap which may be greater than the use of two small motors with single pinions, because of the shortness of the core that is required when the valuable space between the wheels is taken up by the extra gear. It is apparent, therefore, that there is distinct advantage in mounting the motors upon the frames if by so doing the space limitations established by a location between the wheels are eliminated. In such cases, the motor might even be constructed so as to extend out to the clearance line on either side of the engine, thus making the armature shaft of the order of 10 ft. 6 in. long.

Such avoidance of space limitation, secured by moving the motors away from between the wheels, enables motors of very great capacity and less first cost per unit of power to be installed and also permits the use of the frame of the motor as a cross-tie for the locomotive frame, as has been done on the Norfolk & Western locomotives. Also, the use of a few large motors mounted in this way and connected so as to drive several pairs of driving wheels, rather than a single pair, reduces the number of driving details and allows also ample dimensions for the gears so as to keep the unit pressure upon the teeth at a moderate figure.

#### COUPLED DRIVERS PERMIT LARGE MOTORS

The foregoing paragraph leads up to the reasons for using side rods with coupled drivers. Briefly speaking, motors mounted on the frame may be made of large capacity and less first cost per unit of power, and to take full advantage of this, it may become necessary to provide more adhesion than can be exerted at a single pair of wheels. However, the addition of the intervening rods, pins and bearings exaggerates the characteristic called "chattering slip." The cause of this, which has been recognized only recently, is that the driving gear, which may extend through the armature shaft, rods and pins to the driving wheels, when under heavy stress, is distorted without exceeding the elastic limit, like a spring. Should the wheels slip they are shot ahead through the discharge of the stored energy, then come to rest momentarily, and again grip the rails, when the condition of distortion is again set up and again discharged by slippage. This may result in chat-



tering at a high frequency, producing stresses upon the rods and pins of the order of 80 per cent of the adhesive weight on the wheels. In other words, this characteristic may produce a force as much as twice as great as the maximum that is ordinarily deemed possible to place upon a driving wheel owing to the ultimate adhesive limit that exists. It follows, therefore that rods, pins and bearings must be made correspondingly heavier than they would be made on a steam locomotive. With a side-rod drive, also, there is a loss in efficiency through the friction of the rods, and possibly because of excess rolling friction caused by slight differences in diameter of the various driving wheels that may be coupled together. In general, however, the side-rod loss seems to be not more than of the order of 4 per cent at full load.

To offset this loss there are several advantages that are peculiar to the use of coupled drivers. For example, the tractive effort of a locomotive is obtained at the rails and yet is exerted at the drawbar which is 34½ in. above the rails, thus setting up a couple which tends always to relieve the weight upon the front axle of the locomotive, or in other words, to tilt the engine backward. If the propulsion current is divided evenly between the various motors, the tractive effort of the locomotive as a whole is thus limited by the weight on the lightest pair of drivers. This difference may be as much as 15 per cent, and therefore a side-rod drive may be 15 per cent more effective than a drive providing a separate motor for each pair of wheels, because there is no loss in adhesion for the locomotive as a whole, each set of coupled drivers acting as a single unit. Then, too, in case slippage takes place with side rods, all wheels rotate at one speed. With direct current, therefore, there is no difference in the voltage across the commutators, a condition which exists when a separate motor is coupled to each pair of drivers and which may cause serious damage if the trolley voltage is high.

In conclusion it might be well to emphasize the fact that to be thoroughly successful, electric operation in all its phases must be subordinated to the requirements of the railroad as a whole. It is almost futile to construct a locomotive that will be satisfactory only when the railroad is seriously limited in operation by a set of rules laid down by the electrical specialist, or when the machine has to be handled by expert electricians. If the electric locomotive can be operated only upon track of extraordinary rigidity, a handicap is placed upon its use, and this may be of far greater influence than the handicap imposed by the minor complication of providing a cushion between the wheels and the motor. Again, if the locomotive is so expensive that it can be used only under exceptional traffic conditions, it defeats the major reason for its existence, and for this reason the electric locomotive must be economical in design, even though this may mean the use of elaborate gearing as well as a more or less complex construction to permit motors of ultra-large capacity. Primarily, an electrified division is operated for the benefit of the railroad, and should the opposing view be taken and the operation restricted solely to make a record for the electrical equipment, the result may be only an apologetic success.

Some time ago a concession was granted for electrifying the Swedish East Central Railway, but nothing was done in the matter. The proposal was to erect a hydro-electric plant at Nijölar, using the Svarten. The work is now, however, to be taken up, and it is hoped to finish it by 1920. The electrification of the Sund-Björred Railway has been delayed by troubles with the telephones, caused by induction, which difficulties have now been overcome.

## Copper-Zone System Sustained

Connecticut Commission in Groton & Stonington Street Railway Case Says New System Is Improvement Over Old Nickel-Zone System

IN a recent decision, mentioned briefly in the news department of the issue of this paper for June 3, the Connecticut Public Utilities Commission held that the new or copper-zone system put into effect by the Groton & Stonington Street Railway was in general an improvement over the old nickel-zone system in that former inequalities of rates were eliminated. In only four places, where the new arrangement caused some injustice to patrons, was an adjustment necessary. As the decision contains a number of interesting features, an abstract is presented.

### DEVELOPMENT OF CASE

The Groton & Stonington Street Railway, from the time of its incorporation in 1903 until July 1, 1912, was independently operated, but after the latter date it was operated under lease by the Norwich & Westerly Traction Company, which company also owned and continues to own the entire outstanding common stock of the former line. The company operates cars between Groton and Westerly, R. I., a point 0.29 mile east of the Connecticut State line, thus placing itself under the jurisdiction of the Interstate Commerce Commission. On Sept. 30, 1915, the company filed a new tariff with this commission which, after being amended, was made effective on Nov. 22, 1915.

Prior to the filing of this new tariff the system of fares was based on zones of varying lengths, a 5-cent fare being charged for a ride in each zone. Lap-overs were established at the terminals of the several zones. The main line between Groton and Westerly was divided into six 5-cent zones, and a branch line to Old Mystic into two such zones. Tickets were issued in books of forty at a reduced rate of 3.75 cents for regular 5-cent zone ride, good for travel in the last two zones toward Westerly, and similar tickets were sold in books of thirty at 3.5 cents, good on the two zones of the Old Mystic extension. "Public school scholars' fifty-trip ticket books" were also sold for \$1.50, good until used on any zone on the line. These school tickets were available to any persons between the ages of five and twenty-one, and according to the former tariff sheet could be used between 7 a. m. and 6 p. m. Testimony showed that these tickets had been sold not only to school children, but also to school teachers.

The new tariff was based on an entirely different arrangement. The main line between Groton and Westerly was divided into eighteen zones of varying length, but averaging approximately 1.11 miles each, and the Old Mystic branch was divided into four zones of an average length of 0.815 mile. In general, the fare charged under the new schedule was 5 cents for the ride in any part of two zones, 2 cents a zone for a ride in more than two zones, this being an average rate of approximately 1.8 cents per mile for through riders on the main line. On account of the 2-cent unit of fare, the new form was called the copper-zone system to distinguish it from the nickel-zone system, although the 5-cent unit as a minimum charge for each passenger was still retained.

### COMPLAINT ABOUT TEACHERS' RATES

On Nov. 24, 1915, teachers in Groton and Stonington petitioned the commission for relief from alleged unreasonable intrastate rates. Later the two towns men-



tioned petitioned to intervene in the case, and as a result the commission made a double investigation as to the reasonableness of the new Groton & Stonington Street Railway rates for teachers and their reasonableness for the entire riding public in the territory served. The complaint of the school teachers was directed against the withdrawal of the privilege formerly enjoyed by them of riding on scholars' tickets at a reduced rate irrespective of whether they were twenty-one years of age or more. The commission held, however, that there was no statutory obligation to carry teachers as such at rates different from those offered to the general public. The fact that some teachers of more than twenty-one years had been permitted to enjoy lower rates than other passengers (whether with or without the official sanction of the company) vested no rights in the teachers for a continuation of such lower rates. In other words, the main question became one of reasonableness of the rates as they affected the general public.

#### THE RATES IN GENERAL

In judging the rates in general, the commission endeavored to ascertain whether the net return earned under the schedule as a whole was excessive and, if not, whether any of the individual rates were unreasonable. As a basis for judging the fair return the commission had before it various valuation figures. Engineers employed by the company calculated the total estimated cost of reproduction at \$928,610, including \$50,000 for organization expenses, while the investigation of the commission's accountants in the actual cash expenditures showed an original investment of \$811,167, including \$50,000 for organization and construction expense. The plant and equipment account of the company totaled \$1,083,932, while the capital stock and bonds at par value amounted to \$1,075,000, and at taxable value to \$935,000. On the basis of these figures, the commission came to the conclusion that the company should be permitted to earn a return upon a valuation amounting to \$900,000.

The company expected from its new schedule an increase in gross passenger revenue of approximately 20 per cent, and from the figures before the commission it was held to be reasonably apparent that the actual increase attributable to the new tariff would not exceed this figure. Using this percentage, the commission determined that the net income would be less than 5 per cent upon the allowed valuation, which would not constitute an excessive return.

#### REASONABLENESS OF INDIVIDUAL RATES

Turning to the subject of individual rates, the commission stated that it would be impossible to secure the permissible increase of 20 per cent in revenue without increasing some of the individual rates, and it would naturally follow that certain rates which were disproportionately and unreasonably low should be increased at a greater percentage than rates which were formerly fair or high. The petitioners showed instances where the increase in percentages were great, but many of these larger increases appeared to arise at points where the former zone lengths were excessive and bore no fair relation to the cost of service. In general, therefore, the commission found that with certain exceptions the new schedule secured a more equitable distribution of the rates among the several localities, and that the alleged discriminations between localities were in a large part the result of the leveling-off of former inequalities. The withdrawal of the special rate ticket book between Stonington and Westerly and on the Old Mystic branch was considered to be an increase of rates as reasonable as the other increases. In regard to the interstate service,

the commission held the traffic to be so small as to be immaterial in the effect upon the conclusions reached.

The commission made a careful study to ascertain whether a system of mileage or equal-length zones might be established with either a 1-cent, 2-cent or possibly a 3-cent rate per zone. In its opinion inequality would exist to a certain extent in any system having varying lengths of zones with arbitrary terminal points. In the majority of cases in steam railroad passenger transportation, rates are fixed on a mileage basis, but the commission believed that the establishment of arbitrary mile-zones of exactly equal length in connection with street railway transportation might work an injustice to the most popular centers along the line, since it was a recognized economic principle pertaining to street railway rates that the denser the population the longer should be the possible ride for a single fare unit. While an equal-length zone system might equitably and successfully be established on long lines through sparsely settled territory, such a system in cities and lesser centers of population would have a tendency to impose unnecessary burdens upon the traffic.

At the four places where the new system worked some injustices in the opinion of the commission, it ordered neutral zones to be established, the effect being to permit riders where traffic was densest to secure transportation more nearly commensurate with the cost of service. The immediate result would be a slight reduction of gross revenue, but the commission thought that the establishment of the neutral zones would in the course of the year stimulate the riding habit and thus offset the concession in rate. The company is required to alter its system of rates to be effective on and after July 1, 1916, accordingly.

### Warning Signs at City Crossings

The Waterloo, Cedar Falls & Northern Railway, Waterloo, Iowa, has reduced the accident hazard at its crossings in the city of Waterloo by the installation



WATERLOO, IOWA—HIGHWAY WARNING SIGN

of distance warning signs of the type shown in the accompanying illustration. This road, which does a heavy freight business, has a belt line around the city, serving the industrial districts with many branch tracks to manufacturing plants. These tracks, in addition to the high-speed passenger lines, have a proportionately high number of highway crossings. As the tracks are on private rights-of-way, the speeds are comparatively high for city service.

Warning signs of the type shown are placed near the curb

line on the highway at a distance of 300 ft. away from the track. These signs serve to call the attention of travelers to the fact that they are approaching a crossing. The result is a reduced hazard of operation.



## Bridge Construction and Reconstruction in Kansas City, Mo.

Ordinance Provisions Impose Heavy Burden on Railway Company for Bridge Construction and Maintenance

ONE of the unusual conditions that exist on the Kansas City (Mo.) Railways, as compared with conditions on most other systems, is the large percentage of its track that is carried upon bridges or viaducts. This is partly on account of the contour of the ground and partly because so many of the lines cross the Kaw River and various railway properties. The total length of these structures is almost 26,000 ft., and they carry a total of 9.8 miles of single track. Their total cost was more than \$2,000,000. The cost of maintaining and renewing them is naturally very much heavier than the cost of maintaining a similar amount of track upon the surface. Many of the structures are subject to corrosion on account of the smoke from locomotives passing beneath them, in addition to the ordinary wear and tear and decay incident to such structures.

Some of these structures belong to the railway company exclusively, but by far the greater number were erected under some of the ancient ordinances and contracts with the city and the railway company, which obligated the company to build the structures and maintain them for all time. Many which were built some years ago have had to be reconstructed in order to bear the loads of the present day imposed by the cars of increased size, and especially by the very heavy trucks which are now operated over the highways.

For example, the old structure across Jersey Creek at Third and Freeman Streets formerly consisted of three very light trusses weighing in all only about 7½ tons, whereas under modern loads and specifications not less than 15 tons of steel were required to carry the load. The deck of this structure became badly decayed and was unsafe for vehicles. The trusses were so light that they were overstrained by cars passing over the structure. The masonry abutments, however, at either side were very heavy, and with some repairs and painting were put in first-class condition. Four riveted trusses taken from the old Twelfth Street incline were substituted for the old trusses, and a substantial floor of new timber was laid. The total cost of renewing this structure was about \$3,000, all of which was borne by the railway company.

Another steel structure 1664 ft. in length, which crosses the Rock Island and Union Pacific tracks at Seventh Street, became so badly corroded by locomotive gas that all traffic had to be temporarily discontinued until it was reconstructed by the company at an expense of \$30,000.

In order to prevent other structures from deteriorating a great deal of maintenance work has been required. The Fifth Street viaduct in Kansas City needed extensive repairs to its floor system in the past year, costing \$10,000, in order to preserve the metal from corrosion. In making these repairs every bit of the steel work was cleaned by means of a sand blast provided by a portable electrically driven compressor having a capacity of 100 cu. ft. of free air per minute.

The railway company has also contributed \$300,000 for the reconstruction of a three-span, 734-ft. bridge across the Kaw River at James Street, and \$300,000 for a new concrete viaduct at Twelfth Street. Both of these viaducts carry a roadway separate from the space occupied by the street railway tracks. The railway company will also contribute to the construction of a new high-line bridge which will be built across the Kaw River

at Central Avenue. The cost of all the changes in this bridge, not including much of the work that must be done by the street railway, such as rerouteing of its lines, will be in the neighborhood of \$600,000, half of which will have to be paid by the railway.

## "Transmission Losses" in the Purchasing Department

The Author Analyzes the Causes of Losses and Suggests Methods by Which They May Be Reduced

BY H. B. TWYFORD

Formerly Purchasing Agent Underground Electric Railway Company, Ltd., of London

WHEN a purchasing agent buys any manufactured article he is purchasing in a composite form all the materials which go to make up the finished product. The manufacturer of a motor or a looseleaf ledger had to buy various materials to produce these articles, and these materials were again the finished product of some antecedent manufacturing process.

Tracing back this succession of buying and selling, it is found widening and spreading until the original raw material is reached. If, in the exercise of the buying function through all these movements, the execution of it can be more economically administered, it has a very appreciable effect on the ultimate cost of the finished product.

In the great fabric of business there are losses incurred with every operation. These are the "transmission losses" and any lessening of them by the use and adoption of more efficient and scientific methods draws more closely the lines of our economic system. The purchasing function holds an important strategic position in this complex business structure, and by its proper conduct the transmission losses of its own department can be reduced to a minimum.

The influence of a good buying policy and the use of proper methods is not confined, however, to the operation of its own particular function but has a broader and wider significance for it distinctly affects a variety of commercial transactions in many aspects, and the benefits derived are direct and positive and can be set forth beyond any doubt or miscalculations.

### THE CAUSE OF LOSSES

In the purchasing department, as in every other division of a business, there are innumerable small efficiencies and economies which can be put into force and be of considerable assistance in the operation of the department, but these are almost entirely local in the benefits derived, and they are in effect in all well-administered purchasing departments.

There are, however, some phases of purchasing which do not always receive sufficient consideration, and it is these which have a large influence on business generally. Personal experience has demonstrated that the connection between many buyers and the best available sources from which to make their purchases is loose and uncertain, resulting in losses which show up in the increased selling and general expenses of every commercial establishment and consequently adversely affect prices.

If the selling department of an organization worked at an efficiency of 100 per cent and closed every negotiation it entered into, it would mean a tremendous lowering of the percentage that selling expenses bear to the final cost of an article, but this is an impossible condition. It is, however, possible for more efficient buying to make a considerable advance in this direc-



tion. It is not an exaggeration to say that at some time every purchasing department is the cause of transmission losses between buyer and seller.

HOW LOSSES ARE INCURRED

The following incident will illustrate this point and is related because it is an actual occurrence which came under the writer's notice. A requisition was received to purchase a large quantity of steel stampings, and requests for quotations were sent to a number of manufacturers. Owing to the incomplete information on file in the buyer's office 60 per cent of the manufacturers could not quote because they were not fitted to make that particular style of stamping.

This is a clear loss of a very large percentage of the purchaser's efforts, but if that were the only loss it would not have far-reaching effects. As a consequence of the promiscuous manner in which the manufacturers were approached for prices, 60 per cent of them were put to the trouble, inconvenience and expense of investigating and replying to the invitation to bid without the slightest prospect of securing the business.

Such instances very appreciably increase the selling expenses of practically every business house. This expense must be loaded on to the selling price and is ultimately paid for in this way by some buyer. This is a feature of unscientific purchasing which is too

which necessitate references back for additional and correct information. The remedy for this is proper specifications, and these should be on record in every purchasing office. In some cases they may consist of only two or three words, figures or dimensions, but they should be accurate and impossible of misconception.

HOW LOSSES CAN BE REDUCED

Improvement of the conditions outlined involves a continual educational process for the man in charge of the buying. Constant research work is necessary for his department. Negotiations for a purchase should be entered into only with those concerns which are best fitted to undertake the business. This can be accomplished by accumulating and properly tabulating reliable information. In keeping a record of manufacturers and suppliers, there are other considerations besides the knowledge of the actual product they are able to supply. Can they make shipments promptly and in accordance with the buyer's requirements? Are they located geographically to give good service? We have all had experience recently of what freight delays and embargoes mean. Are they financially in a position which insures the buyer protection in that respect? Do they keep their promises? These and any other special features necessary in individual cases should be systematically recorded and tabulated.

MATERIAL			DESCRIPTION							SPEC. NO.	
SUPPLIERS' NAMES	ADDRESS	CAT. NO.	FACTORY			SERVICE AND REPUTATION				SPECIAL FEATURES	
			LOCATION	CAPACITY	TRANSP'TN FACILITIES	SHIPPING PROMPTLY	KEEPING PROMISES	QUALITY	BUSINESS METHODS		FINANCIAL STANDING

FORM ON WHICH PURCHASING AGENT CAN RECORD SOURCES OF SUPPLY

prevalent but can be remedied by better records. In the illustration cited, the buyer should have had accurate information regarding the manufacturers who were able to make exactly the class of stampings required, and his inquiries would then have gone only to such concerns.

Where a buyer is purchasing a very limited assortment of materials, it is entirely feasible for him to work at an efficiency of 100 per cent, but this efficiency cannot be maintained by those departments which handle a very large variety of goods. Even in such cases indiscriminate shopping or marketing is inexcusable. The writer has known cases where vague and loosely worded inquiries have brought salesmen from long distances only to find that the material required was not in their line, or that other houses were better fitted to supply the purchaser's needs.

Among manufacturers of nuts there are some who confine themselves to the milled description only, while others make only punched nuts. Some also make nuts of certain small sizes, while others limit their product to larger sizes. Yet inquiries are frequently sent out to all of them on a hit-or-miss principle. The manufacturers and vendors of almost any product or commodity can be segregated into those who are in a position to supply a purchaser's exact requirements and those who are not.

Losses are also incurred through the ambiguous wording or incomplete description given on many orders

The accompanying form will be found convenient for recording sources of supply. Either a card or the looseleaf system can be used. If it is not possible to give complete specifications in the space allowed for description, they can be kept in separate folders and numbered. If necessary these specifications can be printed, or a number of carbon copies can be kept ready to send out with inquiries and orders. Many articles are purchased through supply houses, and it is important to know where the factory is located.

If a record similar to this is kept, a purchasing agent can be positive that he is negotiating and ordering only with concerns which are best fitted to supply his requirements, and he knows he is keeping to channels where neither he nor others will incur any losses through promiscuous shopping and ordering.

As pointed out in the earlier part of this article, many economies can be put into effect in a purchasing department, which are beneficial only perhaps to the department itself or to the establishment with which it is connected. If a loss is incurred by anyone it is more than offset by the gain. Suppose, also, that a buyer beats down a seller on his price or obtains more favorable terms. This is a loss on one side and a gain on the other, therefore the general economic system of business has suffered no loss. But in "transmission losses" there is no gain to anyone, and by the wasted effort and expense our whole commercial economic system is so much poorer.



# EQUIPMENT AND ITS MAINTENANCE

Short Descriptions of Labor, Mechanical and Electrical Practices  
in Every Department of Electric Railroading

*Contributions from the Men in the Field Are Solicited and Will Be Paid for at Special Rates.*

## A Recent Railway Substation— I—General Features

BY G. C. HECKER

Chief Electrician Pittsburgh Railways

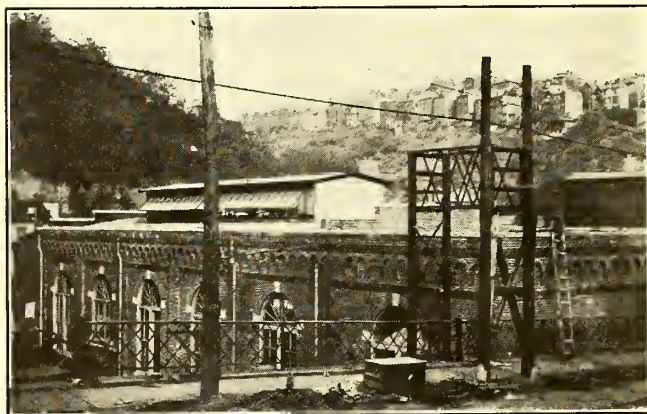
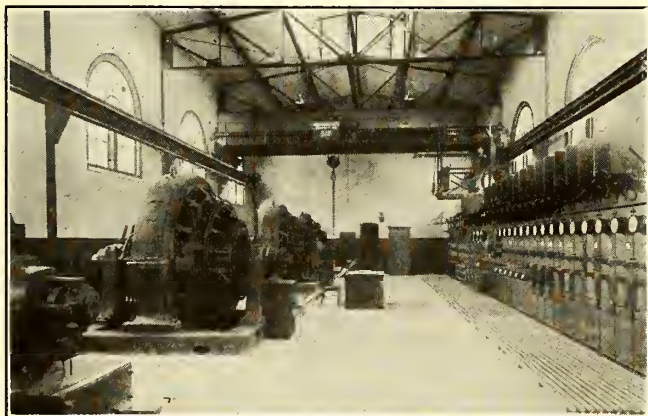
For a number of years the power supply for the lines of the Pittsburgh (Pa.) Railways, in the north-side district of Pittsburgh (formerly the city of Allegheny), was furnished by the Manchester power station containing five engine-type, 600-volt railway generators, and by several similar units in the Brunot's Island power station. The latter is a large a.c. turbo-generator station of which the railway units constitute but a small portion of the total generating capacity.

A recent analysis of the power costs and future power requirements for railway purposes in this district led to the conclusion that a large substation, centrally located and designed to care for the natural growth of traffic, could most economically furnish this power. A series of feeder tests were therefore conducted, the

most entirely of fire-resisting materials, and the completed station is an excellent example of modern practice in railway substation design.

The operating room, containing the converters and switchboard, is located on the second floor of the building. Each converter is supported on two foundation walls built on a reinforced-concrete footing course, 12 ft. square. These foundation walls serve to support one end of the floor beams. On the first floor elevation a car track from Taggart Street extends 16 ft. into the building. Removable floor plates are provided in the second floor, directly over the track, so that equipment may be unloaded conveniently from cars by means of an overhead, electrically operated crane, traversing the operating room.

The transformers are arranged in a single row, in a one-story room on the first floor elevation, parallel to the operating room, and are supported on I-beams, over a ventilating passage extending the length of the room. Air ducts from outside of the building connect with



GENERAL VIEW OF TAGGART STREET SUBSTATION, SHOWING ROTARIES, SWITCHBOARD AND CRANE—VIEW FROM BRIGHTON ROAD LEVEL

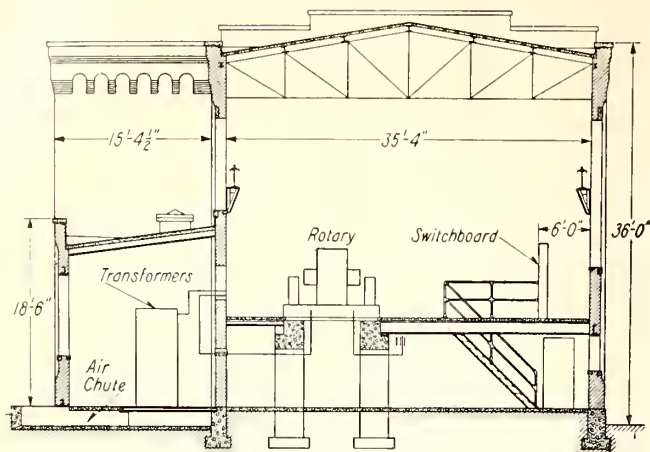
results of which, together with power-station load and traffic data, were used to determine where the substation should be located, the number and size of units necessary, and other general requirements.

The resulting new substation now in operation is located between Brighton Road and Taggart Street, a short distance north of Columbus Avenue. Some of the general features of this substation are given in the present article. In a later one the switchboard and auxiliaries will be taken up more in detail. The present equipment, which was furnished by the Westinghouse Electric & Manufacturing Company, consists of four 1800-kw., 600-volt, six-phase, 514-r.p.m., commutating pole, rotary converters; twelve 625-kva., 11,000/424-volt, oil-insulated, self-cooled, single-phase transformers, and the necessary switchboards and auxiliary apparatus. The station is planned for and can be readily extended to an ultimate capacity of six machines, although the present building will accommodate but four. The high-tension switch structure, switchboard panels and conduits are installed for the ultimate capacity of the station. The building is constructed al-

the passage, one duct being provided for each transformer bank, and ventilators are installed in the roof over the transformers so that an excellent circulation of air is maintained. A system of piping connecting with all transformers permits draining the oil from any transformer in case of fire. When transformer repairs are being made the oil may be drained into drums or barrels.

The high-tension switch structure occupies three floors across the Brighton Road end of the building and is entirely isolated from the remainder of the station by a brick wall. The construction of the switch structure is somewhat of a departure from the previous practice of the company, in that it is a combination of reinforced-concrete slabs and brick. The incoming, 11,000-volt, three-conductor cables enter the high-tension switch structure on the first floor and terminate a short distance inside of the building wall. The 11,000-volt transformer cables leave the switch structure on this floor, passing underneath the floor in 4-in. iron pipes to the transformer room, where they terminate near the tops of the transformers. The electrolytic lightning





CROSS-SECTION OF SUBSTATION

arresters, series and potential transformers and fuses are located in the switch structure on the first floor. The second floor of the switch structure contains the oil circuit breakers and disconnecting switches. The circuit breakers are of the remote-control type, electrically operated, and are supported in channel irons built in the compartment walls. The four circuit breakers in the center of the switch structure control the incoming cables and the remaining six, three on each end of the structure, are for the transformer banks.

The third floor of the switch structure consists of the busbar compartments which are entirely inclosed, except for small openings at the front and rear of the busbar supports. The buses are installed in duplicate, each set being provided with disconnecting switches for sectionalizing. All openings in the switch structure, not isolated by elevation, are covered with transite wood doors. Hardwood insulating mats are placed on the floor in front of all disconnecting switches, fuses and lightning arresters. Provision is made for short-circuiting and grounding any high-tension circuits upon which men may be working. To avoid errors and possible accidents, the names and phase letters of each circuit are

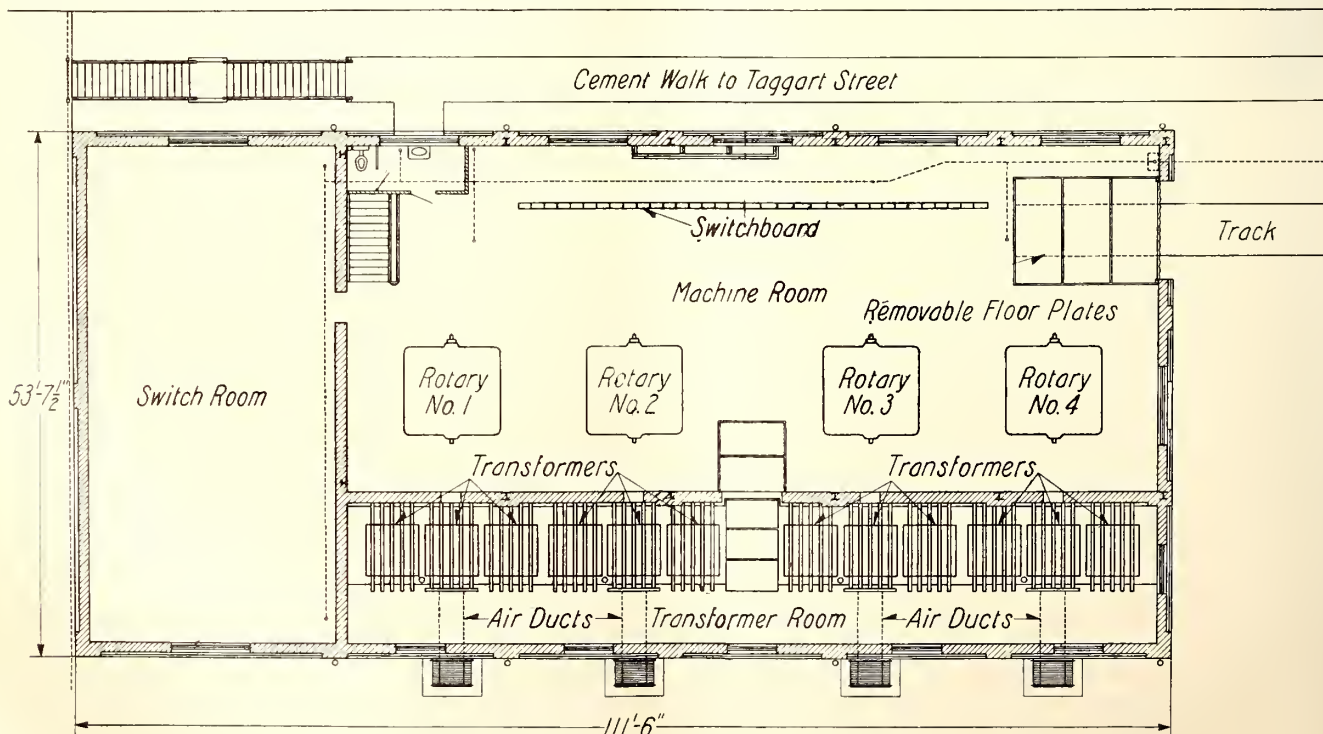
painted on the floors, walls and doors of the switch structure.

On the first floor, under the operating room, is a motor-generator set, consisting of a 5-hp., 600-volt, shunt-wound, d.c. motor, direct-connected to a 4-kw., 125-volt, compound-wound, d.c. generator. During approximately twenty hours of the day the control circuits are energized from this set. A 60-amp.-hr., 125-volt, lead-plate storage battery, located in a small fire-proof and vaporproof room on the first floor, is used for the operation of the control circuit during the remaining four hours of the day and in emergencies. The battery is charged once a week from the 600-volt station bus through a suitable rheostat.

The rotary converters are of the self-starting type, and the starting panels are mounted in the wall between the transformer room and the operating room so that all switch terminals extend into the former room just above the low-tension transformer terminals. Connection from the starting panels to the transformers is made with copper strap, supported on bus-type insulators, this form of construction being very rigid and presenting a neat appearance. The negative converter panels, each containing a negative switch, an equalizer switch, and a series field short-circuiting switch, are mounted on the bearing pedestals at the commutator end of the machines. The negative and equalizer buses are supported from the floor beams, directly under these panels, and connections are made with copper strap passing through openings in the floor. These connections are entirely inclosed by transite wood at the sides and tops of the panels.

The station lighting is supplied from the 600-volt d.c. bus and is supplemented by emergency gas lighting. In the operating room, twelve 250-watt tungsten units with enameled steel reflectors supported 21 ft. from the floor furnish the illumination, no lights on the switchboard being required. A standard motor-driven, railway-type air compressor, located on the first floor and connected with a system of piping in the floor, furnishes compressed air for cleaning apparatus.

In the design of the station simplicity of operation, reliability of service and the safety of the operators



PLAN SHOWING LOCATION OF ROTARIES, SWITCHBOARD, AND TRANSFORMER AND SWITCH ROOMS



have received the utmost consideration. The requirements of the National Board of Fire Underwriters have been fully complied with and every effort has been made to minimize fire hazards. This substation was erected and the equipment installed under the supervision of F. L. Aime, engineer Pittsburgh Railways.

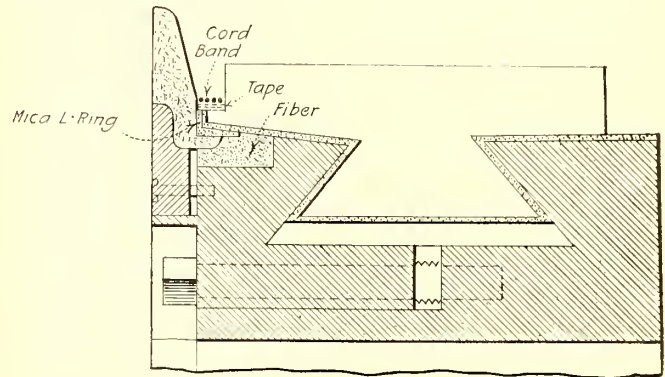
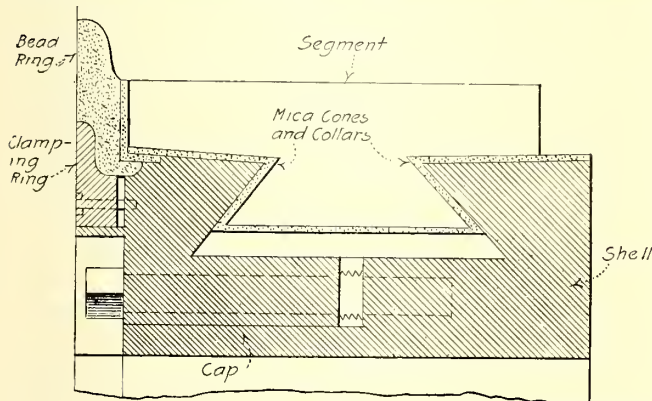
## Maintenance of GE-800 Motors

BY J. R. SMITH

Superintendent Lancaster Traction & Power Company,  
Lancaster, Ohio

Our GE-800 motor equipments were a constant source of annoyance, due to commutator failures, until a few years ago when we attempted in various ways to eliminate the causes of this trouble. After much experimenting we found a way to prevent entirely the short-circuits and grounds so common on the commutators of motors of this type.

As these motors were designed for grease lubrication, they had no adequate oil guards, hence the use of oil as a lubricant resulted in oil reaching the commutator seg-



SECTIONS OF GE-800 MOTOR COMMUTATOR BEFORE AND AFTER REMODELING

ments even though the greatest of care was taken to use minimum lubrication. The commutator contains an L-shaped mica ring clamped by a bead ring of composition material against the outer ends of the segments. This bead ring in turn is held by an iron clamping ring. Oil from the bearing crept over these rings, reached the segments, and penetrated between the ring and the ends of the segments. This oil carried with it particles of carbon dust and developed short-circuits between the segments.

We solved the problem of keeping the oil and other foreign substances from penetrating between the ring and the segments by making the following change on the commutator: The iron clamping ring, bead ring and mica ring were removed from the commutator, and the armature was placed in a lathe. A cut  $\frac{1}{4}$  in. wide and to a depth of within  $\frac{3}{16}$  in. of the bottoms of the segments was turned off the inner ends of the segments, ample brush surface being still left.

After insuring that the armature was free from all defects, the L-shaped mica ring, trimmed down to exactly the diameter of that part of commutator from which the cut was taken, was placed in its original position, butted against the ends of the segments, and held in place by the bead ring and the iron clamping ring. The ends of the segments were sealed to the mica ring with a high-grade commutator cement or plaster of Paris before it was finally clamped on the rings. After the rings were in place and all cement or plaster of Paris was wiped away from the joint, thick shellac was applied, and two thicknesses of friction or linen tape, trimmed to the exact width, were wrapped over the joint. Over this a band of small cord was wound.

The cord was then painted thoroughly with heavy shellac and baked well.

We inspect these motors once every 800 car-miles, and at each inspection wipe out the groove with a piece of felt dipped in gasoline.

The change described above practically eliminated the trouble from short-circuits, but occasionally a ground would occur through the outer mica cone due to the short creepage path to ground. We eliminated this by taking a lathe cut off the inner edge of the commutator cap that supports the outer mica cone and locks the commutator, and substituting a collar turned out of wood fiber. The cut taken from the cap is 1 in. wide and approximately  $\frac{1}{2}$  in. deep, and the fiber collar substitute has, of course, the original surface taper. Commutator troubles are now unknown with this type of motor, although we operate on as high as 625 volts.

Those familiar with this motor are aware that, compared with modern motors, its armature journals are small for its weight. This fact led us to use a high-grade phosphor-bronze bearing instead of babbitt, which gave very low mileage. We realize that the hard bear-

ing shortens the life of the journal, but we plan to sleeve the journal or to build it up by the welding process when necessary. Our bronze bearings are perfectly satisfactory, having already given four times the mileage of babbitt bearings without appreciable wear.

By the above procedure, we have materially reduced maintenance costs of this equipment and, in addition, we no longer face the bugaboo of the disabling of equipment at a time when it is most needed.

## Firing with Gas at Elyria Power Station

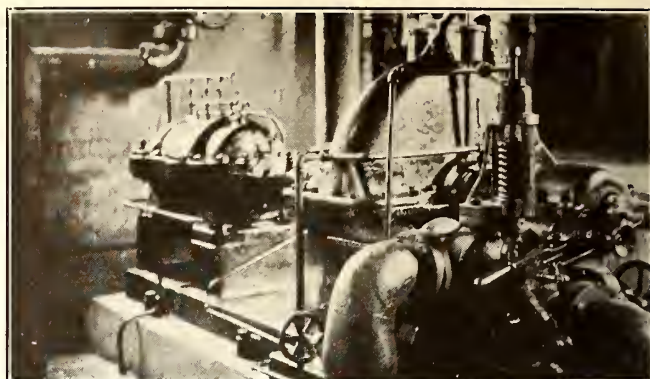
BY A. P. LEWIS

Superintendent Power and Shops Cleveland, Southwestern & Columbus Railway

Previous to the installation of gas for fuel in the Elyria power station of this company the boilers were hand fired. All coal was unloaded by hand and, while this plan was expensive, the company never got to the point of installing coal and ash-handling machinery and stokers. This was mainly because most of the boilers were set too low to admit of stoker installation without raising the boilers, a very difficult and expensive operation under these conditions.

The discovery of natural gas in large quantities near by seemed to offer a solution of our problem, so a long-term contract was made with the Berea Pipe Line Company, which owns extensive fields east of Elyria and south of Cleveland. From the fields gas is piped through an 8-in. high-pressure line, 16 miles long, which has a capacity of 4,000,000 cu. ft. per day. The wells average





BANK OF BOILERS IN ELYRIA POWER STATION EQUIPPED TO BURN GAS FOR FUEL; INTERIOR OF GAS REGULATOR AND METER HOUSE

about 2800 ft. in depth and the rock pressure is about 1000 lb. per square inch. This pressure is reduced to 100 lb. for transmission.

One of the best regulator houses in this country is located on this property, a diagram of which is shown in an accompanying drawing. The gas which reaches the plant at 85 to 90 lb. pressure, is reduced to 20 lb. pressure for metering. The two meters are of the proportional type, each of capacity sufficient for the plant, so that there is always one meter in reserve. After going through the meter, the gas is reduced to 8 oz. pressure and delivered into a 24-in. pipe line, which distributes it to the different boilers.

The boiler grates are brick-covered with a layer of cinders on top, and as most of them are of the dumping type the whole covering can be dropped into the ash pit,

coal cost, we are saving either the entire labor cost of unloading, wheeling and firing coal for hand firing, or the fixed charges that would have occurred had coal and ash-handling equipment and stokers been installed. As our burners are designed for 8-oz. pressure we feel that it is more economical to regulate the steam pressure by turning burners on or off than by using a steam and gas regulator which controls the steam pressure by varying the gas pressure at the burners.

The neatness of the boiler room would be an incentive to change even if it were not for the saving that is being effected.

### Application of Ball Bearings to Railway Car Journals\*

BY O. BRUENAUER

General Sales Manager Gurney Ball Bearing Company

The application of anti-friction bearings to railway car journals is rapidly coming into the focus of interest of the men who are operating railway properties. The development and mechanical refinement of the most prominent friction-reducing element known to technical science, namely, the ball bearing, and its application to almost every variety of machinery during the past fifteen years, has produced such truly remarkable results in the way of power saving that its installation in car journals was but a logical step.

The ball bearing itself as an anti-friction device many years ago passed from the experimental stage into that of an approved and accepted element of machinery. It is, however, only about three years since the electric railway industry has experimented in the way of its application to car journals. Experimental installations have grown rapidly in number for the reason that many of them showed very promising results, so much so that in the city of New York there are being operated to-day 209 cars equipped with ball-bearing journals. In the opinion of the engineers conducting exhaustive tests of this kind the experience gained therefrom is encouraging to a high degree, yet it does not at this time permit of drawing definite conclusions to cover general conditions all over the country.

Quite frequently in the recent past data have been published regarding current consumption, coasting periods, etc., of cars equipped with ball bearings. We find, however, that the conservative railway engineer is inclined to consider these results as more or less isolated.

Pending the publication of data obtained from the very exhaustive tests being conducted at present in New York and elsewhere, I agree with this opinion. Too many conditions must be met, and the problem at hand

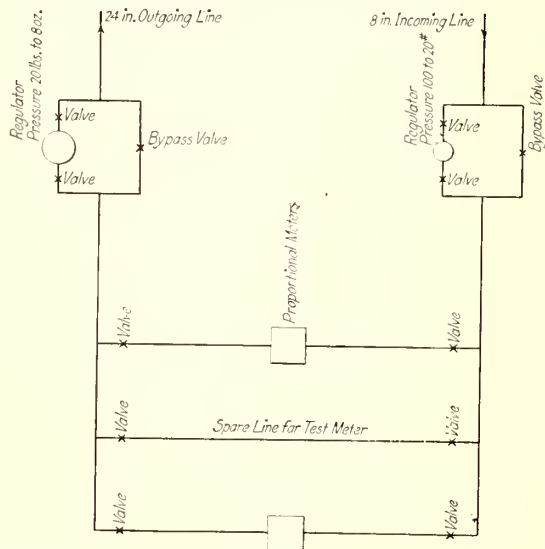


DIAGRAM OF PIPING IN GAS REGULATOR AND METER HOUSE ON THE C. S. & C. RY.

the burners taken out and the boilers fired with coal if necessary without taking a boiler out of service. Considerable difficulty was experienced at first due to vibration caused by the burning of the gas and communicated to the boiler setting. This was treated as a matter of resonance, and by changing the area within the boiler setting, adjusting the baffling, and varying the draft the vibration has been entirely eliminated. The next problem was to get rid of tube trouble, produced by blow-pipe action of the gas flames. This was accomplished by using checkered walls in the furnace to break up the flames and distribute the heat more uniformly.

The plant burns about 2,500,000 cu. ft. of gas per day. As the gas cost is about the same as the former

\*Abstract of a paper read in Chicago, Ill., before the Illinois Electric Railways Association on June 9, 1916.



is too complex to permit of its definite solution in such a short time as has been devoted to it.

I shall, therefore, direct attention to two problems which seem to stand in the foreground of interest and toward a satisfactory solution of which the ball-bearing industry has directed its greatest efforts. A satisfactory yet economical means of taking care of the side thrust when a car takes a curve is a matter of utmost importance. Stress is to be laid upon the economical feature of the problem, as will be realized when the magnitude of the thrust loads imposed is considered.

For example, take a single-truck car weighing, fully equipped, 26,550 lb., and having a seating capacity of forty-five passengers and a standing capacity of forty-five. The schedule speed is 8 m.p.h., the high speed 16 m.p.h., and the highest speed ever obtained 20 m.p.h. In this case the radial load on the two ball bearings in one journal is 8750 lb. when the fully-loaded car is standing still. When it is making 8 m.p.h. straight ahead the radial load is 9430 lb. When the car takes a curve of 35-ft. radius there is being imposed upon the bearings a thrust load of 2150 lb., or 11½ per cent of the radial load obtaining at this moment. The radial load on the inner journal at this time is 44 per cent, whereas the radial load on the outside journal is 56 per cent of the total radial load on the axle. Hence it obviously would be better if the inner journal bearing could be made to take the thrust.

Among the most important problems in the mechanics of bearing mounting are those connected with the stresses at the shoulder against which the inner bearing is locked, that is, at point A in Fig. 1. The moment of inertia of that part of the axle which is outside of the wheel, and on which are mounted the bearings, does not by any means increase in proportion with the bending moment. On the contrary, the moment of inertia increases abruptly at point A. The section at this point is consequently the weakest one in the axle under working conditions, and provision should be made to strengthen it to the required extent. A simple and

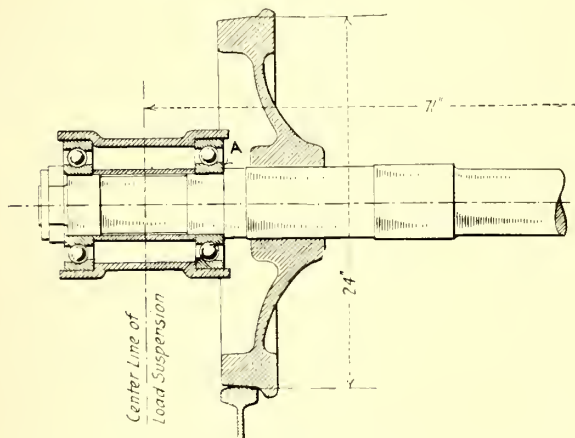


FIG. 1—DIAGRAM TO SHOW WEAK POINT ON CAR AXLE

effective way of doing this, aside from proper heat treatment, is by turning the axle with a fillet of comparatively large radius.

In order to provide for a corresponding seat of the bearing against such a shoulder a special bearing has been designed, which is called the "Railway" type. Its inner ring, on the side facing the shoulder, is provided with a chamfer of a very much larger radius than is customary on standard bearings. The radius of chamfer of a "Railway" type bearing is slightly larger than that of the fillet on the axle. The shoulder on the axle, on the other hand, is high enough to afford a sufficient contact surface between its straight face and the

straight face of the inner ring of the bearing. It is through these two flat contact surfaces that side thrust from the axle is transmitted to the bearing and not through the curved surface of the respective chamfers.

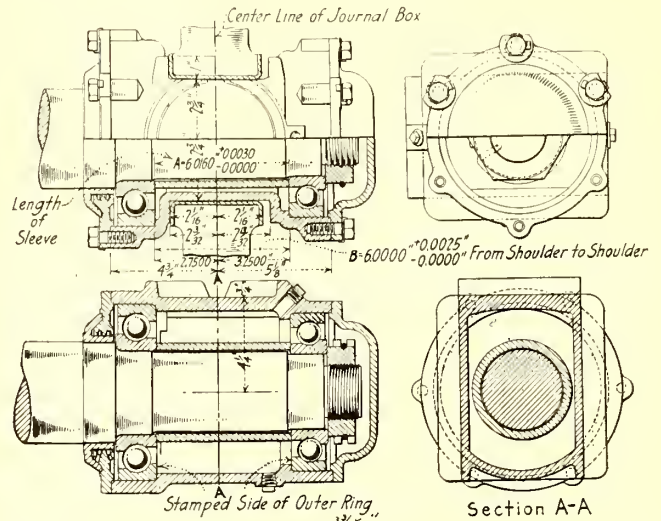


FIG. 2—BALL BEARING AND HOUSING FOR USE ON ELECTRIC RAILWAY CARS

An exceptional method of taking advantage of the radial and thrust load conditions is the application of a combined radial and thrust type of bearing, which we call the "Radio-Thrust" bearing. The mounting of these bearings in the boxes, as shown in Fig. 2, illustrates a solution of a second problem, namely, that of the installation of ball bearings on railway cars without changing the standard truck in the least. The installation as shown applies to a 3-ton standard truck.

There are two features peculiar to this method of mounting "Radio-Thrust" bearings. First, the bearings themselves have radial end play, due to the angular contact between balls and races, affording a thrust capacity in one direction of 100 per cent of the radial capacity. This end play is taken up by locking the bearings against each other with the thrust sides in opposed position. This is done by tightening the nut on the end of the axle. In order to make it absolutely impossible to lock the bearings too tight, thereby imposing a load on them in addition to the weight which they are to carry, a sleeve is provided between the inner rings of the bearings. This sleeve is cut to a length slightly in excess of the distance between the shoulders in the box which bear against the outer rings of the bearings. This simple method insures the required amount of freedom of the bearings regardless of the tightness with which the nut may be turned down, and consequently does away entirely with any kind of adjustment approaching delicate handling.

By reference to Fig. 2 it will be noted that the standard pedestal of the truck fits into the vertical slides of the box with a clearance of about 1/16 in. between the inner surfaces, and a very liberal clearance between the outer surfaces. Consequently, when the car takes a curve to the right, for instance, the right-hand, or inside, box will come in contact with the right-hand pedestal, thereby transmitting the thrust to the inner bearing of this box only. The greatest part of the radial load obtaining at this moment is being carried by both bearings on the other end of the axle, there being no thrust whatever on the outside bearings. This follows on account of the above-mentioned large clearance between the outside shoulder of the box and pedestal, as the latter two are not in contact with each other laterally. The inner bearing of the inside wheel is being



made to take radial load also, but very much less than that imposed on the inner bearing of the outside wheel. The result is that considerably smaller bearing sizes are required with this method than when one of the bearings in the outside wheel is required to carry the thrust.

Satisfactory service of ball bearings presupposes, of course, adequate lubrication and a means of excluding dirt and grit. A highly effective dirt seal is the one shown in Fig. 2. Its working principle is based on the action of the grist mill. There are no contacting or wearing surfaces, and no felt is used either for excluding dirt or retaining grease.

A great number of cars with these trucks have been equipped in this way with the "Radio-Thrust" bearings, among others by the largest electric railway companies in the East. These have been in operation for a period in excess of a year.

Before long I hope to be able to present definite data regarding the working conditions on the cars so equipped.

### New Interurban and Work Cars for the K. C., C. C. & St. J. Ry.

J. N. SPELLMAN

Master Mechanic Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo.

The Kansas City, Clay County & St. Joseph Railway has recently placed in operation four passenger cars built by the Cincinnati Car Company, known as the "60" type. These cars, as shown in an accompanying illustration, are of the center-entrance type, with smoking compartment in the rear end, and have a seating capacity of sixty-six passengers. Completely equipped each car weighs 78,000 lb. The trucks are Baldwin (class 78-30-A) with a 6-ft. 6-in. wheelbase and 36-in. wheels. The air-brake equipment is the Westinghouse type AMM, combined automatic and straight air for double-end operation. Each car is equipped with four No. 334-V-6, 600/1200-volt motors, and HL control, 600/1200-volt, double-end control, designed for half-speed operation of the motors on 600 volts, with changeover switches for the control and lighting circuits when the car is operating in 600-volt zones. The control apparatus is furnished with train

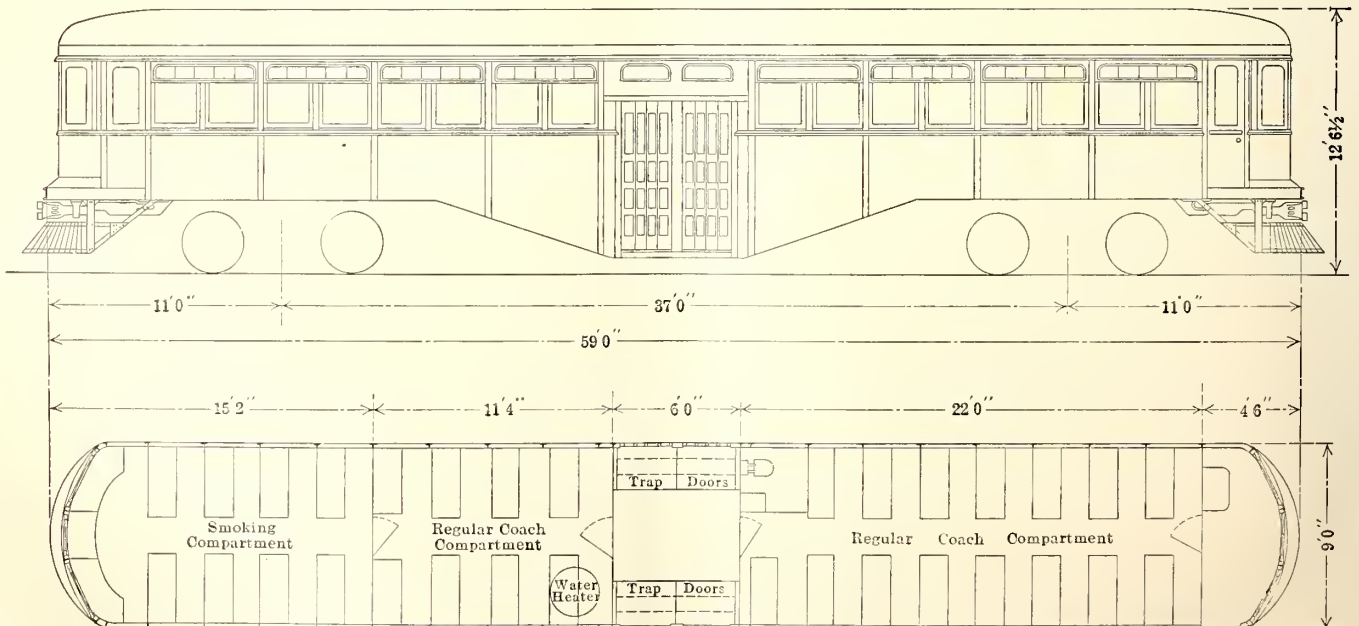


NEW CENTER-ENTRANCE INTERURBAN CAR WITH TRAILER

and bus-line receptacles and jumpers, so that two or more cars can be operated in a train from one master controller, and with but one trolley on the wire. The cars are also equipped with Westinghouse pneumatic train signals.

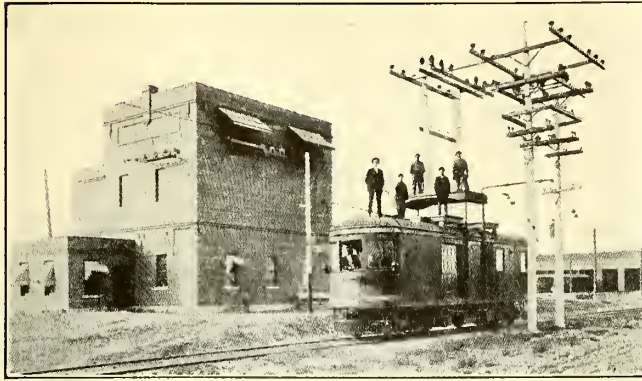
The accompanying illustration shows a plan and elevation of the new car. It differs in several respects from the type of car previously ordered, which was fully described in the ELECTRIC RAILWAY JOURNAL of Jan. 18, 1913. The smoking compartment has been reduced about one-half by the addition of a partition. The space in the motorman's compartment has also been increased, and a side door was installed so that the motorman can have access to the outside without going through the coach.

For use in connection with the maintenance of its overhead work, the company employs a line car which when completely equipped weighs 60,450 lb. The trucks are of Baldwin make (class 73-18-K) with 6-ft. 6-in. wheelbase and 36-in. wheels. The air-brake equipment is the same as that used for the passenger cars. Four Westinghouse No. 327-C, 50-hp. 600/1200-volt motors are used, having a gear ratio of 22:62. Standard HL, double-end, 1200-volt control is employed. The platform on the roof is operated by an air cylinder under the control of the motorman, by means of which the platform can be raised or lowered as required by the lineman at work on the overhead trolley. The line car is furnished with a complete line of overhead mate-



PLAN AND ELEVATION OF CENTER-ENTRANCE INTERURBAN CAR





LINE CAR WITH PLATFORM OPERATED BY AIR

rial and tools necessary for emergency repairs, and in addition is fitted out with an emergency hospital outfit.

### Railless Trolley Battery Vehicle

The Bradford (England) City Tramways have just put into operation the new motor wagon shown in the accompanying illustration. It was designed by C. J. Spencer, general manager, for the transportation of merchandise in connection with the ordinary passenger tramway service. It was constructed by building a suitable wagon body upon the chassis of an old trackless trolley car, of the type used on the Bradford Tramways.

The wagon or truck is equipped with two 20-hp. motors with series-parallel control for operation on 500 volts. It has a trolley pole for use under a trolley wire, and an earthing device for making contact with the rail when drawing line current. The earthing device is an extension of the steering arm of the vehicle bearing on the track by means of a cast-iron block and automatically steering the vehicle while serving as a contact maker. This earthing scheme has been used by the City Tramways on the ordinary trackless trolley car when operating over the tramway routes. It was designed by E. Cross, general manager Rotherham Tramways.

The wagon is also equipped with 120 cells of Edison storage battery, giving a normal voltage of 150. The capacity is sufficient to give the vehicle a range of about 10 miles, at a speed corresponding to the reduced voltage. The battery may be charged in series with the motors while the wagon is operating on trolley voltage.



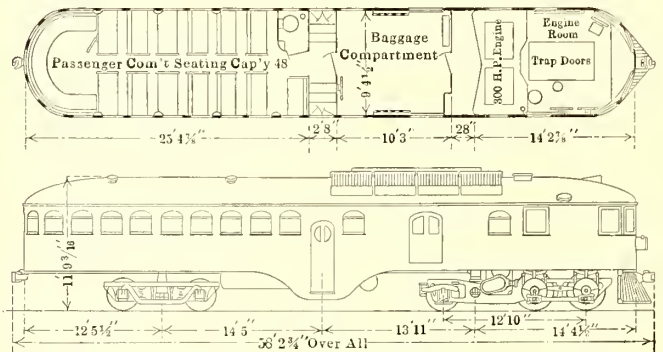
RAILLESS TROLLEY BATTERY VEHICLE FOR BRADFORD (ENGLAND) CITY TRAMWAYS

A change-over switch is provided to shift the connections from battery to overhead wire and earth connector, and vice versa.

The new vehicle was designed particularly on account of the high price of gasoline in England at present. The capacity of this first machine is 2 tons.

### McKeen "Mallet" Motor Car Sold to Southern Utah Railroad

An application of gasoline motor car service which will be especially interesting to lines having unusual grades is announced by the Southern Utah Railroad Company, Price, Utah, which has purchased one of the McKeen Motor Car Company's "Mallet" motor cars. This car will operate in place of the present consolidation locomotive and combination coach train between Price and the mines at Hiawatha, Utah. This is an 8-mile run of continuous 2½ per cent and 3 per cent grades, with frequent curves and a maximum grade of 4.92 per cent. In order to obtain ample surplus power for ascending these grades, the car will be equipped with the builder's gasoline locomotive-type power unit, consisting of a 300-hp. engine from which the power is



PLAN AND ELEVATION OF SOUTHERN UTAH "MALLET" MOTOR CAR

transmitted to the driving axles. In this design a third speed is added to the transmission, and the driving wheels are connected by side rods. The car is 58 ft. 2¾ in. long over all and contains a 10-ft. 3-in. baggage compartment, and a main compartment with seats for forty-eight passengers. The plan and elevation of this equipment are shown in the accompanying illustration.

### Exciter Set Used for Track Welding

The Hattiesburg Traction Company, Hattiesburg, Miss., was recently confronted with the necessity for either buying five new steam railroad crossings or repairing the old ones. The general manager, H. F. Wheeler, decided in favor of building up the old crossings by means of arc welding.

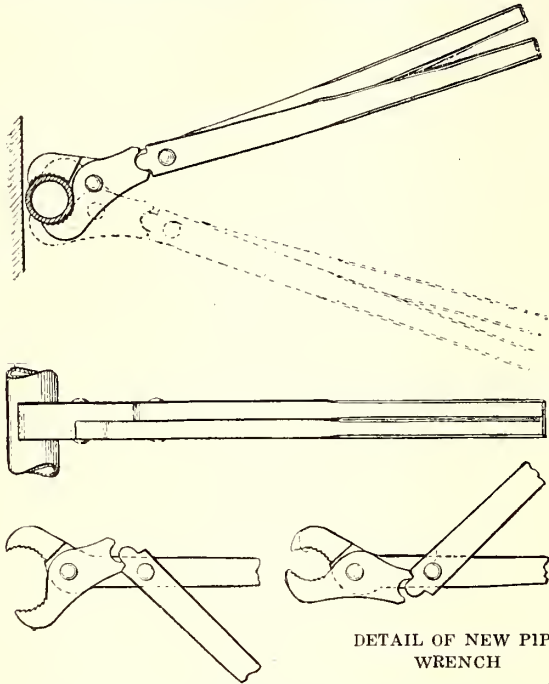
As the job was not large enough to warrant the company in buying a set of resistors for use with the trolley voltage, a 35-kw., 110-volt exciter set was pressed into service. The voltage was reduced to about 60, and the negative terminal was connected to the trolley wire and the positive to the ground during the period between midnight and 5.30 a. m. With about 1 mile of No. 00 trolley wire there was sufficient resistance in the wire and rail return to limit the current on short-circuit, when starting the arc, to an amount not injurious to the machine.

By this procedure the crossings were repaired at a small cost for welding iron and labor and with very little waste in power. Of course, in a job of the size of this one the power saving was incidental compared with the simplicity of the equipment.



### A Pipe Wrench for Limited Clearances

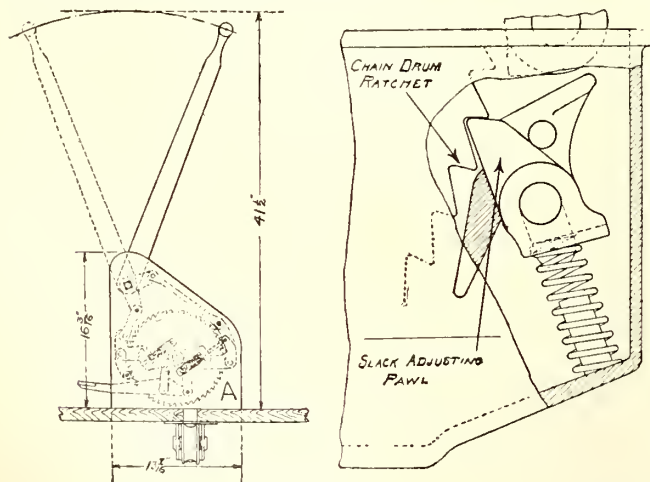
A wrench designed particularly to meet limited clearances such as obtain in pipe and conduit work in car construction has just been put on the market by the Mechanical Specialties Company, Chicago, Ill. The features of this wrench are shown in the accompanying illustration. It will be noted that it is particularly adaptable for pipe work against walls, nested pipe and conduit work within walls. This tool is known as the



“LaRock Wrench,” and it is quite simple in construction since it contains only three parts, with no screws, springs, pins or ratchet, the absence of which makes adjustment unnecessary, and the jaws in the wrench are always in a position to do pipe work.

### Hand Brake and Slack Adjuster

The Horne double-acting hand brake, which the Lord Manufacturing Company recently put on the market and which was described on page 574 of the ELECTRIC RAILWAY JOURNAL for March 18, 1916, has been further im-



HORNE DOUBLE-ACTING HAND BRAKE AND SLACK ADJUSTER

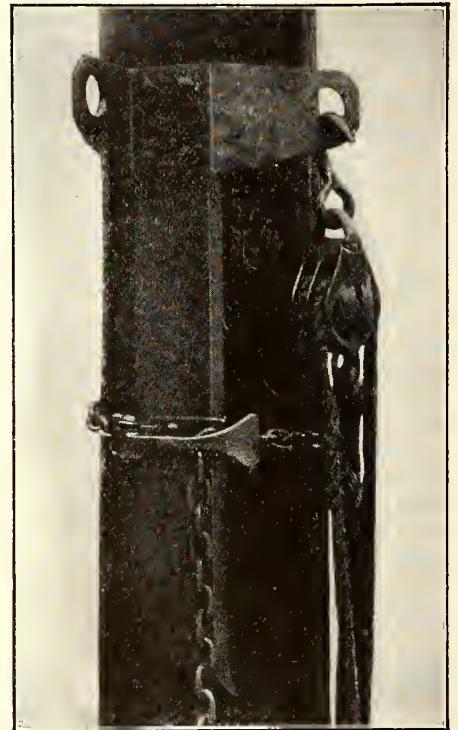
proved by the addition of a slack adjuster. This new device, which is shown in detail at the right in the accompanying drawing, is placed at the position marked A in the assembly drawing of the brake which is repro-

duced at the left from the above-mentioned article. The adjusting pawl is attached to a spring which is of sufficient strength to overcome any slacking of the chain.

On releasing the brake, the toothed wheel which is attached to the drum moves clockwise owing to the released energy which was stored up by braking. The force of the spring in the pawl is overcome and the pawl is pushed away from the toothed wheel. As the brake rigging loses its stored energy and the toothed wheel slows up partly due to the friction of the pawl against the wheel, the pawl engages the wheel, causing the release of only sufficient chain to bring the brake-shoes clear of the wheels. As additional slack occurs, due to wear, the pawl automatically checks the rotation of the chain drum as soon as slack occurs, thus keeping excessive chain reeled upon the drum and the entire brake ready for instant action in the same manner as if the brakes had just been adjusted in the shop.

### A New Pole-Top Gin

The pole top gin, illustrated herewith, which was designed especially for mounting equipment on wood pole lines, has just been placed on the market by the Railway & Industrial Engineering Company of Pittsburgh, Pa. It consists of a main base, or channel, fitted with four spurs and a chain, and a lever for clamping it to the pole. Tackle can be suspended from the arms at the top. To attach the gin the lineman jabs the lower spurs into the pole as he would a spear; then the top of the channel is thrust towards the pole, and the upper supports sink into the wood. In this position the gin will “stay put” while the handle is opened and the chain carried around the pole and linked into the catch. The handle is then closed, causing the chain to bite



NEW POLE-TOP GIN SHOWN IN WORKING POSITION

into the pole, and in this position it is self-locked. If the chain is too loose and does not bite into the pole firmly enough, the handle is opened, the chain disengaged from the catch and shortened one link. This shortens the chain when the handle is closed again. As the load is shifted to the gin, the lower spurs bite into the pole and become firmly placed. When the work is finished the gin can be readily detached.

As designed at present, the gin can safely be used with loads of 1500 lb. or 2000 lb. in emergency. Steel cross-arms weighing from 40 lb. to 120 lb. are, of course, very easily handled.

In addition to its use in handling equipment on poles, this gin can be employed in replacing poles. Other uses will suggest themselves to the reader.



# NEWS OF ELECTRIC RAILWAYS

## CITY ENGINEER DISCUSSES TRANSIT PROBLEMS

### Construction of Elevated Line Urged for San Francisco Within Five Years

M. M. O'Shaughnessy, city engineer of San Francisco, Cal., contributed to a recent issue of the San Francisco Call an article reviewing the history of transportation in the city. This account was of unusual interest because in concluding the article Mr. O'Shaughnessy dealt with the situation as it is at present and with the relations of the Municipal line to the problems now presenting themselves. He said that the track mileage in the city was about five years behind the population requirements. His conclusion follows in part:

"Mr. Arnold, in his report of 1913, stated that there was immediate necessity of 72 miles of single track, which should be provided at a rate of not less than 15 miles a year. Since then the municipality has constructed some 28 miles of track, and this represents the total additional trackage in San Francisco since the completion of the Geary Street road.

"The proper and economic development of the transportation facilities in San Francisco will only be possible when all of the railway lines are owned or operated under one management. This is absolutely necessary to permit of extensions being built along logical lines without wasteful duplication of service in certain districts to reach new territory requiring service. The construction of a few blocks of track here and there will not solve the railway problem.

"On account of the location of the business district and the ferry with relation to the residence districts, a tremendous burden has been thrown on Market Street in the way of both vehicular and railway traffic, and this street, with the present modes of transportation, has about reached the limit of its capacity to handle that traffic.

"The real transportation problem confronting us in San Francisco, then, is to relieve this burden on Market Street and at the same time to provide more rapid and adequate transportation to the outlying districts and permit a healthy growth of the city within its own limits. The construction of the Twin Peaks tunnel is the first real step along lines looking to an ultimate solution of the problem, but this does not reach the root of the trouble, as some means must be found to relieve the congestion on lower Market Street and to shorten the time out Market Street.

"Rapid transit systems are either of the elevated or subway type. The first cost of an elevated system is much less than that for a subway. Comparative costs are about \$800,000 a mile for the former, as against \$3,500,000 a mile for the subway construction. The rapid transit problem has been studied in a large number of Eastern cities, notably in New York, Brooklyn, Chicago, Boston and Philadelphia, and as a result of progress in the art many of the objections and much of the prejudice against the elevated systems have been eliminated. The feature of the noise has been practically eliminated in the Philadelphia system by the use of ballasted construction. The public preference is for riding in the open air and sunlight of the elevated as against the subways.

"The first unit of San Francisco's rapid transit construction will undoubtedly be an elevated road which must be parallel to Market Street, running from about First Street and connecting with the Twin Peaks Tunnel with a branch south in the vicinity of Capp Street, extending toward the county line.

"In order for a rapid transit system to be effective in solving the problem, it is essential that the existing intersecting lines be utilized as feeders, which means, of course, a practical unification of existing systems. Much thought and study throughout the entire United States, and, in fact, throughout the world, is being centered on developing the elevated type of rapid transit, the great effort being to lighten the construction, rendering the elevated structure

correspondingly lighter and more open, and reducing the noise by sound-deadening material between the rails and ties or stringers as the type of construction may call for. Very interesting developments have been made in certain types of elevated systems in which the cars are suspended from the trucks which carry the electric equipment overhead. This type of construction can be built for practically half the cost of the standard type of elevated roads in use throughout the United States.

"Construction of this first unit of San Francisco's rapid transit system should be started within the next few years so that operations could be commenced within not more than five years."

## SHORE LINE EMPLOYEES STRIKE

### Men Return After Several Days on Terms Proposed by Company During Wage Negotiations

The employees of the Shore Line Electric Railway, Norwich, Conn., went on strike on June 1. As a result there was an almost complete suspension of service for several days between New Haven, Conn., and Westerly, R. I., and between New London and West Thompson, Conn. More than 600 men are reported to have been affected. The strike was precipitated through the uncompromising insistence of the men upon the company meeting new wage demands made by them. The old agreement expired at midnight on June 1. The new scale asked for by the men provided for a maximum of 35 cents an hour after three years' service. The company offered a compromise of a 32-cent maximum.

R. W. Perkins, president of the company, on June 1 posted a notice informing the strikers that unless they returned to work within twenty-four hours they could consider themselves no longer in the company's employ, as new men would be brought in to take their places. Many of the men are non-union, and partial service was continued with them as operators at first. Other men, however, were added at once in accordance with the notice of the company to the men who quit and the full quota of cars was soon in service on the New London and other lines. On June 2 another warning notice was posted over the signature of S. Anderson, the general manager. He said that a sufficient number of men had been secured to operate all divisions in full. This was borne out by the arrivals at the New Haven Railroad station in New London, where the men coming in to replace the strikers attracted extraordinary attention on account of their commissary equipment.

Coincident with this Mr. Perkins issued a statement in part as follows:

"I wish that the controversy might be settled by the old men returning to their places. Once again I desire to ask the patience of the public for a day or two until we can get things back to normal shape. We have men enough to do this, men who are experienced motormen and conductors. While not desiring to reiterate any previous statements I have made, I should like once more to make it clear to the public that the demand which has been made by the men is absolutely prohibitive. It simply could not be granted. The revenue of the system would not stand it. For that reason we have been forced to get other men to take the places of the strikers in order that the company may resume traffic accommodations."

Formal announcement was made on June 7 that the strike had been settled. The men accepted the compromise offered by the company previous to the strike and returned to work at once. Under the terms of the agreement the minimum wage scale will be 26 cents an hour and the maximum 32 cents after six years' service. Ten cents an hour additional will be granted for overtime, and an allowance for meal tickets will be made when the men are kept on the cars. The demand of the men for recognition of the union was not granted. The strike was attended with little or no disorder.



## WASHINGTON RAILWAY VALUATIONS REDUCED

By the State Tax Commission's actual valuation of railroad and telegraph lines in Washington for 1916 the total valuation of electric and interurban lines has decreased \$2,747,180 from the total valuation of \$49,211,280 for 1915. What amounts to a total reduction of \$48,075 in tax payment is granted by the commission in allowing the decreased valuation, but electric railway representatives are reported as expecting to go before the State Board of Equalization in August and demand still further reduction. The reports of the electric railways for the year ended Dec. 31, 1915, show a consistent decrease in gross and net earnings ascribed largely to competition with automobiles, operated both as public and private conveyances. In the past three years the greatly increased mileage of improved roads has lent an impetus to the use of automobiles and practically all of the electrical lines have good roads paralleling them. The reduced earnings of the roads, due to falling off of freight and passenger business, has prevented the electric railways from adding to their equipment or extending their lines appreciably so that depreciation and obsolescence of equipment which were heretofore overcome by replacements, improvements and betterments, operate to create a decrease in the value of the electric lines generally throughout the State. The complete schedule of valuations of the electric railways for both 1915 and 1916, as arrived at by the State Tax Commission, is as follows:

	1915	1916
Everett Railway, Light & Water Company	\$2,075,000	*\$1,275,000
Grays Harbor Railway & Light Company	1,225,000	1,200,000
Lewiston-Clarkston Transportation Company		13,700
Loyal Railway	15,000	15,000
Olympia Light & Power Company	330,000	330,000
Pacific Traction Company	245,500	245,500
Puget Sound Traction, Light & Power Company	19,366,780	18,681,600
Seattle, Renton & Southern Railway	1,200,000	1,200,000
Tacoma Railway & Power Company	3,900,000	3,600,000
Western Washington Power Company	44,000	44,000
Willapa Electric Company	128,700	108,700
North Coast Power Company	412,475	373,100
Pacific Northwest Traction Company	2,590,700	2,542,500
Puget Sound Electric Company	3,250,000	3,000,000
Spokane & Inland Empire Railroad	9,000,000	8,700,000
Walla Walla Valley Railway	410,000	372,000
Washington Water Power Company	3,900,000	3,550,000
Yakima Valley Transportation Company	459,000	413,000
Total	\$49,211,280	\$45,664,100

\*\$800,000 deducted on account of the purchase of the water system by the city of Everett.

## WORCESTER AND SPRINGFIELD WAGES GO TO ARBITRATION

Failure to reach an agreement on new wage schedules has led the conferees of the Springfield Street Railway, the Worcester Consolidated Street Railway and the representatives of the employees of the two companies to resort to arbitration for the settlement of the issues in controversy. The principal issues in dispute concern wages and working conditions. The Springfield men sought increases averaging from 50 to 65 cents a day. Men in the service of the company six months were to receive \$2.75 a day; second six months \$3 a day; the second year and thereafter \$3.50 a day. At the present time the minimum daily wage is \$2.25 and the maximum \$2.85. Wage schedules are based on a nine-in-eleven-hour day. The Worcester Consolidated Street Railway employees were seeking a similar wage schedule, based on a nine-in-eleven-hour day instead of an hourly schedule, such as they are now working under. The principal difference was on the methods of working. The company held out for hourly or "platform" time, while the men sought a straight daily wage rate. In the first offer the company submitted a rate of 25 cents an hour for the first six months, 26½ cents an hour for the second six months, 28 cents for the second year, 29 cents for the third year and 31 cents for the fourth year and thereafter. In its second offer, which was in the nature of a compromise proposal, the company agreed to maintain its present daily wage rates, but stipulated that all new employees entering the service of the company should be paid on an hourly basis. A proposal to increase its previous wage offer 1 cent for all grades of employees was also made. This latter proposition was rejected by the men.

## MR. TAYLOR TALKS SUBWAY IN PITTSBURGH

The rapid transit problem that confronts Pittsburgh was discussed at a dinner tendered to A. Merritt Taylor at the William Penn Hotel, that city, on June 1. Members of the Council and many prominent business men attended, among them J. D. Callery, president of the Pittsburgh Railways, who promised to co-operate in any plans that are advanced to better conditions. Mr. Taylor, who is about to enter on a preliminary survey of the needs of the city, was the principal speaker. He said that any recommendations for Pittsburgh must be based upon ascertainable facts. The transit problem should be taken up and disposed of in a methodical way, with regard to future development. Lines built first must eventually become terminal lines. An investigation similar to that made in Philadelphia should determine the location and character of high-speed lines which will be needed to serve the present and future requirements of Pittsburgh.

Continuing, Mr. Taylor said that the people should be informed just what saving of time there would be between all points in the city, and made to understand that the discomfort and inconvenience of traveling in surface cars will be eliminated; that congestion in the downtown district will be relieved; that the field for business men and workmen will be widened, and that passengers will be collected and distributed quickly. It will seem costly and tedious at first, but the resultant advantage will justify the undertaking. Mr. Taylor suggested that an able man of sound judgment, preferably a resident of Pittsburgh, be selected and appointed by Council as transit commissioner, and form an organization of engineers and specialists to diagnose the transit problem. The Mayor and members of the Council present pledged themselves to appropriate \$150,000 for the preliminary work which is regarded as necessary to complete the plans.

## CITY HELD TO STRICT BUSINESS ACCOUNTABILITY

Judge Frater, in the Superior Court at Seattle, Wash., has handed down a decision stating that the city of Seattle must be held to the same strict business accountability as an individual and that because of the city's attempt to revoke the franchise of the Seattle, Renton & Southern Railway, which attempt resulted in losses to the railway, the city abrogated its right to a claim for 2 per cent of the gross earnings of the road for the years 1912, 1913 and 1914, amounting to \$13,078. In his ruling the judge said in part:

"There is no reason in equity, law or justice why a city or its public officials should not be held to the same strict regard in the matter of fair dealings as an individual, and if the city enters into contractual relationship with an individual the city should be held to the same standard of honesty as the individual, and who will contend that a municipal corporation could be authorized to collect rent or compensation for a privilege which it denies to the individual? We submit that there is no reason in law, justice or equity why the claim of the city should be allowed, and it, therefore, follows that the same must be and is hereby rejected."

A franchise was assigned to the railway by W. R. Crawford in May, 1907. The franchise provided that 2 per cent of the gross earnings of the road must be paid annually to the city. In 1912 the City Council passed an ordinance revoking the franchise, and from then until March, 1915, the Council refused to grant any rights or privileges to the railway company according to the decision. Between Aug. 28, 1912, and March, 1913, the receivers tendered to the city the franchise tax of 2 per cent of the gross earnings. It was refused. In March, 1915, the Federal District Court declared the ordinance revoking the franchise to be void. In this connection the court said that it was true the decrees of the United States Court did establish the validity of the ordinance as a binding franchise, but that decree did not and could not restore to the company the benefits which it lost while it had been deprived of its rights by the wrongful act of the city, nor did nor could it establish the right in the city to exact payment for the privileges denied by the city while they were so denied.



### ANOTHER DUAL LINE TO OPEN ON JUNE 19

Another part of the dual system of rapid transit in the city of New York has been declared to be ready for operation by the Public Service Commission for the First District, namely, the New Utrecht Avenue branch of the Fourth Avenue subway, the operation to begin at noon on June 24. All tracks of the New Utrecht Avenue line will be placed in operation from Thirty-eighth Street and Fourth Avenue, where connection is made with the Fourth Avenue, Brooklyn, subway, down to the station at Sixty-second Street and New Utrecht Avenue, where the line crosses the Sea Beach branch of the Fourth Avenue subway. In addition, there will be operation over one track from Sixty-second Street south to the Eighteenth Avenue station. Through trains will be run from Manhattan to Eighteenth Avenue, but south of Sixty-second Street the operation will be limited by the fact that only one track is ready for use at this time. Operation of the remainder of the line should begin in the late summer or in the coming fall. Since the signing of the dual system contracts on March 19, 1913, the commission has issued resolutions placing the following city-owned lines of the dual system in operation: The Centre Street loop in Manhattan, the Fourth Avenue subway and the Sea Beach Railway in Brooklyn, all for operation by the New York Municipal Railway Corporation; and the Queensboro subway, for operation by the Interborough Rapid Transit Company. Other parts of the system are nearing completion, and within a few months, it is expected, the commission will be able to place several new lines in service.

### COMPLETION OF OREM LINE CELEBRATED

In commemoration of the completion of the Salt Lake & Utah Railroad (the Orem interurban electric line) to its southern terminus at Payson, a grand carnival was held there by the citizens on May 26 and 27. A goodly portion of the population of Utah County, whose fertile fields are put in almost hourly communication with the metropolis of the State by this line, turned out to show their appreciation of W. C. Orem, the president, and his associates for the service they had rendered the communities. Prominent railroad officials and citizens of Salt Lake City went down to Payson to join with the residents in the festivities. Included in the party were W. C. Orem, president of the railroad; Mrs. Orem and their two sons and two daughters; W. R. Armstrong, general manager of the Orem line; Ross Beason, traffic manager; Julian Bamberger, president of the Salt Lake & Ogden Railroad; John Hickey, Stephen L. Chipman, A. J. Evans, James McBeth, D. R. Beebe, J. B. Keeler and others. The golden spikes in the last tie in the roadbed were driven by Mrs. George Done, who had been selected queen of the carnival, and Miss Gladys Orem, President Orem's seventeen-year-old daughter.

With the completion of this line to Payson, the company has inaugurated express service with fast time and few stops between Salt Lake City and its terminus 65 miles south. Two express trains are operated daily in each direction, in addition, to the ten regular trains which make all stops. This is the first express service placed in operation by an electric interurban line in Utah.

### PREPARING FOR CINCINNATI BOND SALE

The Rapid Transit Commission of Cincinnati, Ohio, has advised the City Council that the \$6,000,000 of bonds for the construction of the rapid transit line are to be sold as the money is needed and that no part of the issue will be sold until a lease is effected and ratified by the voters. Council, however, will be asked to enact the necessary legislation for the issue of the bonds, so that no delays will be necessary when this step has been approved.

Frank S. Krug, city engineer, will be formally chosen as chief engineer of the commission within a short time. On June 2 James A. Stewart was appointed assistant engineer at \$25 a day for the time spent in the work. Elmer Humphreys and Donald W. Caven will be assistant engineers in charge of surveying crews.

W. L. Woodward presented a report of the Federated Improvement Association at a hearing on the revision of the Cincinnati Traction Company's franchise on June 1, in

which objections were made to the franchise granted recently to the West End Rapid Transit Company, because it does not provide for 5-cent fares and transfers.

The Cincinnati, Lawrenceburg & Aurora Street Railway will within a short time apply for a new franchise between Anderson's Ferry and the corporation line at Fernbank, so that it will cover the same period as that of the West End Rapid Transit Company. It is said that the fare will be reduced from 10 to 5 cents if a new franchise is granted.

### NEW TRENTON ARBITRATION PLAN

On June 7 there was what appeared to be an absolute deadlock in the matter of attempting to select the third arbiter to adjust the differences between the Trenton & Mercer County Traction Corporation, Trenton, N. J., and Division No. 540, of the Amalgamated Association, growing out of the dismissal of conductors for alleged fare "sniping." The union, however, proposed a new plan for the selection of the third arbiter and this was adopted by the company.

Under the new plan the company will be represented by Rankin Johnson, president of the corporation, and Edward Peartree, superintendent, and the union by Marcus Minton and W. N. Frizzell, both members of the executive committee of the union, and the latter the union's secretary. These four will attempt to select the fifth man to act on a committee of three or the fifth man to act on a committee of five. The union representatives and the company will meet under this plan in a few days in the company's offices.

Peter E. Hurley, general manager of the company, and C. Howard Severs, of the union, who were the original arbitrators, found that they could not agree upon a third man. Numerous names were presented by each side and some of them were mutually agreeable. In all cases where there was agreement, however, the men selected would not act, for personal or other reasons. Two prominent men asked to serve as the third arbiter were John Rellstab, judge of the United States District Court, and Frederick W. Donnelly, Mayor of Trenton.

It is the intention of the four new arbiters to try and select a third man to work with Messrs. Hurley and Severs, or a new man to work with the new representatives. The four men will first try and settle some of the ten cases up for arbitration before selecting another man.

At a meeting of the union on June 5 it was decided to stand by the set of conditions for a new agreement served upon the company some time ago. The men are now receiving 27 cents an hour, but in the new agreement ask for 34 cents an hour. The company wants to institute a sliding scale, to start at 25 cents an hour, and also wants an "open shop." The union has notified the company that it will not accept either the sliding scale or "open shop" proposition.

**Increase in Wages in Allentown.**—The Lehigh Valley Traction Company, Allentown, Pa., has again raised the pay of its men. The general advance is 1 cent an hour dating from June 1. This makes the pay for first-year men 25 cents an hour and for five-year men 29 cents an hour.

**Short Strike of Power Employees.**—Linemen and powerhouse employees of the East St. Louis & Suburban Railway, East St. Louis, Ill., went on strike recently for an increase of 15 per cent in wages. E. E. Parsons, general manager of the company, and Bert S. Reed, chairman of the grievance committee, conducted negotiations and effected a compromise under which the men returned after having been out two days.

**Mayor Jost's Services Accepted.**—Henry L. Jost, Mayor of Kansas City, Mo., through two administrations, during which the new franchise of the Kansas City Railways was framed and granted, has offered his services without compensation to the city directors of the railway. These directors were appointed by his administration, and were his personal selections. His good offices have been accepted by the city directors.

**New Wage Terms Sought in Cincinnati.**—The contract between the Cincinnati (Ohio) Traction Company and its platform men expires on June 30, and the men are asking for an increase of 6 cents an hour in the maximum wage



and a proportionate increase down the scale. The maximum is now 27 cents an hour. The company is said to have offered the men an increase of 1 cent an hour. The men are also asking for a closed shop and a reduction from seven to three years in the time for reaching the maximum.

**Hearing on Lessening of Noise on Elevated.**—A hearing will be held by the Public Service Commission for the First District of New York, on June 19, the purpose of which is to bring about the elimination of some of the noise incident to the operation of the elevated railroads in Manhattan, The Bronx, Brooklyn and Queens. At the hearing officials of the companies will be called upon to state what they are willing to do in the direction of providing brakeshoes upon the cars of their lines which will be less noisy than those in operation now.

**Commission Appeals Chicago Service Order Decision.**—The decision of Judge Thomas Taylor, Jr., of the Circuit Court, Chicago, denying the right of the State Public Utilities Commission to issue orders affecting service and equipment on the Chicago Surface Lines, has been appealed to the Supreme Court. A formal injunction preventing the commission from enforcing its order of Sept. 29, 1915, which was intended to effect service changes, has also been entered in the Circuit Court. The decision was referred to in the *ELECTRIC RAILWAY JOURNAL* of June 3, page 1056.

**Plea for Rehearing of Mill Tax Case.**—H. S. Priest, counsel for the United Railways, St. Louis, Mo., on May 30 filed at Washington his petition for a rehearing in the so-called mill tax case, in which the ruling of the United States Supreme Court was adverse to the company. The sending down of its mandate to the Missouri Supreme Court was put off until June 1 by the United States Supreme Court so as to permit the company to file a motion for a rehearing. Mr. Priest contended that the company supposed that its contract with the city protected it against subsequent taxation and brought suit to enjoin the mill tax.

**Traveling Track and Equipment Specialists Appointed.**—Henry L. Doherty & Company, New York, N. Y., who control the Cities Service Company, New York, N. Y., announce the appointment of a traveling master mechanic and a traveling track specialist, to be followed shortly with a traveling transportation director. Arthur Brown of the Toledo Railways & Light Company has been named as traveling master mechanic and A. Swartz, vice-president of the Toledo & Western Railway, will be the track specialist. One of Mr. Brown's attempts will be a standardization of equipment, and Mr. Swartz will soon start on a journey to look over track construction and maintenance.

**Commissioner Carr to Study Foreign Systems.**—Commissioner James O. Carr of the Public Service Commission for the Second District of New York plans to spend six weeks studying the transportation systems of England, France and Italy as these systems have developed under war conditions. Governor Whitman has written Mr. Carr that he has heard that tremendous strides have been made in the transportation field abroad. Accordingly Mr. Carr is taking with him official letters which will put him in direct touch with the men who have solved the problems involved in moving millions of men by steam road, electric railway and automobile. He will study the way in which the various agencies have been enlarged, improved, speeded up and co-ordinated.

**Wages on Chicago Surface and Elevated Advanced on June 1.**—Under the terms of the arbitration award of July 16, 1915, the wages of practically all the employees of the Chicago Surface Lines were automatically advanced approximately 1 cent an hour, making the minimum and maximum for motormen and conductors 27 cents for the first three months of service and 36 cents at the end of the fourth year's service. By an agreement between the management of the Chicago Elevated Railroads and its employees the wages were also automatically advanced on June 1. Motormen's hourly wages were increased from 36 cents to 38 cents, conductors from 29 cents to 31 cents, and regular guards 26 cents to 28 cents. These increases affected approximately 10,000 employees of the two companies.

**Kentucky Assessments Increased.**—Tentative increases in assessments for State taxation have been announced by the State Board of Valuation and Assessment of Kentucky, sit-

ting at Frankfort, which would increase the State's revenue by \$71,000. Electric railways would be affected as follows: Louisville Railway increased from a \$13,400,000 valuation to \$15,048,673; Louisville & Interurban Railroad, \$2,250,000 to \$2,601,488; Louisville & Southern Indiana Traction Company, \$55,000 to \$57,330; Kentucky Traction & Terminal Company, \$1,200,000 to \$1,643,937; Paducah Traction Company, \$260,000 to \$295,735. The Ohio Valley Electric Railway assessment was reduced from \$500,000 to \$496,681. In most cases county taxes are collected on the same valuation as the State taxes.

**Decision Favorable to Cleveland Subway.**—The Ohio Supreme Court has refused to review the decisions of the lower courts which were favorable to the construction of subway approaches to the new bridge across the Cuyahoga River connecting Superior and Detroit Avenues, Cleveland, Ohio. The legality of the plans has thus been established. As a result County Engineer W. A. Stinchcomb has announced that construction work on the approaches will be commenced within thirty days. W. R. Hopkins, president of the Cleveland Underground Rapid Transit Company, and J. J. Stanley, president of the Cleveland Railway, have agreed to cooperate as far as possible in the work. The subway in Superior Avenue will commence 500 ft. east of the bridge. The one in West Twenty-fifth Street will begin 1200 ft. south of the bridge and the one in Detroit Avenue, 1200 ft. west of that point.

**Mr. Doherty Appears Before Milroy Committee.**—At a formal meeting of the Milroy street railway committee at Toledo, Ohio, on June 2 Henry L. Doherty, for the Toledo Railways & Light Company, presented a statement as to the course he felt should be followed in working out the plans for securing municipal ownership. He suggested certain substitutes for portions of the original plan. The provisions of this statement were taken up singly and discussed, but no conclusions were reached on any of the points raised. At an informal meeting on May 31 Mr. Doherty explained the steps necessary for the city to finance the proposition in case the property is taken over. He reviewed the history of the Toledo Railways & Light Company and told of the means used to raise money for improvements and in issuing securities when the present owners assumed control.

**Recognition of Laurel Company's Work.**—The Laurel (Miss.) *Daily Leader* contained recently the following appreciation of the Laurel Light & Railway Company: "No other agency in modern times has done more to develop rural communities or add to the growth of cities than electric interurban railways. Guy M. Walker, owner of the Laurel Light & Railway Company, is aiding immeasurably in the development of Jones County, Laurel and South Mississippi. He has recently acquired the electric properties of McComb City and is negotiating for the Magnolia and Summit electric plants. He proposes to build an interurban railway to connect the three towns. The interurban railway between Laurel and Ellisville has done more than any other agency to develop this section of Jones County, and the extension of electric railways in the city of Laurel has caused the city to grow to double its former size since the street cars were first started."

**Strike on Buffalo Suburban Line.**—Motormen and conductors employed by the Buffalo Southern Railway, Buffalo, N. Y., went on strike at midnight on May 16 for an increase in wages from 25 to 38 cents an hour and recognition of the newly organized local of the Amalgamated Association. No attempt was made by Nathan A. Bundy, receiver and general manager of the line, to operate cars on the Buffalo-Hamburg and Ebenezer divisions until May 25 when a number of new men were employed at the old wage scale. Obstructions were placed at points along the line and overhead wires were cut. Mr. Bundy pointed out to the old men that the road was in the hands of a receiver appointed by the court and was not financially able to pay the increase asked for. The company has been able to secure enough experienced platform men to operate cars. The State Board of Mediation and Arbitration has been unable to effect a settlement. About seventy-five men are employed. The company operates 25 miles of line, connecting Buffalo, Hamburg, Orchard Park, Gardenville and East Seneca.



## PROGRAMS OF ASSOCIATION MEETINGS

## Central Electric Railway Association

Although it is practically three weeks before the Central Electric Railway Association cruise of June 27-30, 200 reservations have been paid for. John Benham, vice-president of the International Register Company, Chicago, Ill., who is in charge of the work of assigning staterooms, advises that by June 10 space on the upper decks will be almost entirely taken up. He is also pleased to state that reservations have already been made by practically all the prominent members of the association, and by leaders among the manufacturers. Several officers of the American Electric Railway Association have also taken reservations or made application for them.

## New York Electric Railway Association

At the annual meeting of the New York Electric Railway Association to be held at the International Hotel, Niagara Falls, on June 27 and 28, the general topic will be "Preparedness." Colonel Bellinger of the United States Army will discuss the problem of troops and munitions transportation, and James E. Hewes, general manager of the Albany Southern Railroad, will speak on "The Advantages of Electrical Transportation in Time of War." At the banquet to be held on Tuesday evening one of the speakers will be Major Babcock. Among the other entertainment features to be provided music will have a large place. A famous band has been engaged to play from 4 p. m. to 7 p. m. on Tuesday, and an orchestra will play all during Tuesday for dancing. A lunch for the ladies will be served at the Buffalo Country Club on Tuesday, and on Wednesday there will be a trip around the Gorge for all. Provision will be made for clock golf on Tuesday morning. The annual business meeting will be held on Wednesday.

## M. C. B. and M. M. Associations

The programs have been announced for the meetings of the Master Car Builders' Association and the American Railway Master Mechanics' Association at Atlantic City, N. J., on June 14, 15 and 16 and June 19, 20 and 21, respectively. At the sessions of the master carbuilders the following reports will be discussed: June 14—Nominations; standards and recommended practice; train brake and signal equipment; brakeshoe and brake beam equipments; car-wheels; arbitration committee; revision of prices for labor and materials, and settlement prices for reinforced wooden cars. June 15—Couplers; draft gear; safety appliances; loading rules; car construction; car tracks, and train lighting and equipment. June 16—Tank cars; specifications and tests for material; welding of truck sides, and bolsters.

At the sessions of the master mechanics on June 19, the following reports will be discussed: Mechanical stokers; revision of standards; dimensions of flange and screw couplings for injectors, and fuel economy and smoke prevention. There will be an individual paper by F. O. Wells, entitled "Standardization of Screw Threads." There will also be a topical discussion of the subject "Best Material for Metallic Packing for Superheater Locomotives," the discussion to be opened by W. E. Woodhouse, of the Canadian Pacific Railroad.

On June 20 the following reports will be discussed: Locomotive headlights; design, construction and maintenance of locomotive boilers; superheater locomotives; equalization of long locomotives; design, maintenance and operation of electric rolling stock; best design and materials for pistons, valves, rings and bushings; co-operation with other railway mechanical organizations. There will also be an individual paper entitled "Alloy Steel" by L. R. Pomery, and a topical discussion of the subject, "Instructions to Young Firemen."

On June 21, the following reports will be discussed: Powdered fuel; specifications and tests for materials; modernizing of existing locomotives, and train resistance and tonnage rating. At this session there will also be an individual paper on "Tests of Four Types of Passenger Car Radiators," by Prof. A. J. Wood and a topical discussion of the subject: "Best Method of Introducing Oil to Cylinders of Superheater Locomotives."

## Financial and Corporate

## I. C. C. ISSUES ACCOUNTING ANSWERS

Another Series of Questions and Tentative Answers Under the Uniform System of Accounts Prescribed by Commission for Electric Railways

Another series of tentative answers to questions raised in connection with the uniform system of accounts prescribed by the Interstate Commerce Commission for electric railways has just been released by the commission. As these answers have not received the formal approval of the commission, however, it should be understood that the decisions do not represent its final conclusions and that they are subject to such revision as may be thought proper before final promulgation in the accounting bulletins of the commission. The questions raised and the answers made to them follow:

**Q.** To what account should be charged the cost of track drips installed for draining tracks? These drips are installed without regard to street intersections or crossings, depending entirely on the condition of the soil.

**A.** The original cost of such drips, whether installed with new construction or subsequent thereto, should be charged to road and equipment account No. 504, "Grading." The cost of labor, repairing or renewing track drips, should be charged to operating expense account No. 8, "Track and Roadway Labor;" material used in connection therewith should be charged to account No. 9, "Miscellaneous Track and Roadway Expenses."

**Q.** To what account should be charged expenses in connection with handling electric light and power accounts, including meter reading, billing and collecting by clerks connected with the general office?

**A.** If the light and power business is not accounted for as an auxiliary operation, the expenses in connection with the handling of the electric light and power accounts should be included in the appropriate general expense accounts for the railway business. Expenses in connection with the reading of meters and the billing and collecting of light and power bills should be charged to operating expense account No. 84, "Salaries and Expenses of General Office Clerks." If the light and power business is accounted for as an auxiliary operation, the expenses in connection with the handling of electric light and power accounts, including meter reading, billing and collecting, should be charged to account No. 214, "Auxiliary Operations—Expenses." If any of such expenses are included in the railway operating expense accounts, they should be cleared therefrom by crediting operating expense account No. 100, "Other Operations—Cr.," and charging account No. 214 (see second and third paragraphs on page 17 of the uniform system of accounts for electric railways).

**Q.** To what account should be charged amounts paid for alleged damage to water and gas pipes by electrolysis?

**A.** To operating expense account No. 92, "Injuries and Damages."

**Q.** To what account should be charged the cost of handling patterns which are kept in the custody of the stores department?

**A.** To operating expense account No. 95, "Store Expenses."

**Q.** During the construction of a road, a commissary was operated at a profit. To what account should this profit be credited? Since commencing operations the commissary has been conducted for the benefit of the roadway department at a loss. To what account should this loss be charged?

**A.** A profit or loss made in the operation of a commissary for employees during the construction period should be credited or debited, as may be appropriate, to road and equipment account No. 550, "Miscellaneous." A profit or loss made in the operation of a commissary for roadway



## ANNUAL REPORTS

## United Railways &amp; Electric Company

The comparative income statement of the United Railways & Electric Company, Baltimore, Md., for the calendar years 1914 and 1915, follows:

	1915		1914	
	Amount	Per Cent	Amount	Per Cent
Gross earnings:				
Revenue from transportation	\$8,904,857	98.63	\$9,083,555	98.69
Revenue from operations other than transportation	123,286	1.37	120,284	1.31
Total	\$9,028,143	100.00	\$9,203,839	100.00
Operating expenses:				
Maintenance of way and structures	\$354,613	3.93	\$399,715	4.34
Maintenance of equipment	362,131	4.01	408,211	4.43
Traffic expenses	7,497	0.08	12,563	0.13
Conducting transportation	2,701,045	29.92	2,727,442	29.63
General and miscellaneous	717,411	7.95	764,507	8.32
Total operating expenses	\$4,142,699	45.89	\$4,312,439	46.85
Net earnings from operation	\$4,885,444	54.11	\$4,891,400	53.15
Income from other sources	8,334	0.09	24,721	0.26
Total net income	\$4,893,778	54.20	\$4,916,121	53.41
Fixed charges	2,999,497	33.22	2,964,826	32.21
Balance	\$1,894,281	20.98	\$1,951,295	21.20
Deduction from income—rental account	67,335	0.74	65,501	0.71
	\$1,826,946	20.24	\$1,885,794	20.49
Extinguishment of discount on securities	37,950	0.42	37,951	0.41
	\$1,788,996	19.82	\$1,847,843	20.08
Interest on income bonds and dividend on preferred stock	560,000	6.20	560,000	6.09
Surplus	\$1,228,996	13.62	\$1,287,843	13.99
Dividends paid on common stock	818,448	9.07	818,448	8.89
Balance carried to the credit of depreciation reserve	\$410,548	4.55	\$469,395	5.10

By comparing the results for 1915 with those for 1914, it will be noted that the decrease in gross earnings was \$175,695 or 1.91 per cent, while the decrease in operating expenses was \$169,740 or 3.94 per cent, and the increase in fixed charges was \$34,670 or 1.17 per cent. The percentage of operating expenses to gross earnings was 45.89 per cent in 1915 as compared with 46.85 per cent in 1914. If the charges to depreciation were included in the operating expenses, the percentage of operating expenses to gross earnings would have been 50.43 per cent. For maintenance of way, structures and equipment, there was charged to operating expenses during the year \$716,744, which with the \$410,547 credited to the depreciation reserve made a total of \$1,127,291.

It is said that this general showing should be especially gratifying for the following reasons: (1) Because of the industrial, commercial and financial depression which prevailed through the first nine months of the year, throwing large numbers of people out of employment with resulting decreased riding. (2) Because of the unfavorable weather conditions during the summer months, causing a heavy reduction in excursion travel. (3) Because of the unregulated jitney competition, which started early in the month of February and reached its maximum during the summer months.

The company has no floating debt. At the end of the fiscal year, it had cash on hand amounting to \$609,771, of which \$400,170 was unexpended balance of proceeds of its two-year notes. As a result of the falling off in earnings the company postponed much of its contemplated construction work in 1915.

The average earnings per car-mile were 30.58 cents, an increase of 0.15 cent, and the cost of service (exclusive of depreciation, etc.) 14.03 cents, a decrease of 0.23 cent. The number of car-miles run was 29,522,100, a decrease of 728,094 miles. The total number of revenue passengers carried was 181,744,023, a decrease of 3,552,327. The number of transfers used was 75,807,256, about 42 per cent of the paying passengers having availed themselves of the transfer privilege.

The total amount of taxes and public charges was \$1,161,838, an increase of \$24,637. This 1915 total represented 12.87 per cent of the gross revenue and 23.78 per cent of the net receipts after paying costs of operation. The park

maintenance employees after a road has commenced operations should be credited or debited, as may be appropriate, to operating expense account No. 19, "Miscellaneous Way Expenses."

Q. Stoves have been installed in each of this company's cars for the purpose of heating same by the hot water system. To what accounts should the cost of installing the stoves and piping and repairs thereto be charged?

A. The original cost of the stoves and piping should be charged to road and equipment account No. 530, "Passenger and Combination Cars," or No. 531, "Freight, Express and Mail Cars," as may be appropriate. The cost of repairs should be charged to operating expense account No. 30, "Passenger and Combination Cars," or No. 31, "Freight, Express and Mail Cars," as may be appropriate. The cost of fuel should be charged to operating expense account No. 67, "Miscellaneous Car Service Expenses."

Q. To what account should be charged the rent paid by a company for a power plant building, power plant equipment and transmission lines? The lessee company has the exclusive use and maintains and operates the property leased. The amount of rent paid represents interest on investment only.

A. As the lessee company has the exclusive use of the leased properties, and the amount of rental paid represents interest on investment only, the amount paid should be charged to income account No. 217, "Miscellaneous Rents." The rents chargeable to operating expense account No. 97, "Rent of Tracks and Facilities," represent rents of property used jointly by the accounting and other carriers.

Q. To what account should be charged the cost of teaming materials, and cost of tools, used in construction?

A. The cost of hauling track material by team for construction purposes should be charged as follows: To account No. 504, "Grading," if the cost of material is chargeable thereto; and to account No. 505, "Ballast," if the cost of the material is chargeable thereto (the cost of final distribution of ballast should be charged to account No. 510, "Track and Roadway Labor"). The cost of teaming ties, rails, rail fastenings, special work and material for underground construction, from storerooms or supply yards in final distribution, should be charged to account No. 510, "Track and Roadway Labor." The cost of tools purchased for use in construction should be charged to the same primary account as the cost of work on which they are used. If, however, the tools are used generally, making it impracticable to distribute the cost to the several accounts affected, it may be charged to account No. 529, "Other Expenditures—Way and Structures" (see third paragraph of Section 3 and Section 10 of the general instructions on pages 92 and 93 of the uniform system of accounts for electric railways).

Q. To what account should be charged the first cost of switch lights and switch targets?

A. To road and equipment account No. 517, "Signals and Interlocking Apparatus."

Q. An electric railway crosses a steam railroad at grade and shares in the expense of maintaining the crossing. To what account should be charged the electric railway's proportion of the cost of maintaining this crossing?

A. The electric railway company's proportion of the cost of labor and material should be charged to the same accounts as if the electric railway did the work itself. For example, if the material used is chargeable to accounts No. 2 to No. 7, inclusive, the cost of labor should be charged to account No. 8, "Track and Railway Labor." If repairs are made to signals or interlocking apparatus, the labor and material should be charged to account No. 17, "Signals and Interlocking Apparatus," etc.

Gross earnings of the West India Electric Company, Ltd., Kingston, Jamaica, for 1915 totaled \$274,317, a decrease of 5.05 per cent as compared to 1914. The operating expenses at \$143,368, however, showed a decrease of 7.64 per cent, so that the net earnings of \$130,949 decreased only 2.05 per cent. The falling off came in the railway department, whose earnings dropped from \$206,870 to \$184,217. The passengers carried decreased 539,563 or 10.72 per cent.



tax for the year was \$580,210, as compared with \$593,813 in 1914, a decrease of \$13,603. This was attributable to the depressed business conditions and unregulated jitney competition.

In discussing the tax question, the report states that through the instrumentality of the street railway system, Baltimore has acquired and is now maintaining nearly 2500 acres of parks. In 1859, the year that street car transportation was inaugurated in Baltimore, there was spent by the city upon its parks but \$16,760, as compared to the \$580,210 just paid by the company, without imposing any tax whatever upon the ordinary taxpayer. This amount represents, at 4 per cent per annum (the average interest rate of city stock), interest upon an investment of over \$14,000,000. The total amount of park tax paid since the consolidation of the different street railway lines in 1899 to 1915, inclusive, is \$7,264,945. These figures serve to show how close a relationship exists between the municipality and the railway system.

**Tennessee Railway, Light & Power Company**

The following statement shows the combined results of the Tennessee Railway, Light & Power Company, the Nashville Railway & Light Company, the Chattanooga Railway & Light Company, and the Tennessee Power Company for 1915 and 1914, all transactions between these companies being eliminated:

	1915	1914	Per Cent Change
Gross earnings .....	\$3,947,268	\$3,762,387	+4.9
Operating expenses, rentals and taxes .....	2,267,394	2,270,989	-0.2
Net earnings .....	\$1,679,874	\$1,491,397	+12.6
Interest .....	\$1,320,263	\$1,194,419	+10.5
Dividends paid on stocks of constituent companies not owned .....	108,472	109,049	-0.5
	\$1,428,735	\$1,303,468	9.6
Balance .....	\$251,139*	\$187,929	33.6

\*Of this balance \$956 accrues to stocks of constituent companies not owned by the Tennessee Railway, Light & Power Company.

The gross earnings shown are derived from street railway, electric light, retail power and wholesale power business, sales to distributing companies controlled not being included in wholesale power. The following statement shows the amount and percentages of each kind of business done by the company:

	Amount	Per Cent of Total
Street railway .....	\$2,031,490	51.5
Retail power and light, etc.....	1,339,735	33.9
Wholesale power .....	576,042	14.6
Total .....	\$3,947,268	100.0

The industrial depression of 1914 continued in aggravated form throughout most of 1915 and the resulting economy among all classes of people affected adversely the earnings of public utility companies. In addition the street railway business in Nashville was affected by jitney competition and in Chattanooga by a smallpox epidemic. The improvement shown in the gross and net earnings was due to additional power business and to normal rainfall and stream flow which enabled the hydroelectric plants to supply a very large percentage of the power requirements, whereas in 1914 the drought necessitated an abnormal amount of costly steam generation. Interest charges increased with the completion of the larger construction work and the resulting charge against operation instead of capital.

The street railway earnings of the Nashville Railway & Light Company were about \$100,000 less than in 1914, and probably three-fourths of this decrease was caused by jitney competition, the enforcement of the measures passed by the authorities having been delayed by litigation until the end of the year. The industrial depression was seriously felt in Chattanooga, and while the Chattanooga Railway & Light Company did not suffer from jitney competition its patronage was, as before stated, reduced by a smallpox epidemic during the first three months of the year. In September, however, business began to show some improvement, bringing increases in all classes of earnings of the company.

**BOSTON ELEVATED INVESTIGATION ASSURED**

Governor McCall of Massachusetts has signed a resolution providing for a commission to investigate the financial condition of the Boston Elevated Railway in accordance with the company's recent letter setting forth its need of increased net earnings. The commission will be composed of the Lieutenant-Governor, the President of the Senate, the Speaker of the House, two members of the Senate, four members of the House, and the members of the Public Service Commission and the Boston Transit Commission. The special commission is to consider what changes, if any, should be made in existing laws relative to the company to enable it to meet the reasonable demands of the public for the extension and improvement of its system of transportation; also the advisability of any change in subway rentals, any reduction in taxes, and any increase in fares or changes in the present transfer system. The commission is to report to the next Legislature not later than Jan. 15, 1917, its recommendations for legislation and such further recommendations as in its judgment may be necessary or desirable to enable the company to provide a more efficient service and improve its credit. The Senators and Representatives on the special commission are to receive such compensation as may be approved by the Governor and Council, and the commission may incur any necessary expenses.

**American Railways, Philadelphia, Pa.**—At a session of the Board of Public Utility Commissioners of New Jersey on June 6 the American Railways informally advised the board that it had contracted to purchase, subject to the approval of the board, the entire capital stock of the Electric Company of New Jersey, the Penns Grove Electric Light, Heat & Power Company, the Woodstown Ice & Cold Storage Company, the Clementon Township United Electric Improvement Company and the Williamstown Electric Company. It also advised the board that every share of the stock of those companies had been deposited under agreements, and that an application would be made to the board for authority to merge and consolidate those companies and for the right of the American Railways to acquire all of their outstanding capital stock.

**Bay State Street Railway, Boston, Mass.**—The Bay State Street Railway, in a petition filed with the Massachusetts Public Service Commission has asked permission to issue \$2,750,000 of 5 per cent coupon notes to be dated Aug. 1, 1916, and to mature serially on dates and in amounts as follows: Aug. 1, 1917, \$360,000; Aug. 1, 1918, \$370,000; Aug. 1, 1919, \$380,000; Aug. 1, 1920, \$390,000; Aug. 1, 1921, \$405,000; Aug. 1, 1922, \$415,000; Aug. 1, 1923, \$430,000. The proposed notes are to be issued for the purpose of reconstructing track and overhead equipment and of replacing rolling stock and other property. The directors on May 31 voted to issue the proposed \$2,750,000 of notes, which are part of a \$3,500,000 issue authorized on March 9, 1916.

**Chicago & Milwaukee Electric Railroad, Highwood, Ill.**—Judge Landis has confirmed the sale of the Chicago & Milwaukee Electric Railroad to the reorganization committee. In passing on claims of various attorneys for services rendered the court allowed only the claims of attorneys for the trustees and said that those of other attorneys cannot be presented as claims against the purchase price of the property. The court, however, took no action in reducing any of the claims. A member of the reorganization committee is reported to have said that under the terms of the present reorganization Samuel Insull will receive some participation certificates, when issued, but no other securities. Under the former reorganization plan he would have received \$700,000 in junior securities, with the understanding that he would manage the reorganized company and obtain an entrance for it into downtown Chicago over the tracks of the Northwestern Elevated by an agreement with the Chicago, Milwaukee & St. Paul Railroad. This agreement was not concluded, but it is believed that a similar operating agreement will be made after the reorganization has been effected. Receiver Johnson of the company has called for payment at the office of the Central Trust Company of Illinois at 105 and interest on July 1 all the outstanding first mortgage 5 per cent bonds of the company.



**Cumberland County Power & Light Company, Portland, Me.**—A petition has been filed with the Maine Public Utilities Commission by the Portland Railroad asking authority to issue and sell \$850,000 face value of its first lien and consolidated mortgage 5 per cent gold bonds at 96 per cent of their face value with accrued interest. The company asks for the authority to make the bond issue for the following purposes: Refunding \$600,000 of 4½ per cent gold coupon notes of the company, dated Dec. 1, 1911, and maturing on Dec. 1, 1916; reimbursing the company for permanent extensions, enlargements and additions to its properties from Feb. 1, 1912, to Nov. 1, 1915; paying the amount due to the county of Cumberland as its contribution for the new Portland bridge, and for permanent extensions, additions and enlargements of its properties presently needed. A petition has also been filed with the commission by the Cumberland County Power & Light Company to issue and sell \$350,000 face value of its first and refunding mortgage 5 per cent bonds due on Sept. 1, 1942, at not less than 94 per cent of their face value with accrued interest. The company states in its petition that it is necessary to acquire additional funds for the following purposes: To reimburse the company for extensions, additions and improvements made to its properties from Jan. 1, 1916, to April 1, 1916, for which bonds have not been authorized, \$33,583; for the purchase of the capital stock of the Westbrook Electric Company, amounting to \$11,000. The petition further states that the company is entitled under its mortgage to issue and sell the bonds to the extent of 85 per cent of expenditures, or \$124,000. The company is proceeding with the development of its water power at Hiram Falls, with other extensive improvements, additions and extensions of its properties and at present needs funds to carry on all this work.

**Georgia Railway & Power Company, Atlanta, Ga.**—The operating revenues of the Georgia Railway & Power Company and its leased and subsidiary companies for 1915 were \$6,507,656, with operating expenses of \$3,268,349 and net operating revenue of \$3,239,307. Taxes totaled \$443,731. After payment of rentals, interest and sinking funds, the surplus on the year's operations amounted to \$492,174. No comparative figures by years or by classes of service are presented in this company's report. On Dec. 31, 1915, the total single-track mileage operated was 231.902 miles. During the year 0.817 mile of new track was built and 0.802 mile was abandoned and taken up.

**Kansas City (Mo.) Railways.**—The Missouri Public Service Commission has authorized the Kansas City Railways to issue \$1,000,000 of its bonds to take up a similar amount of certificates issued by the receivers for the Metropolitan Street Railway, the predecessor company.

**Oklahoma Railway, Oklahoma City, Okla.**—R. J. Edwards, Oklahoma City, recently offered at par and interest \$500,000 of short-term 6 per cent coupon bonds of the Oklahoma Railway. The purpose of the issue is to refund a temporary note issue of an equal amount previously issued for construction and cover part payment of a modern terminal station in Oklahoma City and to purchase bonds of the Guthrie Street Railway. The bonds are dated Jan. 1, 1916, and are due \$15,000 semi-annually from Jan. 1, 1918, to July, 1925, inclusive. Interest is payable on Jan. 1 and July 1 at the office of the Mississippi Valley Trust Company, St. Louis, Mo. They are redeemable on thirty days' notice on any interest date at a premium of 1½ per cent with accrued interest.

**San Diego & South Eastern Railway, San Diego, Cal.**—The San Diego & South Eastern Railway has filed with the California Railroad Commission an application for a rescission of its decision permitting the company to issue \$343,000 par value of its bonds. The commission three years ago granted the company permission to create a bonded indebtedness of \$600,000 and to issue \$343,000 of those bonds. None of the bonds have been issued because the company has been unable to earn operating expenses. The application which has just been made says that it is doubtful if the corporation will ever be able to do this and to pay interest on the proposed bonds, so that it has abandoned its intention to create the issue.

**San Francisco-Oakland Terminal Railways, Oakland, Cal.**—The California Railroad Commission has authorized the San Francisco-Oakland Terminal Railways to issue \$180,000 of 6 per cent equipment notes to pay in part for thirty-two new cars. The notes are to be in denominations of \$500 and \$1,000, to be callable at 100½ on sixty days' notice and to mature at the rate of \$10,000 every six months beginning May 1, 1917.

**Standard Gas & Electric Company, Chicago, Ill.**—All of the subsidiaries of the Standard Gas & Electric Company earned in excess of their interest requirements, with the exception of two gas companies, one power company and the Fort Smith Light & Traction Company, Fort Smith, Ark. The gross earnings of this last company amounted to \$454,664 in 1915, as compared to \$492,397 in 1914, while the net earnings totaled \$122,895 and \$170,967 respectively. In January, 1916, however, it is said that this company had an increase in both gross and net for the first time in two years. The Arkansas Valley Railway, Light & Power Company, Pueblo, Col., secured gross earnings of \$1,171,628 in 1915 and \$1,156,851 in 1914, with net earnings of \$505,823 and \$422,389 respectively, while the gross of the Ottumwa Railway & Light Company, Ottumwa, Iowa, was \$329,824 in 1915 and \$324,928 in 1914, and the net \$151,070 and \$145,802 respectively.

**Texas Traction Company, Dallas, Tex.**—The consolidation of the Texas Traction Company and the Southern Traction Company is said to be assured. The new company will be known as the Texas Electric Railways. Its corporate existence will date from July 1. The properties are generally known as the Strickland lines and have been operated under one management, but as separate corporations. J. F. Strickland, president of the companies, will be president of the new company. The combined system will include more than 250 miles of line.

**Toronto (Ont.) Railway.**—The stockholders of the Toronto Railway have voted to increase the capital stock of the company by the creation of \$3,000,000 of new stock, making the aggregate capital stock \$15,000,000. The company controls the Toronto & York Radial Railway, the Toronto & Niagara Power Company and the Electrical Development Company of Ontario. A circular to the stockholders calling the meeting of the stockholders explained that the proposed increase was necessary to provide funds to meet the financial requirements of the company and for financing the requirements of subsidiary companies for extensions and betterments. The new shares will be offered to present holders pro rata, and any balance remaining unsubscribed will be sold to the public. It is explained that steady progress has been made in the sale of power. In 1909 the gross sales of power amounted to \$651,830, while in 1915 they aggregated \$1,463,639. In 1916 they are expected to reach a total of \$1,800,000. In acquiring the properties now forming the Toronto & York Radial Railway and the Shomberg & Aurora Railway the chief object was to foster the growth of suburban traffic and to feed the city system of the Toronto Railway. Should the city elect to purchase the Toronto Railway the security holders will have left a suburban electric railway system and an extensive and profitable plant for the production and distribution of electricity.

**Winnipeg (Man.) Electric Railway.**—The net earnings from the operations of the combined properties of the Winnipeg Electric Railway for the calendar year 1915 amounted to \$1,331,737, in comparison to \$1,769,114 for the previous year, a decrease of about 24 per cent. Of this amount, the fixed charges, including taxes, city percentages, car licenses, interest on the funded debt and other contingent charges, absorbed \$835,635. The surplus earnings for the year were \$496,101, which, when added to the surplus brought forward from the previous year, as adjusted, aggregated \$1,637,598. The decrease in earnings was due to the general depression following the first winter of the war, coupled with the advent of the jitneys in the spring. The duration of the depression from both causes was temporary. The excellent crop prospects of the West, followed by an enormous yield, had a stimulating effect upon the business of the company. The net earnings for November, December and January compared favorably with a similar period in previous years.



**DIVIDENDS DECLARED**

Arkansas Valley Railway, Light & Power Company, Pueblo, Col., quarterly, 1 3/4 per cent, preferred.  
 Brazilian Traction, Light & Power Company, Toronto, Ont., quarterly, 1 1/2 per cent, preferred.  
 Louisville (Ky.) Traction Company, quarterly, 1 per cent, common.  
 Twin City Rapid Transit Company, Minneapolis, Minn., quarterly, 1 3/4 per cent, preferred; quarterly, 1 1/2 per cent, common.  
 Virginia Railway & Power Company, Richmond, Va., 3 per cent, preferred.

**ELECTRIC RAILWAY MONTHLY EARNINGS**

**BANGOR RAILWAY & ELECTRIC COMPANY, BANGOR, ME.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$62,654	*\$35,266	\$27,388	\$17,697	\$9,691
1 " " '15	60,617	*31,000	29,577	17,620	11,897
12 " " '16	794,421	*420,172	374,249	212,875	161,374
12 " " '15	787,177	*378,258	408,919	209,796	199,123

**BERKSHIRE STREET RAILWAY, PITTSFIELD, MASS.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$78,445	*\$73,041	\$5,404	\$28,024	†\$22,447
1 " " '15	69,860	61,583	8,277	17,177	†8,808
10 " " '16	789,588	667,715	121,873	201,845	†178,153
10 " " '15	795,162	715,698	79,464	172,337	†191,472

**CHATTANOOGA RAILWAY & LIGHT COMPANY, CHATTANOOGA, TENN.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$99,983	*\$60,498	\$39,485	\$29,671	\$9,814
1 " " '15	87,745	*58,533	29,212	29,291	†79
12 " " '16	1,154,663	*739,473	415,190	357,734	57,456
12 " " '15	1,049,582	*705,016	344,566	346,193	†1,627

**COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY, GRAND RAPIDS, MICH.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$1,313,207	*\$692,895	\$620,312	\$427,094	\$193,218
1 " " '15	1,093,746	*585,894	507,852	359,203	148,649
12 " " '16	15,411,384	*8,202,084	7,209,300	4,726,934	2,482,366
12 " " '15	14,016,905	*7,521,252	6,495,653	4,277,796	2,217,857

**CONNECTICUT COMPANY, NEW HAVEN, CONN.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$744,170	*\$46,678	\$197,492	\$98,009	†\$122,525
1 " " '15	612,898	449,561	163,337	98,178	†86,709
10 " " '16	7,330,975	5,024,550	2,306,425	984,647	†1,551,881
10 " " '15	6,587,442	4,809,689	1,777,753	982,710	†1,011,255

**EAST ST. LOUIS & SUBURBAN COMPANY, EAST ST. LOUIS, ILL.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$237,646	*\$141,270	\$96,376	\$62,648	\$33,728
1 " " '15	193,827	*119,538	74,289	66,996	†3,293
12 " " '16	2,606,949	*1,553,933	1,053,016	755,424	297,592
12 " " '15	2,531,939	*1,519,661	1,012,278	737,802	274,476

**GRAND RAPIDS (MICH.) RAILWAY**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$103,047	*\$67,256	\$35,791	\$13,700	\$22,091
1 " " '15	83,353	*67,025	16,328	13,702	†2,626
12 " " '16	1,220,107	*829,735	390,372	167,166	223,206
12 " " '15	1,258,480	*835,100	423,380	162,162	261,218

**LAKE SHORE ELECTRIC RAILWAY, CLEVELAND, OHIO**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$118,621	*\$80,063	\$38,558	\$36,588	\$1,970
1 " " '15	111,548	*71,191	40,357	35,962	†5,605
4 " " '16	453,144	*311,823	141,321	145,378	†4,057
4 " " '15	391,307	*282,175	109,132	143,871	†34,739

**LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY, LEWISTON, ME.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$60,400	*\$41,224	\$19,176	\$16,120	\$3,056
1 " " '15	58,317	*35,755	18,062	15,681	2,381
12 " " '16	754,476	*496,289	258,187	191,663	66,524
12 " " '15	696,011	*459,466	236,545	187,161	49,384

**NEW YORK (N. Y.) RAILWAYS**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$1,135,801	*\$697,054	\$438,747	\$374,208	†\$110,897
1 " " '15	1,127,388	715,631	411,757	373,913	†83,822
10 " " '16	11,351,420	6,939,954	4,411,466	3,710,734	†1,170,177
10 " " '15	11,126,973	7,123,415	4,003,558	3,746,865	†694,167

**NEW YORK, WESTCHESTER & BOSTON RAILWAY, NEW YORK, N. Y.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$44,833	\$43,965	\$868	\$4,759	†\$2,558
1 " " '15	37,555	43,041	†5,486	\$5,990	†19,943
10 " " '16	419,987	469,472	†49,485	\$62,931	†196,361
10 " " '15	366,508	435,442	†68,934	\$63,608	†116,243

**REPUBLIC RAILWAY & LIGHT COMPANY, YOUNGSTOWN, OHIO**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., April, '16	\$327,672	*\$199,281	\$128,391	\$68,559	†\$60,053
1 " " '15	237,746	*151,559	86,187	55,211	†25,957
4 " " '16	1,286,493	*755,037	531,456	269,925	†262,694
4 " " '15	962,583	*610,906	351,677	221,100	†130,836

**RHODE ISLAND COMPANY, PROVIDENCE, R. I.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$444,826	\$311,539	\$133,287	\$118,902	†\$41,338
1 " " '15	349,814	329,941	19,873	117,300	†170,806
10 " " '16	4,491,470	3,400,927	1,090,543	1,161,329	†20,503
10 " " '15	4,263,808	3,308,088	955,720	1,179,248	†129,671

**TWIN CITY RAPID TRANSIT COMPANY, MINNEAPOLIS, MINN.**

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Apr., '16	\$616,181	\$506,703	\$309,478	\$140,299	\$169,179
1 " " '15	784,428	490,149	274,279	139,421	134,858
4 " " '16	3,307,167	2,115,877	1,191,290	568,181	623,109
4 " " '15	3,042,345	2,045,274	997,071	557,917	439,154

\*Includes taxes. †Deficit. ‡Includes non-operating income.  
 §Excludes interest on bonds, charged income and paid by the New York, New Haven & Hartford Railroad under guarantee, as well as interest on notes held by the New York, New Haven & Hartford Railroad not credited to income of that company.

**Traffic and Transportation**

**TAMPA PASSES PROGRESSIVE JITNEY MEASURE**

The tendency in recent jitney regulation is illustrated strikingly in the ordinance passed on May 24 by the City Council of Tampa, Fla. The measure provides as follows:

1. All jitneys shall operate under licenses issued by the city based on the seating capacity of the jitney as prescribed by a schedule contained in the ordinance.

2. A bond or indemnity insurance policy of \$5,000 shall be filed with the application for license. Said bond or indemnity insurance shall be so made that the insurance or bonding company shall be directly liable for a suit in case of accident or death.

3. All jitneys shall operate from 6 a. m. until 11 p. m., over a prescribed route set forth by the operator in writing when he applies for his license. This route cannot be changed and is awarded upon the judgment of the Council.

4. Every jitney shall have painted on sides, front and rear the route it traverses and the terminals thereof and shall be lighted, after sundown, so as to make the signs distinguishable at a reasonable distance. Said signs are to be painted in letters not less than 1 1/2 in. in height.

5. No jitney shall run within 25 ft. of another jitney or street car or run past them in an effort to reach prospective passengers first.

6. Every jitney shall come to a dead stop before crossing any steam railroad.

7. No jitney owner shall change or alter in any manner the body or seating arrangement of his bus.

8. It shall be unlawful for any person to ride on the hood, running board, step or any other place excepting within the bus where seats have been arranged.

9. Jitneys must carry police or firemen or members of the sanitary department, when in uniform, free.

10. All lost articles found in jitneys must be turned over to the police department within twenty-four hours.

11. Any person violating any section of the ordinance shall be subject to a fine not to exceed \$75 or imprisonment for thirty days.

12. An operator three convicted of violation shall forfeit his license to operate.

The twelfth clause mentioned above applies to the man operating a bus. If the man operating the machine at the time of arrest is merely an employed chauffeur and has been convicted twice before, and he loses his chauffeur's license, is deprived of the privilege of driving any car whatever. However, if the jitney owner is operating the machine and is arrested and convicted three times he loses his license to operate a bus.

**NEW SURFACE RULE BOOK FOR BROOKLYN**

A new rule book for the surface transportation department of the Brooklyn (N. Y.) Rapid Transit Company has been completed after sixteen months' work by a committee of depot superintendents headed by Superintendent of Employment A. Maxwell. In addition to rules for conductors, motormen and all other car service employees it presents a full résumé of instructions and notices bearing on the operation of cars, the care and protection of passengers, the handling of defective equipment, delays on the line, accidents—in short, every known condition and circumstance that may be encountered in surface railroading.

Of 220 rules appearing in the last rule book, issued on Jan. 1, 1911, no less than 160 have been revised and amplified, and nine new rules of general application have been added. The advent of the center entrance car, presenting an entirely new set of problems, necessitated a supplementary set of twenty-eight rules. The rules for inspectors have been extended to include the duties of inspectors of instruction, these duties having been modified and coded since the previous book was published.

Besides Mr. Maxwell the members of the committee on the new rule book were Superintendents Henry Mueller, Frank O'Keefe, Frank Bush and Herman Bongard. Every



change and addition was submitted first to Superintendent of Surface Transportation William Siebert, and later in turn to the other heads of departments, finally going to President Williams for approval.

#### PROBLEMS OF LOCAL COMMUNITIES DISCUSSED IN BAY STATE HEARINGS

The hearings in the Bay State Street Railway fare case before the Massachusetts Public Service Commission have been devoted since May 31 to the consideration of the effect of the proposed changes in fares upon various local communities. In announcing the program of hearings up to June 8 the commission stated that it assumed that the patrons of the road do not welcome an increase in fares and that the board desires at these hearings no general protests, but the presentation of facts and reasons why the specific increases proposed in the various cities and towns should not be permitted. For many weeks the commission has been holding hearings dealing in the main with the general aspects of the case, viz., with the history, capitalization, investment, property, revenue, expenses, operation and management, and these hearings are not yet concluded. The commission called attention to the fact that it has devoted an unprecedented amount of time to the case and urged the avoidance of cumulative evidence and discussion in future proceedings.

As a result of a conference on May 19 the company has prepared an exhibit segregating the investment receipts and expenses of the system in the 1914 fiscal year into fifteen divisions, and these data afford evidence as to the financial results of operation in each one of the districts assigned for hearing on the local program. The board is of the opinion that the information thus prepared, with the boundaries tentatively shown at the conference will answer all reasonable requirements.

#### ONE-MAN CAR PERMIT IN SEATTLE

The franchise committee of the City Council of Seattle, Wash., has authorized the use of one-man cars on the Bellevue-Summit line and the Twelfth Avenue line, between Fourteenth and Madison and Jackson Streets, by the Puget Sound Traction, Light & Power Company, providing a suitable ordinance can be furnished by the corporation counsel. The question of the use of one-man cars on the Greenwood Avenue line, operated by the Western Washington Power Company, has been laid over for consideration, owing to a petition of patrons against the change. A. L. Valentine, superintendent of public utilities of the city, in a report to the franchise committee, stated that the new cars could be operated with as much security to passengers as the ordinary cars. One-man cars are already in use on three shuttle lines in Seattle.

The Olympia Light & Power Company, operating in Olympia, Wash., has re-established a one-man car service on the west side. A similar arrangement was used on the line late last year. L. B. Faulkner, manager, said the West Side line had never paid, and that the change was made as a matter of economy.

Otto B. Frank, manager for the North Coast Power Company in Chehalis, Wash., which operates one-man inter-urban cars between Chehalis and Centralia, states the service is satisfactory. He also reports a considerable increase in travel on the street cars since the fare was lowered to 10 cents each way.

#### "I BELIEVE" CREED FOR EMPLOYEES

Harry D. Frueauff, vice-president, treasurer and general manager of the City Light & Traction Company, Sedalia, Mo., has prepared a public utility creed which every employee of the company is asked to sign, and must observe in his dealings with the public. The creed reads:

"I believe in Sedalia, and am anxious to see it become the best city in Missouri.

"I believe in its people, and I want to see each and every one of them prosper.

"I believe in electricity, gas, traction, and ice, four of the greatest factors in improving the conditions of mankind.

"I believe in service, the biggest word in our language, and the secret of all success.

"I believe in City Light & Traction Company service, and I will so exemplify and define 'Service' to the public and to our customers, that the terms 'City Light & Traction' and 'Service' shall become synonymous.

"In my contact with every person in my work, I will faithfully represent my company, so that I may make them all my friends, and consequently friends of the company."

**Earnings Tax Suggested for Seattle Jitneys.**—The City Council of Seattle, Wash., has been petitioned to pass an ordinance which will provide that jitney buses operating in the city be required to pay 2 per cent of their earnings to the city, the same as is now collected from the Puget Sound Traction, Light & Power Company.

**Hearing on Service Standards Postponed.**—The formal public hearing before the Public Utilities Commission of the District of Columbia to consider standards of street railway service has been postponed from June 14 to June 19. The memorandum showing the commission's tentative results of studies made was referred to in the ELECTRIC RAILWAY JOURNAL of June 3, page 1063.

**Traffic Department, Michigan Railway, Removed to Grand Rapids.**—Traffic Manager F. W. Brown, of the Michigan Railway, and his staff, including the freight, claim, tariff and traffic departments, have removed to Grand Rapids and established headquarters there. The change is made in consideration of the importance of Grand Rapids as a trade and shipping center and the closer relationship will insure improvements in the service as needed. The offices will be in the terminal building at the Michigan Railway station.

**New Orleans Jitney Measure Upheld.**—On May 29 Judge Foster, in the Federal Court at New Orleans, La., upheld the constitutionality of the New Orleans jitney ordinance requiring a \$5,000 indemnity bond for each car operated, and denied the plea for an injunction to restrain city officials from enforcing the measure. The State Supreme Court recently held the ordinance valid. Three hundred operators are reported to have suspended service the day following the court decision. Only one arrest for violation of the decree was recorded that day.

**Trenton Ticket Case Up for Argument.**—Argument on the writ of certiorari asked by the Trenton & Mercer County Traction Corporation, Trenton, N. J., in its case against the continuance of strip tickets is set for the June term of the Supreme Court, which opened on June 6. The case was placed on the calendar, but no date was assigned to it, as George L. Record, who conducted the case before the Board of Public Utility Commissioners, is in Detroit. The company is attacking the right of the board to order the tickets continued. L. Edward Hermann, counsel for the commission, will present the case for the commission before the Supreme Court.

**Chicago Surface Lines Issues Vacation Folder.**—Under the title "How to See Chicago—The Vacation City and Ideal Summer Resort," the Chicago Surface Lines has issued a twelve-page map and guide for the information of visitors. The sight-seeing routes of the Chicago Surface Lines are indicated in red on a map which includes the entire Chicago park and boulevard district. The advantages of Chicago as a vacation city and summer resort are set forth, and the principal points of attraction are described and directions are given how to reach them. One-half million of these folders have been printed, and they are being distributed at the principal hotels, and are advertised in the newspapers.

**Safety Advertisements in 100 Newspapers.**—As the next step in its efforts for greater safety at grade crossings, the Long Island Railroad is now conducting an advertising campaign in the newspapers of Manhattan, Brooklyn and Long Island. It is advertising primarily to induce automobile drivers to stop at each crossing before going over the railroad tracks. Altogether twenty-four different advertisements will appear in 100 newspapers. On June 6 the company secured its first conviction of an automobile driver for carelessness in managing the machine at one of the company's crossings. A fine of \$10 was imposed. The company intends to press other actions against reckless automobilists.



**Nashville Jitney Question Before City Attorney.**—The City Commission of Nashville, Tenn., is wrestling with a problem as to how to handle the jitney bus proposition, in connection with an application for permit to operate a line made by the Nashville Street Jitney Company. A personal bond was presented to the Mayor, who declined to accept it without approval of the Commission. The city attorney has been asked for an opinion as to what the city should do under the State law on the subject. Nashville formerly had a number of ordinances relating to operation of jitneys, but enactment of the State law nullified them. It is proposed that the city draw up and offer a franchise, stipulating routes and schedules, for sale to the jitney promoters.

**Twin City Folder Extols Trolley Trip Attractions.**—The alluring call of the many easily accessible lakes, rivers and parks which form a characteristic feature of the country surrounding St. Paul and Minneapolis, Minn., is voiced in a new folder entitled "Twin Cities, 1916," issued by the Twin City Rapid Transit Company, Minneapolis. Effective advertising use of these fruitful sources of electric railway income is utilized by the inclusion of several maps in the folder showing clearly how to reach the numerous places of amusement and recreation near these two cities. The folder also contains information describing all trolley trips in the vicinity and the special points of interest in connection with each trip.

**New Portland Jitney Ordinance Contemplated.**—City Commissioner Daly of Portland, Ore., recently announced that he was working out plans whereby the jitney interests will be required to obtain franchises and operate on that basis alone. Mr. Daly's ordinance plans to exclude jitneys from operating except as units of a company, or a series of companies pledged to give a certain fixed service. The franchises, according to tentative plans, will be for the various jitney routes. Holders of franchises will be required to maintain a dependable service or forfeit their rights. It is reported that less than 20 per cent of the jitneys operating in Portland are complying with the jitney ordinance regarding service.

**Express on Dallas Interurban Lines.**—Burr Martin, general manager of the Southern Traction Company and the Texas Traction Company, Dallas, Tex., and Louis Horner, president of the Electric Express & Baggage Company, have announced the details of a system of handling express and baggage in and out of Dallas on all local interurban cars. Hereafter express and baggage will be carried to Denison, Corsicana and Waco and intermediate points on "every other hour" schedule. This is a wide departure from the system now in effect. At present all express shipments and all baggage are handled on special express and baggage cars operated twice daily. To make the new service possible special express and baggage compartments have been installed in all local cars of the companies.

**Jitney Certificate Granted in Jamestown.**—The Public Service Commission for the Second District of New York has granted a certificate of convenience and necessity to Frank A. Raymond for that part of his motor-bus route between Jamestown and East Randolph which lies in Jamestown and along the streets provided for in the local consent for the line granted by the Jamestown Common Council and Mayor. The certificate restricts the bus line from carrying local passengers in Jamestown, in accordance with the objection of the Jamestown Street Railway, whose lines the bus line will follow. It is pointed out in the commission's order, to the residents of the village of Falconer who objected to the line, that the commission has no jurisdiction outside of cities, but that the police power of the village over its streets might be invoked to control this operation.

**Oak Park, Ill., Wants 3½ Cent Fare Restored.**—In an opinion handed down by the Illinois Supreme Court in the mandamus suit brought against the Chicago Railway and the Chicago & West Towns Railway by the village of Oak Park, Ill., it was decided that the village authorities could not enforce a 5-cent fare over lines which extended beyond the corporate limits. This fare was stipulated in an amendment, passed by the village board in 1903, to an ordinance granted in 1898. The 1898 ordinance gave the now Chicago & West Towns Railway a fifty-year franchise, which was

permitted by the Allen law, then in force, and the railway under this ordinance sold twelve tickets for \$1. When the village was unable to enforce the amendment to the 1898 ordinance fixing a 5-cent fare from Oak Park to the downtown district of Chicago it asked the railway to restore the 3½-cent fare which was provided under the 1898 ordinance.

**Massachusetts Jitney Bill Signed.**—Governor McCall of Massachusetts signed a bill in the closing hours of the legislative session which authorizes cities and towns to license and regulate the transportation of passengers for hire as a business between fixed and regular termini by means of any motor vehicle except the trackless trolley vehicle. No such motor vehicle can be operated as above until the licensee has deposited with the city or town treasurer security by bond or otherwise, approved by the city or town treasurer, conditioned to pay any final judgment obtained against the principal for any injury to person or property or damage for causing the death of any person by reason of any negligent or unlawful act in the operation of the vehicle. Only one bond need be filed by a licensee, and the act is to take effect in cities upon being accepted by the City Council and in towns when accepted by the voters at any duly called town meeting.

**Reading Jitneys Disappearing Without Regulation.**—During the season of 1915, Reading, Pa., like many other cities, was struck with the jitney craze, the maximum number of cars operating in any one day being 300. There was no attempt during 1915 on the part of the City Council to pass any legislation. Reading is under the commission form of government, consisting of five commissioners, including the Mayor and various department heads. The 1916 commission passed an ordinance on April 5, 1916, regulating the operation of motor buses in Reading. This ordinance, among other clauses, provided for the deposit of a bond of \$1,500 or \$2,000, according to the capacity of the vehicle. It also required license fees varying from \$5 to \$15. The day after the passage of the ordinance, the jitney people presented a petition to the city clerk, asking him to prepare a referendum on the ordinance. This petition was granted and a referendum petition submitted to the people was successful in obtaining the desired number of votes. The commission then repealed the ordinance. Reading is, therefore, without any jitney legislation whatever. The number of jitneys operating this year, however, is extremely small, and it is thought that the high price of gasoline will eventually wipe them out entirely.

**Increase in Interurban Fare Upheld.**—The Public Service Commission of the State of Washington has dismissed the case brought against the Pacific Traction Company and the Tacoma Railway & Power Company by the Central Improvement League. It states that the 30-cent fare charged by the Tacoma Railway & Power Company on its line between Tacoma and American Lake is neither unjust nor excessive. The line in question was owned originally by the Pacific Traction Company, and a fare of 25 cents for the round trip was charged. The fare was raised to 30 cents when the line was taken over by the Tacoma Railway & Power Company. The commission stated: "It appeared from the evidence that the earning capacity of the respondent companies under the rates now charged is sufficient after paying necessary operating expenses to pay a reasonable return on the market value of the properties, as found by the commission, and the rates now charged are not inherently unjust or excessive." The finding of facts showed that the cost of the property of the company on Dec. 31, 1915, was \$6,244,000, including stores and real property. The investigation was begun in 1913, and for the last six months of that year net earnings of the company were \$175,120; in 1914, the net earnings were \$81,440, and in 1915, \$133,024. The Pacific Traction Company, a subsidiary of the Tacoma Railway & Power Co., showed net earnings in 1913 of \$11,435, in 1914, \$7,413, and in 1915, \$6,882. The market value of the property of the Pacific Traction Company on Dec. 31, 1915, was set at \$648,800. The report of the commission stated that the company was earning 3½ per cent on its investment, and that on June 30, 1913, it would have cost \$5,334,783 to reproduce the property of the company. The total value of the property now used for public convenience was set at \$6,244,000.



## Personal Mention

Mr. G. S. Storrs has been elected assistant treasurer of the Maryland Electric Railways, Annapolis, Md.

Mr. Charles Duffer has been appointed superintendent of the Jacksonville Railway & Light Company, Jacksonville, Ill., to succeed Mr. Otto Kuchman.

Mr. R. McKee, formerly foreman of overhead line construction for the Memphis (Tenn.) Street Railway, has been appointed general foreman of overhead lines of the company, succeeding Mr. C. W. Blackinton, resigned.

Mr. F. J. Derge, chief engineer for Henry L. Doherty & Company, New York, N. Y., since the resignation of Mr. Milan R. Bump, will return to Toledo, Ohio, as assistant manager of the Toledo Railways & Light Company.

Mr. G. W. Manley has been appointed commercial agent for the Illinois Traction System with offices in Champaign, Ill. His territory embraces a section of the eastern line. He retains the agency of the Champaign local station.

Mr. Otto Kuchman has resigned as superintendent of the Jacksonville Railway & Light Company, Jacksonville, Ill., to take a similar position with the Quincy (Ill.) Railway. Both properties are part of the Illinois Traction System.

Mr. J. G. Holtzclaw, formerly superintendent of railway of the Pensacola (Fla.) Electric Company, is now general superintendent of the company. This position is a combination of his former position and that of superintendent of lighting.

Mr. E. M. Carr, who has been general foreman at the shops of the Kentucky Traction & Terminal Company, Lexington, Ky., for the last five years, has resigned to accept a position as master mechanic with the Kewanee Light & Power Company at Kewanee, Ill.

Mr. Milan R. Bump will again resume the duties of chief engineer of Henry L. Doherty & Company, New York, N. Y. Mr. Bump, who had been with the Doherty interests for some years, resigned last fall as chief engineer to assume the vice-presidency of the Picher Lead Company, Joplin, Mo.

Mr. J. N. Shannahan of Allen & Peck, Inc., who manage the Maryland Electric Railways, Annapolis, Md., has been elected vice-president and treasurer of the railway, succeeding Mr. T. C. Cherry, who has resigned as vice-president and general manager, and Mr. Alan P. Norris, who has resigned as treasurer.

Mr. Ernest Gonzenbach has resigned as general manager for the receivers of the Empire United Railways, Syracuse, N. Y., the resignation taking effect as of June 1. He will continue as receiver of the Syracuse & South Bay Electric Railroad and the Syracuse, Watertown & St. Lawrence River Railroad until the reorganization of these properties is completed.

Mr. A. Swartz, vice-president of the Toledo & Western Railway, Toledo, Ohio, has been appointed traveling track specialist of the Cities Service Company, New York, N. Y., which controls the Toledo Railways & Light Company and ten other railway properties. Mr. Swartz will start soon on a journey to inspect track construction and maintenance as followed on the properties.

Mr. James R. Hammond, Fort Worth, Tex., has been appointed engineer of maintenance of way of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio. Mr. Hammond has worked on steam and interurban electric railway construction and maintenance as civil engineer in the West and Southwest and prior to going to Youngstown spent seven years in various sections of Texas. He was also engaged for two years on similar work in Central America.

Mr. Arthur Brown of the Toledo Railways & Light Company, Toledo, Ohio, has been appointed traveling master mechanic of the Cities Service Company, New York, N. Y., which controls the Toledo property and street railways in Amarillo, Tex.; Athens, Ga.; Bartlesville, Okla.; Sedalia, Mo.; Cumberland, Md.; Durham, N. C.; Meridian, Miss.;

Hattiesburg, Miss., and St. Joseph, Mo. Mr. Brown will direct his efforts toward the standardization of the equipment of the properties operated.

Mr. C. D. Porter has been appointed general manager of the Maryland Electric Railways, Annapolis, Md., to succeed Mr. T. C. Cherry, resigned. Mr. Porter was graduated as a civil engineer from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1906. He has since then been employed in the construction or operation of the following properties: Hudson & Manhattan Railroad, Greenwich & Johnsonville Railway and the Washington, Baltimore & Annapolis Electric Railway. Since 1912 Mr. Porter has been chief engineer of the Newport News & Hampton Railway, Gas & Electric Company.

Mr. Charles N. Black, whose resignation from the position of vice-president and general manager of the United Railroads, San Francisco, Cal., was announced in the ELECTRIC RAILWAY JOURNAL of May 13, was the guest of honor at a farewell banquet on May 23 attended by forty business associates, all of whom were United Railroads' officials. The company's chief legal counsel acted as toastmaster and paid high tribute to Mr. Black for his work in rehabilitating the system after the disaster of 1906. Mr. Jesse W. Lilienthal, president of the company, complimented Mr. Black upon his management of the company's affairs and presented a beautiful silver trophy to him as a token of esteem from the heads of departments. As a more personal token Mr. Black received a set of diamond studded platinum cuff links. In expressing his appreciation of the loyalty of his associates, Mr. Black referred to the work still to be done if the system is to be operated successfully.

Mr. T. C. Cherry, whose appointment as second vice-president and general manager of the Auburn & Syracuse Electric Railway, Syracuse, N. Y., was noted in the ELECTRIC RAILWAY JOURNAL for May 27, has been appointed by the receivers as general manager of the Empire United Railways, Inc., Syracuse, N. Y., to succeed Mr. Ernest Gonzenbach. Mr. Cherry was born in 1876 and was graduated from Syracuse High School in 1894 and entered Syracuse University, where he took a two-year course in engineering. He also took a two-year course in Syracuse law school. In May, 1898, he entered railway work as timekeeper on construction and track work and as rodman with the engineers of



T. C. CHERRY

the Syracuse Rapid Transit Railway. On Jan. 1, 1900, he was made superintendent of track of the Syracuse Rapid Transit Railway. Later in 1900 Mr. Cherry went to Lorain, Ohio, as superintendent of construction of line and track of the Lorain Street Railway. Mr. Cherry also served as dispatcher on the Lorain Street Railway, and from August, 1901, to December, 1903, he was general manager of the company. He has also been connected at various times with the Saginaw Valley Traction, Light & Gas Company as general superintendent, with the Ohio Central Traction Company as general manager, with the Buffalo & Lake Erie Traction Company as superintendent, with the Utica & Mohawk Valley Railway as superintendent, with the Schenectady (N. Y.) Railway as general manager, and for the last four years with the Maryland Electric Railways as vice-president and general manager. Mr. Cherry is a director of the firm of Allen & Peck, Inc., electric railway managers and engineers. He was prominent in the work of the New York Electric Railway Association during his connection with roads in that State and has always taken an active interest in the affairs of the American Electric Railway Transportation and Traffic Association. Having spent most of his life in the territory through which the Empire United Railways operates Mr. Cherry is unusually well qualified through his intimate knowledge of men and affairs to assist materially in the task that confronts the receivers.



## Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (\*) indicates a project not previously reported.

### RECENT INCORPORATIONS

\***Central Florida Interurban Railway, St. Cloud, Fla.**—Application for a charter has been made by this company for the construction of an electric railway from St. Cloud to Sanford, Dunnellon and Tampa; also through Volusia County to a point on the Atlantic Coast; also through Osceola and Brevard Counties to a point on the Atlantic Coast, in all about 300 miles. Incorporators: Carl E. Carlton, William S. Aleya and William Hall.

### FRANCHISES

**Hartford, Conn.**—The Public Utilities Commission of Connecticut has approved the plans of the Connecticut Company for the reconstruction of its double tracks on Albany Avenue between Magnolia and Woodland Streets, Hartford.

**Lawrence, Mass.**—The Bay State Street Railway has asked the Council for a franchise to construct a double-track extension from the present terminus of the single track on Water Street to the Lawrence-Methuen boundary line via the Lawrence-Lowell Boulevard.

**New Bedford, Mass.**—The Union Street Railway has received a franchise from the Council to construct double tracks on Brock Avenue from Oakland Street to Rodman Avenue.

\***Newark, N. J.**—The Balbach Smelting & Refining Company has asked the Board of Public Works for permission to construct a private trolley line along Doremus Avenue from Hamburg Place to its factory in Bay Avenue to accommodate employees.

### TRACK AND ROADWAY

**Northern Electric Railway, Chico, Cal.**—The receiver of this company has received permission to contract for the reconstruction of its bridges over the American and Feather Rivers. It is estimated that the work will cost about \$70,000.

**Pacific Electric Railway, Los Angeles, Cal.**—The City Council of Los Angeles has asked the Railroad Commission of California to compel the Pacific Electric Railway to construct a new bridge approximately 300 ft. wide across the Arroyo Seco, between the city limits and South Pasadena. The Council has ordered the company to construct a viaduct over its tracks at Vineyard Station. The order opening a right-of-way across the tracks connecting Sherman Drive with West Boulevard at Sixteenth Street was rescinded.

**Martinez & Concord Interurban Railway, Martinez, Cal.**—This company has filed with the Railroad Commission of California a second amended application changing the route of its line, and for authority to issue and sell 600 shares of its capital stock at \$80 per share and \$125,000 face value of its first mortgage bonds at 90 per cent. [May 27, '16.]

**Castro Point Railway & Terminal Company, Richmond, Cal.**—Preliminary work has been begun by this company on its project to connect the lines of the San Francisco-Oakland Terminal Railway and the Richmond Belt Railway.

**Southern Pacific Company, San Francisco, Cal.**—Surveys have been begun for a system of interurban electric lines subsidiary to the Southern Pacific Company to be built through the mining section and into orchard areas where new groves are coming into bearing.

**Connecticut Company, New Haven, Conn.**—Work has been begun by this company installing new track on Arch Street, Hartford.

**Aurora, Mendota & Western Railroad, Aurora, Ill.**—Grading has been begun by this company on its line to connect Aurora, Plano and Sandwich. [April 8, '16.]

**Urbana & Champaign Railway, Gas & Electric Company, Champaign, Ill.**—This company is relaying the tracks on its John Street line, Champaign.

**Rapid Transit Company of Illinois, East St. Louis, Ill.**—It is reported that this company has disposed of \$3,500,000 worth of bonds for the construction of its proposed electric railway from East St. Louis to Mount Carmel. A contract has been let to William Martin, St. Louis, for the construction of the line. It is stated that the company has practically concluded negotiations for the purchase of the Wabash, Chester & Western Railroad, a steam road which operates between Chester and Mount Vernon, and which will be electrified. D. P. Roberts, manager. [March 4, '16.]

**Southern Illinois Railway & Power Company, Harrisburg, Ill.**—It is reported that this company will extend its line to Marion, Herrin and Benton and will build a loop which will reach from Benton to Herrin via DuQuoin, Pickneyville, Murphysboro and Carbondale.

**Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind.**—This company plans to extend its South Wayne car line to Rudisill Boulevard. The company has secured the permission of the Park Department to construct its tracks across the Boulevard at South Wayne Street.

**Terre Haute, Indianapolis & Eastern Traction Company, Terre Haute, Ind.**—It is reported that the Vandalia Coal Company of Sullivan, Ind., is negotiating with this company for an extension of its line from Terre Haute to Sullivan.

**Topeka (Kan.) Street Railway.**—Work has been begun on the construction of a three-arch cement bridge at East Sixth Street, Topeka. The structure will be more than 160 ft. long and about 40 ft. wide, with a roadway 30 ft. wide and a 5-ft. walk on each side. The street car tracks will run in the center of the road. The Topeka Street Railway will pay \$2,000 to the city of Topeka for the use of the bridge.

**Shelbyville & Frankfort Realty Company, Shelbyville, Ky.**—The project for construction of the electric railway to connect existing lines terminating at Frankfort and Shelbyville, Ky., is reported to be advancing favorably. A second survey is now in progress. J. W. Gudgell, secretary, states that Yorkville (Ill.) interests will finance the project. [May 20, '16.]

**Alexandria (La.) Municipal Railway.**—Work will soon be begun by the Alexandria Municipal Railway on the construction of an extension to connect all the depots in the city. The extension will begin at the corner of Second and Casson Streets at the Southern Pacific Company depot, extending across the city property adjacent to the tracks of the Southern Pacific Company, entering Third Street in front of the Louisiana Railway & Navigation Company station, thence down Third Street to or below the Louisiana & Arkansas Railway freight depot. It is the ultimate intention of the City Commissioners to extend the line to Bogan Lane, out to the Ruston Foundry and through the hardwood mill district to connect with the Lee Street line, probably at Vance Avenue, making a complete belt line of the Lee Street line.

**Cumberland County Power & Light Company, Portland, Me.**—A report from this company states that it expects to install eleven sets of Chapman block signals before June 30.

**Winnipeg (Man.) Electric Railway.**—Work will be begun at once by this company on the double-tracking of its line from the city limits to Kildonan Park.

**United Railways & Electric Company, Baltimore, Md.**—A plan has been submitted to the Public Service Commission of Maryland by the United Railways & Electric Company to give direct service to the center of the city, to some parts of the northwestern suburban section, and to give quicker service to most of it. The plan provides that part of the Edmondson Avenue line be extended from Walbrook Junction to Electric Park; that part of the Edmondson Avenue line be extended from Walbrook Junction to Windsor Hills, and that the service on the Edmondson Avenue line from Walbrook Junction to Charles and Lexington Streets also be increased by five cars an hour during the non-rush hours. Further, the plan provides the withdrawal of the Electric Park branch of the North Avenue line, and



the use of that service in increasing the service to Woodlawn and Windsor Hills. The three present branches of the North Avenue line will be reduced to two branches, one to Woodlawn and one to Windsor Hills.

**Cumberland (Md.) Electric Railway.**—This company will construct an extension out Green Street Road to the Dingle, about 1 mile.

**Hannibal Railway & Electric Company, Hannibal, Mo.**—Work has been begun by this company reconstructing its tracks along West Market Street.

**\*Great Falls, Mont.**—L. D. Urton and J. P. McDonald, Genou, Mont., representing farming and ranching interests north of Great Falls, Mont., backed by the Commercial Club of Great Falls, are promoting the construction of an electric line into that section.

**Bay State Street Railway, Boston, Mass.**—Plans are being made by this company for the construction of a  $\frac{3}{4}$ -mile extension of its Lynnfield Street line, Lynn.

**Manchester (N. H.) Street Railway.**—Work has been begun by this company improving its tracks on Beech Street, Manchester.

**Interborough Rapid Transit Company, New York, N. Y.**—The Public Service Commission for the First District of New York has awarded a contract for the construction of Section 2 of Route No. 8, a part of the Fourteenth Street-Eastern District subway, to the Degnon Contracting Company, New York, at \$1,972,349. A contract has also been awarded to Dennis E. Conners, New York, for the construction of Route No. 31 of the Livonia Avenue elevated extension of the Eastern Parkway, Brooklyn, subway at \$1,376,122.

**\*Asheville, N. C.**—Work has been begun on the construction of an electric railway from Biltmore Avenue to the residence portion of Kenilworth Park, in connection with extensive developments to be made in Kenilworth Park. The improvements are being undertaken by the Kenilworth Development Company, Patton Avenue, composed of E. G. Hester, Roland A. Wilson and J. M. Chiles.

**Mount McKay & Kakabeka Falls Railway, Fort William, Ont.**—Permission has been received by this company from the Ontario Legislature to use steam as an alternative motive power to electricity on its railway. The company has been granted an extension of time in which to construct the uncompleted portion of its line to Kakabeka Falls.

**Ottawa (Ont.) Electric Railway.**—This company is reconstructing its track on Rideau Street between Sussex and Waller Streets with 108-lb. and 115-lb. T-rails.

**Toronto (Ont.) Civic Railway.**—The Toronto City Council has awarded a contract to the General Railway Signal Company of Canada at \$2,400 for the installation of a signal system in connection with the operation of the Lansdowne Avenue branch of the Toronto Civic Railway at its crossings with the Toronto Suburban Railway.

**Montreal (Que.) Tramways.**—The Board of Control of Montreal has asked the Montreal Tramways to extend its service from Park Avenue to the Canadian Pacific Railway station at Mile End. The tracks for this extension have already been laid. The Council of Montreal has accepted the offer of the Montreal Tramways to purchase the overhead material removed from St. Catherine and Bleury Streets for \$19,400. This material was discarded on account of the installation of the conduit system.

**Jackson Railway & Light Company, Jackson, Tenn.**—Plans are being made by this company to reconstruct its tracks on Main Street, Highland Avenue and Royal Street. The order has been placed for heavy steel rails to be used. Delivery will be made about July or August. About \$45,000 will be spent by the company on this track improvement. The company will also spend about \$15,000 as its share of permanent street improvement.

**El Paso (Tex.) Electric Railway.**—Work will soon be begun by this company on the construction of double track on Alameda Avenue.

**Salt Lake & Utah Railroad, Salt Lake City, Utah.**—This company's extension to Payson has been completed, as noted on page 1103 of this issue.

## SHOPS AND BUILDINGS

**Albany (Ga.) Transit Company.**—Work has been begun by this company on the construction of a carhouse on Seventh Street near Tift Park. The building will be 30 ft. x 165 ft., of sheet iron, and will cost about \$1,500. R. S. Smith, Albany, has the contract for the construction of the carhouse.

**Georgia Railway & Power Company, Atlanta, Ga.**—Plans are being made by this company to construct a new carhouse to cost about \$18,000. The location has not as yet been decided.

**Rockford & Interurban Railway, Rockford, Ill.**—It is reported that this company is considering the erection of a freight depot in Freeport, Ill.

**Union Traction Company, Coffeyville, Kan.**—This company has purchased a site on South Depot Street from the city of Cherryvale for the construction of a new passenger and freight station.

**Interborough Rapid Transit Company, New York, N. Y.**—The Public Service Commission for the First District of New York has awarded a contract at \$278,182 to John Roberts, New York, for station finish on Sections Nos. 7 to 11 inclusive of Route No. 5 of the Lexington Avenue subway. The lowest bid opened on June 1 by the Public Service Commission for station finish on Sections 12 to 15 of Route No. 5 of the Lexington Avenue subway was submitted by A. W. King & Company, New York, at \$316,000.

**Ardmore (Okla.) Railway.**—This company has awarded a contract to I. M. Putnam, Ardmore, for the construction of a new carhouse and shops in Ardmore. The building will be 40 ft. x 155 ft., one and two stories, of fireproof construction, with corrugated iron and other fireproof roofing.

**Lake Erie & Northern Railway, Brantford, Ont.**—It is reported that a contract has been awarded to Schultz Brothers & Company, Ltd., Brantford, for the construction of a brick station on Colburn Street, to be used jointly by the Lake Erie & Northern Railway and the Brantford & Hamilton Railway.

**Monongahela Valley Traction Company, Fairmont, W. Va.**—This company has awarded a contract to E. Elford, Columbus, Ohio, for the construction of its new interurban station at Clarksburg.

## POWER HOUSES AND SUBSTATIONS

**Arkansas Valley Railway, Light & Power Company, Pueblo, Col.**—This company has ordered a 1500 kw. frequency changer for installation in its Pueblo power house. All poles for the transmission lines between Manzanola and Crowley have been set and construction crews are now working on the line to Olney Springs, after which the work of building a new line from Holbrook to Cheraw will be started.

**Richmond Light & Railroad Company, New Brighton, N. Y.**—This company is installing in its power house at Livingston, Staten Island, a 6000-kw. Westinghouse unit, including steam turbine, generators, condenser and pump equipment. The new generator will be air cooled by means of an air washer and pump outfit manufactured by the American Spray Company, 201 Devonshire Street, Boston, Mass., which will have a capacity of 37,000 cu. ft. of air per minute. The new generator unit is expected to be in operation in about three weeks.

**Columbus Railway, Power & Light Company, Columbus, Ohio.**—This company has announced that it will abandon its site for a new power station on the Scioto River, just north of West Broad Street, in view of the fact that the Chamber of Commerce has requested this step, in order that a plan to protect the city from floods may be carried out. The company will probably select another site if the city takes this over, as it is expected it will do.

**Montreal (Que.) Tramways.**—A contract has been let by the Montreal Tramways to the Canadian General Electric Company for a new a.c. switchboard for its Hochelaga power station. The board is of the vertical type and is planned for a double busbar layout.



# Manufactures and Supplies

## HIGH PRICE OF COPPER RETARDS POLE MARKET

A combination of circumstances, including a shortage in the production of poles, an uncertainty of market conditions and the high price of copper, has greatly retarded the purchase of Northern cedar poles both for line extensions and renewals. The depressed market during the latter part of the summer of 1915 influenced the producers of poles in the timber regions of northern Minnesota, Wisconsin and the northern peninsula of Michigan to cut a smaller number than usual. Labor also was scarce and high priced, and unusually heavy snows fell during the winter, all of which reduced the quantity of the poles cut to about 60 per cent of normal. About 1,000,000 Northern cedar poles were cut for 1916 requirements, whereas 1,500,000 were cut during the years 1914 and 1915, and an average of 2,000,000 has been cut in this industry for a number of years prior to 1914. This shortage in the total number of poles cut created a scarcity in certain sizes in the storage yards where as a rule one year's supply is carried. There are plenty of 20-ft. and 25-ft. 4-in. poles in stock, however, but the quantity of 5-in., 6-in. and 7-in. top poles of these lengths is limited. The standard 30-ft. and 35-ft. 7-in. and 8-in. Northern cedar poles generally used in railway work are quite scarce. Under the present market conditions, however, the prices for poles are but slightly increased over those obtaining for the past few years, and this advance was prompted by the shortage of certain sizes. Those familiar with market conditions and the influences which control the quantity of poles cut predict that the existing uncertainty in the pole market will greatly reduce the number of poles taken out of timber regions during the winter of 1916 and 1917.

## ROLLING STOCK

**Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.**, is reported to be in the market for two cars.

**Chicago, Lake Shore & South Bend Railway, Michigan City, Ind.**, is reported to be in the market for two baggage and express cars.

**New York Central Railroad, New York, N. Y.**, has decided on a type of car, 70 ft. long, to seat ninety persons, twelve of which will be ordered shortly for its suburban electric service.

**Carolina & Yadkin River Railway, High Point, N. C.**, has leased a test car of the Railway Storage Battery Car Company for trial operation on its line from High Point to Thomasville.

**North Carolina Public Service Company, Greensboro, N. C.**, has recently placed in service on its Salisbury-Spencer lines two cars which were overhauled and rebuilt at the Salisbury carhouse.

**Montgomery Light & Traction Company, Montgomery, Ala.**, noted in the *ELECTRIC RAILWAY JOURNAL* of May 6 as having ordered six cars from the Southern Car Company, is reported to have increased the order to ten cars, delivery to be made by Oct. 1.

**Boston (Mass.) Elevated Railway** is making informal inquiries from manufacturers regarding 100 new center-entrance motor cars and forty-two elevated cars. It is not asking for formal bids as the cars have not as yet been approved by the Public Service Commission.

**San Francisco-Oakland Terminal Railways, Oakland, Cal.**, noted in the *ELECTRIC RAILWAY JOURNAL* of May 13 as having applied to the Railroad Commission of California for permission to issue car trust certificates to provide funds with which to purchase new car equipment, has received authorization from the commission for this purpose.

**New York State Railways, Syracuse, N. Y.**, noted in the *ELECTRIC RAILWAY JOURNAL* of April 15 as having ordered thirty-five city cars from the G. C. Kuhlman Car Company, ten of which are for the Utica lines, have specified the

following details for this equipment, which is to be of "The Witt" front-entrance, center exit type:

- Date of delivery . . . . . July and August
- Seating capacity . . . . . 51
- Weight of car body . . . . . 12,500 lb.
- Bolster centers, length . . . . . 25 ft.
- Length of body . . . . . 35 ft. 5 3/4 in.
- Length over vestibule . . . . . 46 ft. 7 in.
- Width over sills . . . . . 8 ft. 2 in.
- Width over all . . . . . 8 ft. 4 in.
- Height, rail to sills . . . . . 25 1/4 in.
- Height, sill to trolley base . . . . . 8 ft. 8 in.
- Body . . . . . Metal
- Interior trim . . . . . Cherry
- Headlining . . . . . Agasote
- Roof . . . . . Arch
- Air brakes . . . . . West
- Axles . . . . . Std. Steel Works
- Bumpers . . . . . Channel iron
- Cables . . . . . West
- Car trimmings . . . . . Bronze
- Control . . . . . West, K-6
- Curtain material . . . . . Pantasote
- Destination signs . . . . . Keystone
- Door-operating devices . . . . . Nat'l pneumatic
- Fare boxes: Utica lines . . . . . Cleveland
- Syracuse lines . . . . . Johnson
- Fenders . . . . . Eclipse
- Gears and pinions . . . . . Tool Steel Gear & Pinion Co.
- Gongs . . . . . Brill
- Hand brakes . . . . . Peacock
- Heaters . . . . . Peter Smith
- Headlights . . . . . Crouse-Hinds—W. B. F.
- Journal boxes . . . . . Symington & Rollway
- Motors . . . . . 4 West, 506-A, inside hung
- Paint . . . . . Flood & Conklin
- Registers: Utica Lines . . . . . Sterling-Meaker
- Syracuse Lines . . . . . International
- Sanders . . . . . Ohio Brass
- Sash fixtures . . . . . Brill
- Seating material . . . . . Rattan
- Step treads . . . . . Feralun
- Trolley retrievers . . . . . Earll
- Trolley base . . . . . Ohio Brass
- Trucks . . . . . Baldwin
- Varnish . . . . . Beckwith-Chandler
- Ventilators . . . . . Automatic
- Wheels . . . . . National Car Wheel Co.
- Window fixtures . . . . . Brill
- Brill renitent post construction

**Reading Transit & Light Company, Reading, Pa.**, noted in the *ELECTRIC RAILWAY JOURNAL* of May 6 as being in the market for additional equipment, has placed an order with The J. G. Brill Company for ten semi-convertible one-man motor cars. The following details of equipment have been specified:

- Seating capacity . . . . . 32
- Length of car body over corner posts . . . . . 19 ft. 6 3/4 in.
- Length of each platform from end of car body to outside vestibule sheathing . . . . . 5 ft. 6 in.
- Length of car body over vestibules . . . . . 30 ft. 6 3/4 in.
- Length of car body over bumpers . . . . . 31 ft. 6 3/4 in.
- Width of car body over sills including panels . . . . . 7 ft. 8 1/2 in.
- Width of car body over posts . . . . . 7 ft. 11 in.
- Height from rail over trolley boards . . . . . 11 ft. 4 1/2 in.
- Center to center of side posts . . . . . 2 ft. 4 1/2 in.
- Window arrangement, Brill patented semi-convertible tandem sash arrangement
- Window sash . . . . . Cherry
- Vestibules, Round end, sheathed outside and inside with sheet steel.
- Doors, Four-part in two sections; glazed in upper panels
- Steps, Folding, Brill mechanism; Universal safety treads
- Underframe . . . . . Steel
- Flooring, Yellow pine, 13/16 in.; maple mat strips in body and on platform
- Posts . . . . . Ash
- Body frame, Ash and yellow pine
- Roof, Brill plain arch; poplar covered with duck
- Hoods . . . . . Same as roof
- Ventilators . . . . . Brill "Exhaust"
- Bumpers, Brill patented angle iron; Hedley anti-climbers.
- Drawbars . . . . . Brill radial
- Brakes, Brill patented ratchet brake handles, solid bronze
- Gongs, Brill patented "Dedenda"
- Trimmings . . . . . Bronze
- Curtains . . . . . Pantasote
- Trolley catchers . . . . . Wilson
- Seats and backs, Brill "Winner"; rattan
- Inside finish, Cherry stained mahogany; dull
- Signs . . . . . Keystone
- Sand boxes . . . . . Brill "Dumpit"
- Hand straps . . . . . Rico
- Life guards . . . . . H-B
- Push buttons . . . . . Farraday
- Headlights . . . . . Elec. Ser. Sup.
- Heaters . . . . . Consol.
- Registers . . . . . International
- Paint, Chicago Varnish Company
- Light fixtures, Safety Car H. & L. Trucks, Brill 21-E, single; wide-wing journal boxes, Brill half-ball brake hangers
- Motors . . . . . G. E. 247-D; 35 hp.

## TRADE NOTES

**National Scale Company, Chicopee Falls, Mass.**, announces that its New York City agency is now located at 20 Vesey Street, Room 309, with H. S. Trezevant in charge.

**General Electric Company, Schenectady, N. Y.**, has received an order for GE-247 motors and PC multiple-unit control for the fifteen cars recently ordered by the Buffalo & Lake Erie Traction Company, Buffalo, N. Y.

**James A. Nolan**, for some years superintendent of the track tool department of Hubbard & Company, Pittsburgh, Pa., has resigned to accept a similar position with the Oliver Plow Company, Hamilton, Ont.

**Standard Underground Cable Company, Pittsburgh, Pa.**, has recently opened a branch office at 704 Wilkins Building, Washington, D. C., in charge of Edward Kerschner, formerly with the Philadelphia office.

**White Company, Cleveland, Ohio**, has recently delivered to the New York State Railways-Rochester Lines, a second White truck with tower, similar in all respects to the one described in the *ELECTRIC RAILWAY JOURNAL* for April 8.

**W. E. Greenwood** has been appointed assistant manager of the railway sales and fuel oil department of the Texas Company, to succeed L. S. Jordan, resigned, effective June 1. Mr. Greenwood's headquarters will be at 17 Battery Place, New York City.



Clyde E. Dickey announces that he has resigned his position as secretary and sales manager of Denman & Davis, New York, with whom he has been associated for the past eleven years, and has organized the Dickey Steel Company, of which he is president, with offices in the Woolworth Building, New York City. The new company will represent several manufacturers of high-grade steel. Mr. Dickey was with the Crucible Steel Company of America for nearly five years prior to his connection with Denman & Davis.

Lord Manufacturing Company, New York, N. Y., has received the following orders: 100 Lord screenless air cleaners from the General Electric Company for use on the air-brake equipment of the new cars for the Bay State Street Railway; Lord screenless air cleaners from the Westinghouse Air Brake Company for installation on air-brake equipment going to the various properties of the American Railways Company; twenty-eight new Horne double-acting hand brakes from the Osgood Bradley Car Company for the new express and passenger cars being built for the Worcester Consolidated Street Railway; new Horne double-acting hand brakes from the Southern Car Company for the cars being built for the Lehigh Valley Transit Company; 287 Giant brakes from the Public Service Railway for cars which they are building; seventy-eight Giant brakes from the American Car Company for installation on cars being built for various Stone & Webster properties; 100 Giant brakes from the Laconia Car Company for installation on cars being built for the Rhode Island Company, and thirty-eight Giant brakes from the St. Louis Car Company for one of the Stone & Webster properties. The New York State Railways, Rochester Lines, after a thorough test, have ordered fifty-three Q-P trolley catchers to fill their present requirements. The Southern Car Company has ordered Q-P trolley catchers for the cars being built for the Scranton Railway, and the Three-Cent Fare Line has ordered Q-P trolley catchers for all of its lines. The Cincinnati Car Company recently ordered fourteen differential stainless brakes for installation on the cars being built for the Manhattan & Queens Traction Corporation, as well as Giant brakes for the new cars for the Muskegon Traction & Lighting Company. The Rhode Island Company has ordered 100 of the improved Sterling wheelguards for installation on its new cars.

#### ADVERTISING LITERATURE

Western Electric Company, New York, N. Y., has issued an unusually complete catalog of telephone apparatus and supplies.

Terry Steam Turbine Company, Hartford, Conn., is distributing a loose-leaf folder containing data and representative photographs of its duplex exciter sets.

Frankel Connector Company, Inc., New York, N. Y., has issued a catalog which contains price lists and describes and illustrates its various types of solderless electrical connector, testing clips and spark plugs.

#### NEW PUBLICATIONS

Proceedings of American Wood Preservers' Association, published by the secretary of the association, F. J. Angier, B. & O. RR., Baltimore, Md. 470 pages.

The American Wood Preservers' Association has issued the complete stenographic report of the twelfth annual meeting of this association held at the Hotel Sherman, Chicago, Ill., on Jan. 18, 19 and 20, 1915. The report contains the constitution and by-laws of the association, a classification of the membership, reports of committees relating to the materials, methods and principles involved in the design, maintenance and operation of wood-preserving plants and specifications for wood preservatives. Statistical data compiled by this association show that the first timber-treating plant was established in 1860, and that the number of plants in operation in the United States has grown to 102. During the past fifteen years, however, the increase in the number of plants has been most marked, there being fifteen in operation in 1900 and 102 in 1915. Although there were seven more plants in operation in 1915 than there were during the previous year, the amount of timber treated fell off 10 per cent. There was a reduction in the number of cross-ties treated of more than 6,700,000, while the quantity

of paving material increased in excess of 300,000 sq. yd., or 11 per cent. Less than one-half as many cross-arms were treated during the year 1915 as were treated the previous year, and there was a reduction in the miscellaneous timbers treated of 14 per cent.

**Railroad Valuation and Rates.** By Mark Wymond. Wymond & Clark, 909 Rand-McNally Building, Chicago, Ill. 344 pages. Buckram, \$1.50.

This book contains a general discussion of the historical facts regarding steam railroads and of the subjects of promotion, construction, reconstruction and capitalization, in order to show the influence of these factors upon valuation and rate making. The remainder of the book is then devoted to a treatise on the latter subject. The work is confined almost entirely to the steam railroad field but some general valuation points might be interesting to street railway men.

**Industrial Arbitration.** By Carl H. Mote. Bobbs-Merrill Company, Indianapolis, Ind. 351 pages. Cloth, \$1.50 net.

Originally undertaken with an object of finding some tangible device for the prevention of strikes and lock-outs, this work in its present form aims to present a consideration of those devices now existing. In summing up his book, Mr. Mote states that neither voluntary nor compulsory arbitration will work with any conspicuous degree of success in this country until the worker receives a compelling voice against his employer as to wages, hours and working conditions. When these steps have been taken, the public may well insist upon its right to prevent strikes and lock-outs altogether in those industries to which the public looks for daily conveniences.

**Auditing Theory and Practice.** By Robert H. Montgomery. The Ronald Press Company, 20 Vesey Street, New York, N. Y. 900 pages. Leather, \$5 postpaid.

Not alone for the several pages dealing specifically with electric railway auditing but also for the generally excellent information in regard to auditing theory and practice, should every electric railway accounting officer with a broad vision have this second edition of Mr. Montgomery's authoritative work, if the first is not already in his library. Even in the latter case, the new material in the second edition, on such subjects as the income tax, would probably make the purchase worth while. A book so well known as that by Mr. Montgomery needs no detailed description; suffice it to say that it should be in the accounting library of every electric railway.

**Value for Rate Making.** By Henry Floy. McGraw-Hill Book Company, Inc., New York, N. Y. 222 pages. Cloth, \$4.

Four years ago Mr. Floy, with the hope of helping to define methods used and of standardizing practices in valuation procedure, brought out the first book relating to the general subject of the valuation of public utility properties. He has now followed this with the present volume in an attempt to emphasize further at least three principles that seem to him to be essential in determining the fair value for use in fixing rates. These are as follows: (1) To conform to the rulings of the courts the basis for rate making should be the fair present value of the property used, regardless of the amount of the original investment in utilities established previous to the present public regulations régime. (2) Present value for rate making is obtained by making deduction for absolute depreciation only and not for theoretical depreciation. Absolute depreciation is that depreciation which is in evidence, existing and determined by inspection. Theoretical depreciation is an estimate only, based on assumptions and computations. (3) Practically every utility includes certain intangible non-visible elements, which should be evaluated and allowed in addition to the material, sensible elements. The value of a non-visible part may vary from a few per cent to 100 per cent or more of the value of the visible parts of a property. In elaborating these principles the author has reviewed the various decisions of public authorities that seem to him correct and sensible and has in general outlined the valuation course that he thinks it would be fair to follow.