Electric Railway Journal

A CONSOLIDATION OF

Street Railway Journal and Electric Railway Review

VOL. XXXIII. NEW YORK, SATURDAY, JUNE 19, 1909 No. 25

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

James H. McGraw, President. J. M. Wakeman, 1st Vice-president.
A. E. Clifford, 2d Vice-president. C. E. Whittlesey, Sec. and Treas.

Henry W. Blake, Editor.
L. E. Gould, Western Editor. Rodney Hitt, Associate Editor.
Frederic Nicholas, Associate Editor.

NEW YORK, 239 WEST THIRTY-NINTH STREET.

CHICAGO: Old Colony Building.
PHILADELPHIA: Real Estate Trust Building.
CLEVELAND: Schofield Building.
LONDON: Hastings House, Norfolk St., Strand.

Cable Address, Stryjourn, New York; Stryjourn, London—Lieber's Code.
Entered at the New York Post Office as Second Class Mail Matter.

TERMS OF SUBSCRIPTION

United States, Hawaii, Puerto Rico, Philippines, Cuba, Mexico and Canal Zone.

ELECTRIC RAILWAY JOURNAL (52 weekly issues and also special daily convention issues published from time to time in New York City or elsewhere), postage prepaid..$3.00 per annum

Single copies.....10 cents

Combination Rate, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).....$6.50 per annum

CANADA: extra postage.....$1.50 per annum

To All Countries Other Than Those Mentioned Above.

ELECTRIC RAILWAY JOURNAL (52 weekly issues and also daily editions as above), postage prepaid.....$6.00 per annum
25 shillings. 25 marks. 31 francs.

Single copies.....20 cents

Foreign subscribers may remit through our London office.

NOTICE TO SUBSCRIBERS.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—For back copies of the ELECTRIC RAILWAY JOURNAL, STREET RAILWAY JOURNAL and ELECTRIC RAILWAY REVIEW, applications should be addressed to the McGraw Publishing Company. No copies of issues of the STREET RAILWAY JOURNAL OR ELECTRIC RAILWAY REVIEW prior to January, 1907, are kept on sale except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the ELECTRIC RAILWAY JOURNAL *9000 copies are printed.*

The Summer Traffic Season

Opening of the summer traffic season is coincident with the issue of circulars by various lines, describing the attractive points of interest which may be reached by short rides. While it is relatively a simple matter to prepare a folder or booklet giving train schedules, it is much more difficult to arrange one that, because of its well-written text and attractive arrangement of carefully-selected illustrations, will lead observers to travel. Since summer tourists will probably be evident in larger numbers this year than ever before the possibilities for gross earnings from this source will be inviting, and electric lines may prepare to get their full share of the business.

Encouraging Motormen to Save Power

It is generally recognized that a large saving in power consumption could be made by an electric railway company if it were possible to operate each car under ideal accelerating and braking conditions. Automatic controller devices may accomplish a great deal, but they can never be a complete substitute for brains, nor will they prevent considerable waste of energy on the part of some motormen. A course in an instruction school where practice can be had with controllers connected with indicating lamps or other devices, will serve to impress on a motorman's mind the current values for different steps in the controller. This indoor practice lacks one element essential to the most economical operation of cars—that is, the adjustment of the speed of the car to the alignment and grades of the road, so that a minimum amount of power will be used while the required schedule speed over the entire run is maintained. On some roads coasting signals have been placed at the top of grades and in advance of stations and curves in an endeavor to reduce the amount of power wasted through sudden stops at high speeds. The Metropolitan West Side Elevated Railway, of Chicago, is trying still another plan by issuing the circular letter which will be found on another page in this issue. This letter expresses the waste of power in terms of dollars per month lost by the company, the loss being estimated at $5,000 per month or $60,000 per year. The request for co-operation of the motormen in an effort to reduce this loss is accompanied by the statement that hereafter the records of the men will include the results of observations of their efficiency in saving power on the part of the superintendent and other officers.

A Transfer on a Transfer

Additional evidence is obtainable frequently regarding the increasing appreciation by street railway managers of the serious losses resulting from abuse of the transfer privilege. The latest company in a large city to take summary action designed to prevent the continuation of unlawful drain upon its revenues from this cause is the Seattle (Wash.) Electric Company, which, pending definite reformative measures, has given an order to its conductors directing them not to issue transfers on transfers except between certain streets on one line. The issue of universal transfers, when given freely either for cash or on transfers, is somewhat similar, as a business inducement, to the action

of the merchant who seeks to secure general advertising for his establishment by offering $5 gold pieces at the marked-down price of $4.95. Either practice increases the risk of business failure if it does not make disaster certain. While the danger of universal transfers is understood more generally now than it was in past years, some companies are still laboring under the burden of ordinances containing provisions governing transfers which have proved to be extremely onerous. If companies will give transfers freely to passengers who pay either cash fares or tender transfers received from other lines, abuse will be difficult to prevent. The ultimate effect of continued excessive abuse will be the reduction of the average fare per passenger to a point that will not meet the requirements. Many companies have stood all the reduction in the average gross fare per passenger carried that they can bear if they are to struggle along without receivership and resultant reorganization.

Results of Single-Phase Operation on the Erie Railroad

W. S. Murray's recent "Log of the New Haven Electrification" was an early portent of the new conditions under which steam railroad electrification is to be discussed in the future; that is, from the standpoint of results in service instead of from theoretical assumptions. We are glad to add to Mr. Murray's paper along those lines the modest account of the pioneer single-phase electrification of the Erie Railroad now in operation for two years between Rochester and Mt. Morris, N. Y. There is little in common between the New Haven and Erie installations except in the use of a single-phase line potential of 11,000 volts, but the experience of the Rochester-Mt. Morris line proves that a single-phase railway unhampered by d.c. complications can operate from the very start as reliably as the most conservative railway manager could desire. It seems really extraordinary to maintain the line, rolling stock and power service of a 34-mile railway with no more than five men and give at the same time a far better service than was possible under steam operation. A direct-current electrification for such a line with its inevitable substations would certainly have doubled this force, leaving aside the question of additional investment for buildings and machinery. The several changes in line and car equipment which have been made in the Erie installation involved little expense and were not serious. The only considerable delays were due to failures in the hydro-electric transmission lines, a drawback having no relation whatever to the type of electric current in use for transportation.

The Improvements in Brooklyn

Six years ago the Brooklyn Rapid Transit Company began to carry out a thorough rehabilitation of every department of its properties. At that time the power service was so inadequate that schedules could not be maintained, nor was it possible to complete the electrification of the elevated division. The line and track department was practically homeless. In the rolling stock department the car bodies, trucks and electrical equipments were of the most diverse types; there were no real facilities for storage and maintenance, and few systematic records of service performance. Through the efforts of President E. W. Winter and Vice-President and General Manager J. F. Calderwood, the directors of the company have appropriated since 1903 the enormous sum of $40,000,000 to remedy these conditions and give Brooklyn an adequate transportation system. Every department has been thoroughly reorganized, so that to-day the Brooklyn Rapid Transit Company is equipped to offer the public first-class service in every department for years to come. The improvements in the rolling stock which are now being described in a series of articles in this journal are necessarily those most conspicuous to the patrons of the company. Clean and comfortable cars, free from breakdowns, have become an established condition. These betterments were in the province of the mechanical department, which, under W. G. Gove, its superintendent of equipment, has given special attention to the standardization of the cars and uniformity in maintenance. The intimate relation between improved equipment on the one hand and better service, lower accident charges and increased economy, on the other, imparts an interest to these articles which is not confined to the engineering features described. The practical effects of such a plan are widespread and favorably concern every department of the company. The courageous foresight which prompts a manufacturer to scrap a half-worn tool for a later but more productive design has its counterpart in the policy of a management which adopts the recommendations of its engineers and supplies the funds for carrying them out in the realization that better equipment must eventually pay, even if the discarded material could still move along the rails.

A New Departure in Electric Locomotive Design

The powerful electric locomotive built for service in the Detroit River tunnel of the Michigan Central Railroad which is described on another page in this issue embodies many new features in the design of its mechanical parts. To the casual observer it appears to be of the ordinary double-truck type such as have been built in large numbers for interurban roads. It is designed on an entirely different principle of traction, however. In the ordinary double-truck type of car or locomotive the tangential tractive effort exerted by the motors through the axles and wheels is transmitted through the journal boxes, truck frames, bolsters, center plates and body framing to the draft gear. The Detroit River tunnel locomotive consists of two independent traction units or trucks connected together with a hinge to permit curving. From the truck frames the tractive effort exerted by the wheels is transmitted directly to the draft gear and not through the bolster, center plates and body framing. In other words, the body or cab of the locomotive is subjected only to the stresses due to its own weight. When it is considered that the draft gear of these locomotives, which is attached directly to the truck end frames, was designed to resist buffing shocks of 500,000 lb., the advantage of relieving the underframe of the cab from such stresses is evident. Another reason for the adoption of this design was that owing to the large diameter of the driving wheels and the size of the motors mounted on the axles, it would have been impossible to have lowered the cab underframing to a point where its neutral axis would approximately coincide with the standard height of center line of draft which is 36½ in. above the rail.

The locomotive is designed for hauling heavy loads up the steep approach grades of the tunnel at a normal speed of about 10 m.p.h. Its maximum speed is but 35 m.p.h, and hence no pilot wheels are required to relieve the stresses on the rail induced by high speed when rounding curves. The articulated principle has been demonstrated to be successful for slow speeds by its application to steam locomotives of great power both in this country and in Europe so that its adoption in this type of electric locomotive as well as in the Great Northern three-phase locomotive is not altogether an experiment.

The electrical equipment of the locomotive is interesting because of the large size of the direct-current geared motors suspended on the axles. These motors have an approximate rating of 300 hp each and are wound to give an exceedingly high torque at starting. With a gear reduction of 1 to 4.37, each motor can exert an instantaneous starting tractive effort at the periphery of the 48-in. driving wheels of from 12,500 lb. to 15,000 lb. In order to provide adhesive weight sufficient to prevent the wheels from slipping the locomotive has been loaded down with ballast and extra heavy truck members. At the normal operating speed the capacity of the motors is sustained by forced ventilation which is a novelty in direct-current railway motor design. The number of resistance steps in the control circuits is unusually high, affording smooth acceleration, which is very essential under operating conditions such as will exist in the Detroit River tunnel with its steep approaches and sharp changes of grade.

Train Dispatching by Telephone

The standard code of interurban rules as revised by the committee of the Transportation & Traffic Association at the Washington conference departs from the standard code of the American Railway Association in the method of transmitting train orders. It has been contended by most interurban railway officers that the use of the telephone instead of the telegraph in transmitting orders makes necessary an entirely different procedure to guard against errors arising from imperfect speech or hearing. The general practice of transmitting orders from the train dispatcher directly to the train crews, which is one marked advantage of the telephone over the telegraph, is also advanced as a reason for requiring both members of the crew to participate in the routine of reporting and receiving orders. Up to about two years ago telephone dispatching was confined almost exclusively to electric interurban lines, and telegraph dispatching to steam railways, and a fair comparison could not be made of the relative merits of the two systems. Within the past year a number of important steam railways have introduced telephone train dispatching on some part of their lines and have had an opportunity of giving it a fair trial under exactly the same conditions as formerly obtained with the telegraph. The letters from officers of six steam roads using the telephone, which are printed elsewhere in this issue, throw some new light on the much-discussed question of whether the American Railway Association standard code is applicable to telephone dispatching. They also suggest some special precautions to insure accuracy of transmission which may be of interest to electric railway officers.

A careful perusal of the letters reveals the fact that, without exception, the American Railway Association code is followed in every important particular. The majority of the train orders issued by these roads are transmitted through operators at stations, but the Chicago & North Western Railway, Pennsylvania Railroad Company and the Chicago, Burlington & Quincy Railroad make provision for the train crews receiving orders at outlying stations or sidings where no operator is on duty. Mr. Morse, general superintendent of the Chicago & North Western, in his letter says: "The person in charge of the train performs the same functions as the operator." The North Western special rule No. 1, under the heading "Relaying Telegraph Train Orders by Telephone," uses the words, "the person receiving it," and does not specifically state whether the engineman or conductor shall receive the order. In rule No. 3, under the same head, however, the conductor is required to mail his copy of the order to the superintendent after executing it. It will be remembered that rules Nos. 210 and 211 of the American Railway Association exempt the engineman from signing an order in the presence of the operator, and a strict construction of these rules would not require the engineman to be present when the order is received and signed at an outlying telephone station.

The Burlington places the responsibility of receiving an order at a station where no operator is on duty on the conductor, who for the time being assumes the place of the operator, as defined in rules Nos. 210 and 211. The practice of the Pennsylvania Railroad under ordinary circumstances is to have the conductor alone receive the order at stations where no operator is on duty, but it is interesting to note that Mr. Myers says: "In some instances where conditions are possibly a little more exacting than others, we require the conductor to receive the train order and the engineman to repeat it back." On these three roads it seems to be thought sufficient under ordinary circumstances to have but one member of the train crew participate in receiving orders directly from the dispatcher. The practice of having one member of the crew receive, write and repeat the order and the other member again repeat it from the written copy, as defined in the revised rule No. 256 of the interurban code may not be absolutely necessary under all circumstances, but, at least, it leans to the side of extra safety.

Spelling out the names of stations and numerals has not been practised, to our knowledge, by any electric interurban railway. It would seem to be a rather slow process, but, on the other hand, the steam roads dispense with the second repetition of the order by the other member of the train crew. There probably would be little if any difference between the two methods in the total time required to transmit an order and obtain the "complete." The probability of conscious or unconscious error in writing and repeating a spelled-out order is exceedingly small; less, we believe, than when both members of the crew repeat the order back. Mr. Melcher says that after more than a year's experience he has yet to learn of a case of discourtesy or inaccuracy arising from the use of the telephone according to this plan, and he also states that the telephone has the advantages over the telegraph of rapidity and general efficiency.

ROLLING STOCK STANDARDIZATION IN BROOKLYN—IMPROVEMENTS IN DETAILS OF POWER EQUIPMENT AND WIRING

The process of car standardization in Brooklyn has been accompanied by improvements and economies from time to time in the several details of motor and control equipment. It will be noted later that in some items like carbon brushes very extended tests have been made to select the best, regardless of first cost, but with an eye to the ultimate cost and to reliability in service. The suspension of motive apparatus and the use of fireproof wiring are two other important power subjects considered in this article.

STANDARDIZING AND MAINTAINING BRUSH TENSION ON SURFACE AND ELEVATED LINES

The determination and maintenance of standard brush tensions for the surface and elevated motors, respectively, has had a valuable influence on the reduction of commutator troubles. Formerly, the motors were operated with any brush-holder spring tension which seemed desirable to the individual repair man. After extended investigation, the tension on the surface motors was placed at 7 lb., while that on the elevated motors ranges from 6½ lb. to 8 lb. Whenever a motor is inspected, the brush-holder tension is determined with a cylindrical pocket spring balance placed at a point directly over the brush, with the hammer even with the top of the brush guide. This scale is of 15-lb. capacity, and in size and shape resembles a dime savings bank.

CARBON BRUSHES

The Partridge carbon brush has been made the standard for the surface motors. The greater requirements of the elevated service, however, led to an elaborate series of carbon brushes tests which extended over the period from March 27, 1908, to Jan. 1, 1909, and resulted in the selection of the Le Carbone brush. In view of the results indicated in the accompanying table, two grades of this brush were adopted—grade "E" for the West, 300 interpole motors and West. 50 motors with slotted commutators, and grade "G" for the West. 50 motors with non-slotted commutators. The slotting of commutators on the West. 50 motors, however, is being carried on at the present time, and as soon as this work is completed the grade "E" Le Carbone brush will be standard for all elevated motors. While the grade "E" brush costs more than others per possible 1,000 miles, it proved far superior with regard to the proportion of chipped, broken and wornout brushes. Thus 59 per cent of the 51 brushes installed on the interpole motors were in good condition after eight months' service, when six other types had dropped out entirely. The average mileage of the discarded "E" brushes was 15,872, which was in excess of all others. The possible mileage of the perfect brushes was 159,600. This comparison indicates that the policy in brush selection was not to secure the lowest cost per 1000 miles, but to find a brush which would reduce to a minimum the costly flash-over troubles which result from broken or chipped brushes. Perhaps the most interesting feature of the table is the much lower wear of the same grade brushes when used on the interpole motors. These differences in wear throughout afford a splendid tribute to the value of the commutative feature of the No. 300 motor.

DATA ON TESTS OF CARBON BRUSHES OF ELEVATED RAILWAY MOTORS, MARCH 27, 1908, TO JAN. 1. 1909

Brush.	Brushes installed.	Brushes chipped.	Brushes broken.	Brushes worn out.	Brushes good.	% brushes good to those installed.	Aver. mileage of brushes chipped.	Aver. mileage of brushes broken.	Aver. mileage of brushes worn out.	Aver. mileage of brushes good.	Aver. wear of brushes, in. per 1000 miles.	Av. mil. for all brushes.	Aver. mileage for brushes chipped, broken and worn out.	Cost per 100 brushes.	Cost per 1000 miles for chipped, broken and worn.	Possible mil. per brush based on wear per 1000 miles.	Cost per 1000 miles for possible mil.
Westinghouse No. 300 Interpole Motor:																	
A	122	33	67	2	20	16.4	12,842	14,000	18,532	19,385	.008203	14,644	13,714	$7.43	$0.00541	121,800	$0.000611
A B E	51	6	15	0	30	59	12,532	17,208	....	20,643	.00626	18,678	15,872	22.00	.01386	159,600	.001380
A C	28	8	16	0	4	14.3	3,970	5,418	....	11,411	.01165	5,860	4,935	10.60	.02148	85,800	.001235
B	48	45	3	0	0	..	4,585	7,883	....	....	*.004104	4,791	4,791	9.90	.02066	243,600	.000406
C	3	6	2	0	0	..	7,412	7,412	....	....	....	7,412	7,412	4.05	.00546	....	....
D	27	18	9	0	0	..	4,812	3,144	....	....	....	4,256	4,256	4.05	.00951	....	....
E	57	39	17	1	0	..	9,580	10,467	6,222	....	*.00650	9,786	9,786	4.05	.00414	153,800	.000263
F	48	30	16	2	0	..	7,694	9,984	5,788	....	*.00991	8,378	8,378	4.05	.00482	100,900	.000401
G	26	17	9	0	0	..	7,798	10,462	....	....	*.00946	8,720	8,720	4.05	.00463	105,700	.000383
Westinghouse No. 50-E Motor, Non-Slotted:																	
A C	112	4	2	76	30	26.8	10.645	10,417	14,630	16,143	.0423	14,817	14,333	13.40	.00935	23,600	.00568
H	12	6	1	2	3	25	10,754	7,715	12,666	13,296	.0524	11,455	10,841	13.61	.01255	19,100	.00714
I	8	2	4	1	1	12.5	15,131	10,807	15,029	15,805	.0445	13,040	12,645	4.54	.00359	22,500	.00202
Westinghouse No. 50-E Motor, Slotted:																	
A C	11	0	0	4	7	63.6	....	....	13,086	9,171	.05354	10,594	13,086	13.40	.01024	18,700	.00717
H	18	3	1	4	10	55.5	5,722	8,035	10,977	12,532	.0506	10,801	8,639	13.61	.0158	19,780	.00689
I	11	5	4	0	2	18.2	5,812	6,996	....	7,204	.0338	6,495	6,338	4.54	.00718	29,600	.00154
J	34	10	0	7	17	50	8,667	....	10,869	8,959	.0488	9,266	9,574	4.54	.00475	20,500	.00222
Westinghouse No. 50-L Motor, Slotted:																	
A C	13	5	3	4	1	7.7	3,945	2,384	8,707	8,707	.06139	5,416	5,142	12.90	.02314	16,300	.00792
H	11	7	2	1	1	9.1	3,909	7,197	10,248	10,248	.0427	5,659	5,200	16.36	.0315	23,400	.0070
I	5	2	3	0	0	..	4,075	6,545	....	....	†.0388	5,557	5,557	7.29	.0131	25,800	.00282
														5.36	.0106	....	.00208
J	18	3	1	12	2	11.1	3,119	1,604	8,335	9,451	.0588	7,216	6,936	7.29	.0105	17,000	.00428
Westinghouse No. 50-L Motor, Non-Slotted:																	
A C	10	8	0	2	0	..	2,318	....	1,884	....	†.1407	2,231	2,231	12.90	.0578	7,107	.018
H	18	9	2	1	6	33.3	2,375	1,679	2,932	7,497	.03265	4,036	2,305	16.36	.071	30,600	.00535
I	12	9	1	0	2	16.7	2,904	5,354	....	7,497	.0439	3,874	3,149	7.29	.0232	22,800	.00319
														5.36	.0170	....	.00235

Notes.—"Number of brushes installed" includes only brushes of which record is complete.
*Taken from report of Oct. 5, 1908.
†Taken from report of Nov. 14, 1908.

ARMATURE SHAFTS AND MATERIAL

It will be unnecessary to refer to any but the surface armature shafts in the following account, as the elevated shafts were standardized at the Thirty-ninth Street shops between the years 1904 and 1906. Before the work of standardization was begun there was no uniform practice in the size of armature bearings and the permissible wear of armature shafts. All bearings are now made only at the Fifty-second Street shops, in accordance with the fixed standards given in the accompanying table. No shaft is allowed to stay in the same motor after its wear exceeds 1/64 in. All non-standard shafts and those with bad keyways have been entirely eliminated.

The wornout armature shafts are not scrapped, but are

re-turned to the proper diameters for other motors in accordance with the following conversion list:

Motor	Armature Shafts Turned from Same
West. 300	GE64, West. 93 and 93A, West. 81, West. 68, West. 101, West 101B, GE80.
West. 50 E and L.	Walker L-15, West. 81, West. 68, GE64, West. 93 and 93A, West. 101, GE80.
Walker L-15	West. 68.
West. 93 and 93A	West. 68, West. 81, Wes. 101.
West. 81	West. 68.
GE64	West. 68.
West. 101B	West. 68.
West. 68	Compressor armature } Occasionally.
GB80	Compressor armature }

The saving introduced by this practice is very considerable, as will be noted from the following comparison: Cost of new No. 93-A armature shaft is $7.50 for material and $3.50 for labor, while the cost of cutting down a No. 50 E armature shaft for a No. 93-A motor is only $1 for material and $4 for labor, a saving of $6.

As the armatures go into the shop from time to time, the round tapered keyways are changed to square-bottomed keyways. This alteration is being made because it was found that when a pinion was being pressed on the round key moved away from its seat, thereby tending to wear out the keyway and loosen the pinion. The use of the better holding square key has avoided this trouble without weakening the shafts appreciably.

An advance in armature material has been made by winding railway and compressor armatures with an asbestos insulated fireproof magnet wire. This wire is particularly suited for overload conditions, and the insulation is not too thick to prevent securing the right number of turns in railway motors.

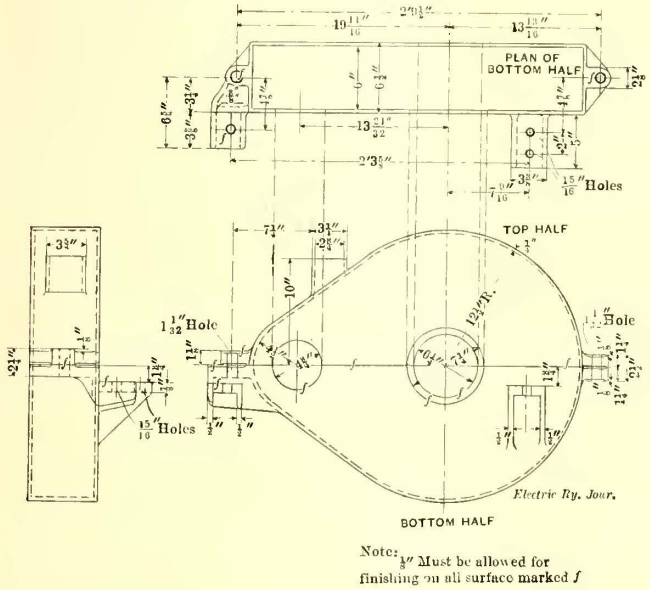


Fig. 1—Brooklyn Power Equipment—Malleable Iron Gear Case for Westinghouse 68 Motor

The elevated armatures wound with ribbon or bar copper have the coils made up with mica insulation in place of the usual oil linen. This involves greater first cost, but pays through the material reduction of maintenance troubles All newly wound armatures, elevated or surface, are given an insulation breakdown test of 2000 volts a.c., and all repaired armatures a breakdown test of 1000 volts a.c.

After testing 10 armature varnishes, the company adopted "Ajax" black baking varnish for dipping armature, field and magnet coils. The tests were made at the Fifty-second Street shops, and were of both mechanical and electrical nature. Pieces of cloth were dipped in the different varnishes and then baked at a temperature of 190 deg. Fahr. for 12 hours, 24 hours, 62 hours and 300 hours. The pieces baked 300 hours were given two dippings before baking and were the specimens chiefly considered in judging the merits of the varnishes. The trials showed that the varnishes could be divided electrically into four classes,

STANDARD ARMATURE SHAFT AND BEARING SIZES

Type motor.	Diameter shaft and bearing, pinion end.	Diameter shaft and bearing, commutator end.
West., 50-B	4¼ in.	3¾ in.
West., 50-E	4½ in.	3¾ in.
West., 50-L	4½ in.	3¾ in.
West., 68	3⅞ in.	2¾ in.
West., 81	3½ in.	3 3/16 in.
West., 93-A2	3¾ in.	3½ in.
West., 101-B	3¼ in.	3¼ in.
West., 300	4¾ in.	4 in.
G. E., 64	3½ in.	3⅛ in.
G. E., 80	3¼ in.	2¾ in.
G. E., 800	2½ in.	2½ in.
Walker, 15-L	3¼ in.	3 in.

as follows: Insulation value up to 6000 volts (the highest a.c. potential available in the shops); breakdown potential between 5000 volts and 6000 volts; breakdown potential between 3000 volts and 4000 volts; breakdown potential of 3000 volts or less. One of the interesting results shown by the test was that the best electrical varnish was also superior mechanically. After being baked for 300 hours at 190 deg. Fahr., it was still pliable, elastic, non-cracking and non-scaling when the cloth was creased or torn. The tests made on four air-drying varnishes resulted in the selection of the same maker's "Ajax" black air-drying compound. This is used at the inspection and maintenance shops for

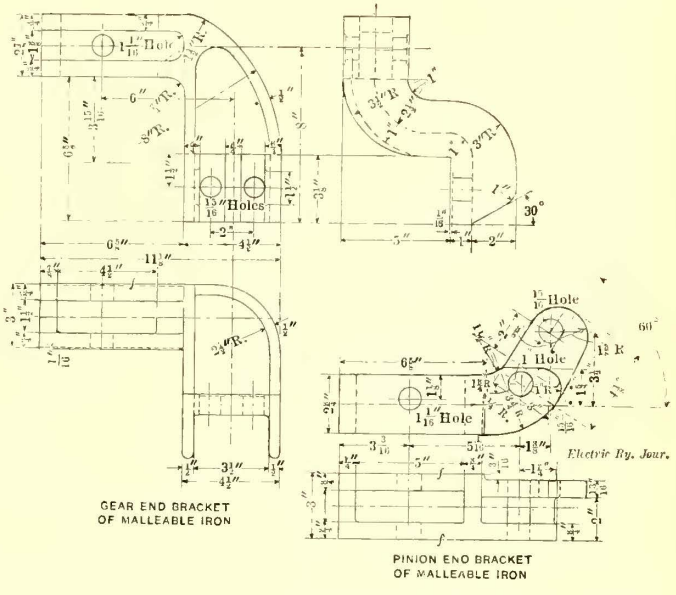


Fig. 2—Brooklyn Power Equipment—Gear Case Brackets for Westinghouse 68 Motor

touching up and painting armatures, fields and control apparatus insulation.

MOTOR BEARING FITS

The motor shells of West. 68 motors are being bored out to secure larger axle and armature bearing fits, as the old fits had worn to such an extent that it was impossible to keep the bearings tight except temporarily with shims. The old axle bearings had an outside diameter of 5¾ in. and the new ones will be 6 in. Similarly the armature bearing diameter has been increased from 4¾ in. to 5 in.

GEAR CASES

Malleable-iron gear cases made by the company are standard throughout. One interesting feature in this connection is the adaptation of the West. 101-B gear case for West. 68 motors by using some special brackets and enlarging the gear and pinion bores. The details of this practice are shown in three accompanying drawings of the standard West. 68 case, the combination case and the special brackets, Figs. 1, 2 and 3.

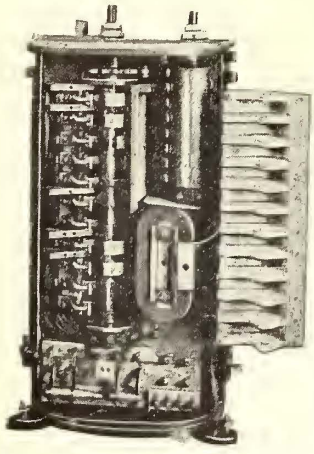


Fig. 4—Improved Controller

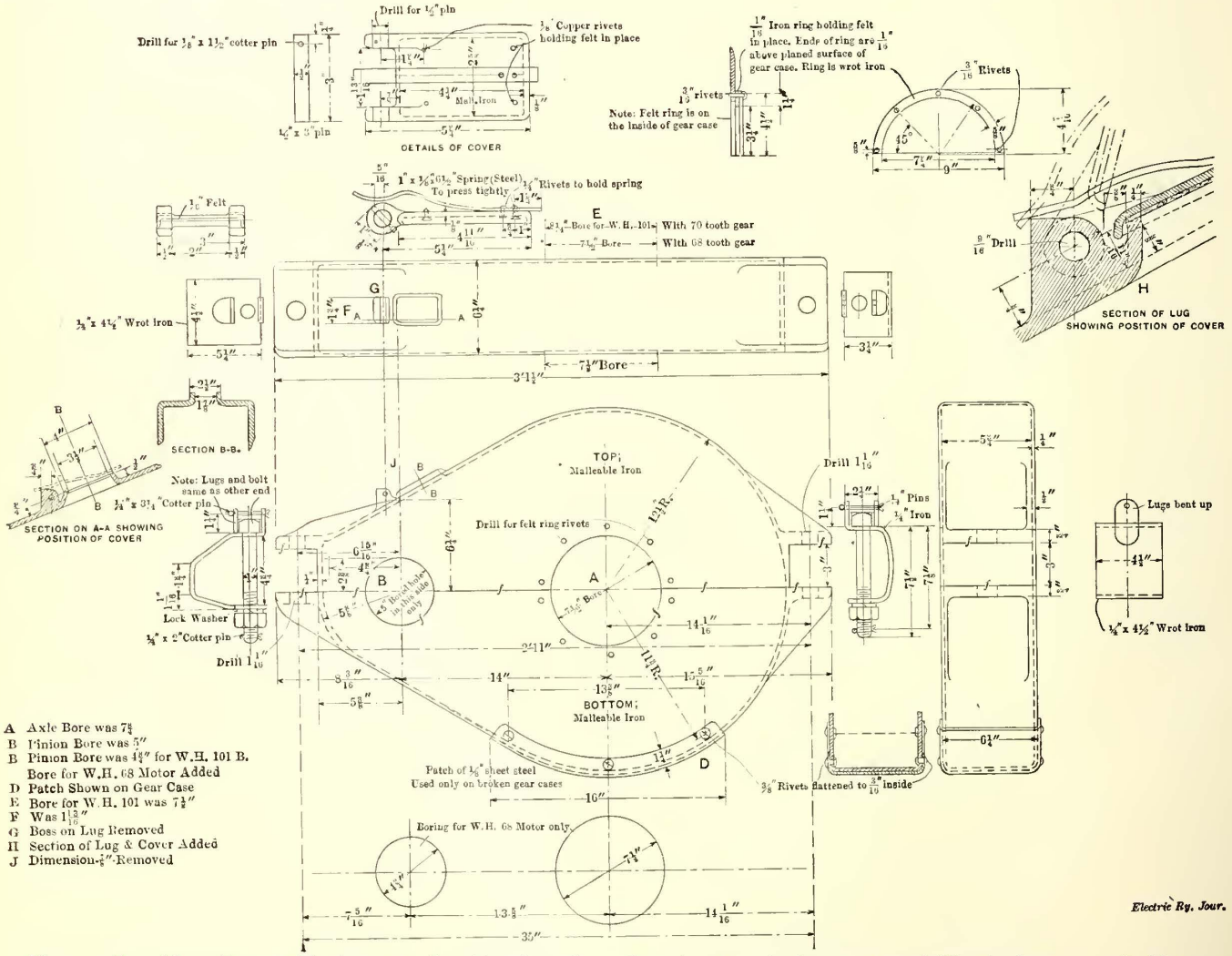
CONTROLLER IMPROVEMENTS

Controller service in Brooklyn is severe, as the operating conditions require a good deal of running on resistance points when traversing the bridges and in the lower parts of the city. Improvements in the insulation and other features of the controllers were begun, therefore, as early as 1904. In all the K-11 controllers the 1/16-in. fiber separator between the reverse cylinder and main drum was replaced by ½-in. vulcabeston. The same material was also used for additional insulating partitions between controller fingers, as follows: Trolley and R; R 4 and R 5; 19 and 15; 15 and E. The use of the extra insulating pieces, which are shown applied in Fig. 4, made it necessary to change the shape of the arc deflector plates so that the controller could be closed.

The K-11 controller has been furnished with a new style terminal, the screw of which is inserted perpendicularly on the wire ends. In the original design the screw was placed at an angle, thus cutting the strands of the wire. The old No. 6 wire has been replaced by No. 4 wire. Early this year the company began to remove the switch blade of the No. 2 motor cut-out switch connecting to wire F 2 from the reverser, because considerable trouble had been experienced from the burning of the switch contacts and terminal. The No. 2 motor is now directly connected to the F 2 wire.

TROLLEY STANDS

There are still several types of trolley stands in service, but it will be noted from what follows that the tendency is to adapt the Nuttall No. 11 ball-bearing base as the standard for closed cars. The open cars are supplied chiefly with Nuttall No. 1 stands and the freight cars with Malloy stands. The standard surface line trolley-base tension with the pole at an angle of 45 deg. is 18 lb. On the elevated lines the Nuttall No. 6 stand is used at a tension of 24 lb. with the pole at 45 deg.



A Axle Bore was 7⅝
B Pinion Bore was 5″
B Pinion Bore was 4¼″ for W.H. 101 B. Bore for W.H. 68 Motor Added
D Patch Shown on Gear Case
E Bore for W.H. 101 was 7½″
F Was 1 1/16″
G Boss on Lug Removed
H Section of Lug & Cover Added
J Dimension-⅝″-Removed

Fig. 3—Brooklyn Power Equipment—Combination Gear Case for Westinghouse 68 and Westinghouse 101-B Motors

The changes in surface trolley bases were made as follows:

During 1906 the company installed 150 Sterling-Meaker roller-bearing trolley stands on 150 new convertible cars. In 1907 602 No. 11 ball-bearing stands were installed, 200 on 100 new convertible cars (two per car) and 402 on 201

old convertible cars, replacing 201 6-in. Nuttall No. 1 spindle stands. These 6-in. stands in turn were substituted on closed cars for 3-in. stands which were scrapped. In 1907 150 No. 11 ball-bearing stands were purchased for 75 convertible cars to replace roller-bearing stands which were added on 75 other convertible cars having then only one stand each. In other words, this last lot of cars was

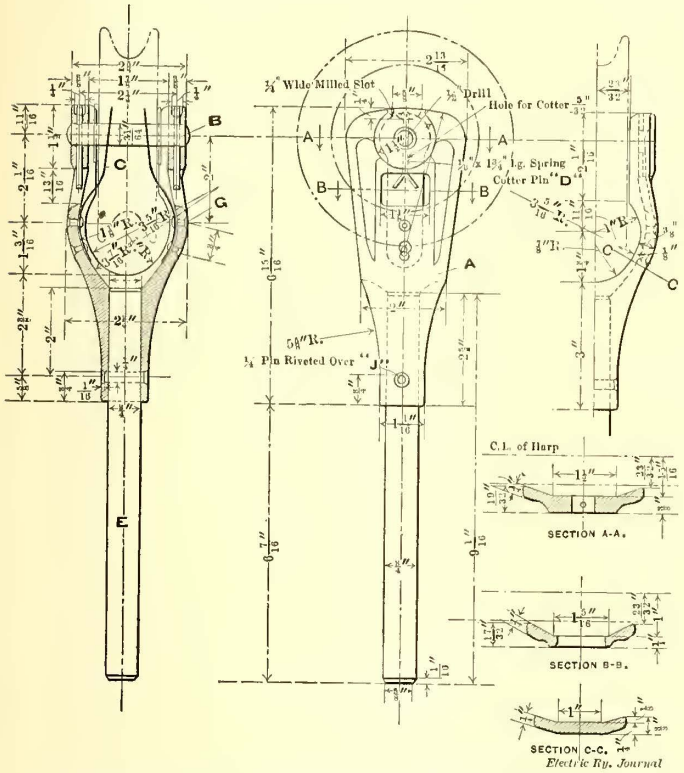


Fig. 5—Brooklyn Power Equipment—Standard Trolley Harp, Surface Division

equipped for double pole operation. One hundred No. 11 ball-bearing stands were placed on 100 new semi-convertible cars and 267 were bought for semi-convertible cars, to displace No. 1, 3-in. spindle stands. During 1906 and 1907 the company overhauled and placed new bushings on 1275 No. 1, 6-in. spindle stands and discarded 728 No. 1, 3-in. spindle stands in all.

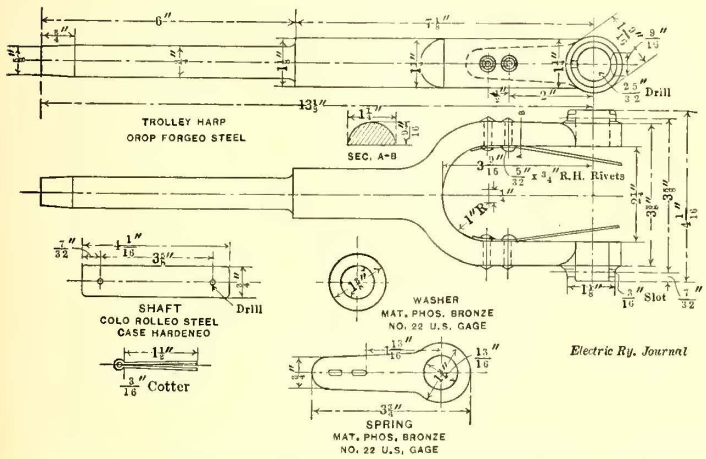


Fig. 6—Brooklyn Power Equipment—Standard Trolley Harp for the Elevated Service

TROLLEY HARPS, WHEELS AND SHOES

The company is now making its own trolley harps for both the surface and elevated lines, in accordance with the construction details shown in Figs. 5 and 6. The new surface harp can take either a 4½-in. or 5-in. diameter wheel. The special variations from the older design are the widening of the top to reduce the wear of the wheel on the contact shunts and the dishing of the harp as shown in section *aa* of Fig. 5. This dishing brings the harp so close to the wheel that there is little danger of the trolley wire cutting in between the wheel and the harp. The elevated harp was altered by extending the hub and placing longitudinally the cotter hole, which was formerly transverse to the prong of the harp. The latter change prevents the burning of the cotter pin when the trolley harp and wheel are being replaced on the wire.

The trolley wheel question is still a very active one, as may be judged from the fact that during 1908 some 20 dif-

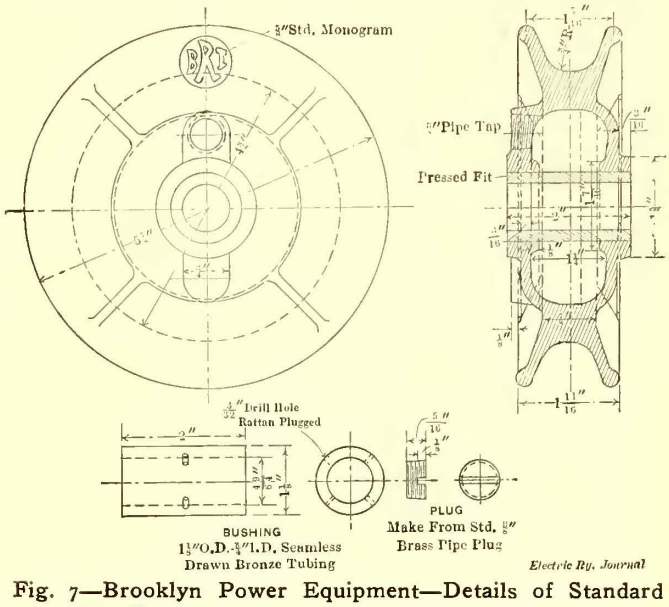


Fig. 7—Brooklyn Power Equipment—Details of Standard Trolley Wheel for Elevated Service

ferent kinds of wheel were under test. The accompanying curve sheet, Fig. 7, shows the considerable variations in cost per 1000 car-miles of steel and composition wheels. The latest wheel adopted is 4½ in. in diameter and weighs 1¾ lb. It has been in service only a few months, so that it is not yet possible to state whether it is likely to become the standard.

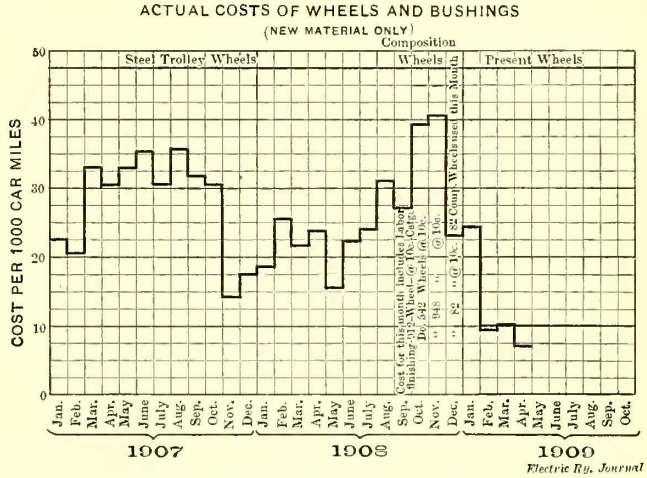


Fig. 8—Brooklyn Power Equipment—Passenger Surface Trolley Wheel Costs on Mileage Basis

A feature of the elevated trolley wheel, which is shown in Fig. 8, is the oil well with bronze bushings and rattan oil feeders. This wheel is 5⅞ in. in diameter, weighs about 5 lb. and is made of 88.4 per cent copper, 5.5 per cent tin, 2.8 per cent lead, 3.3 per cent zinc, with maximum

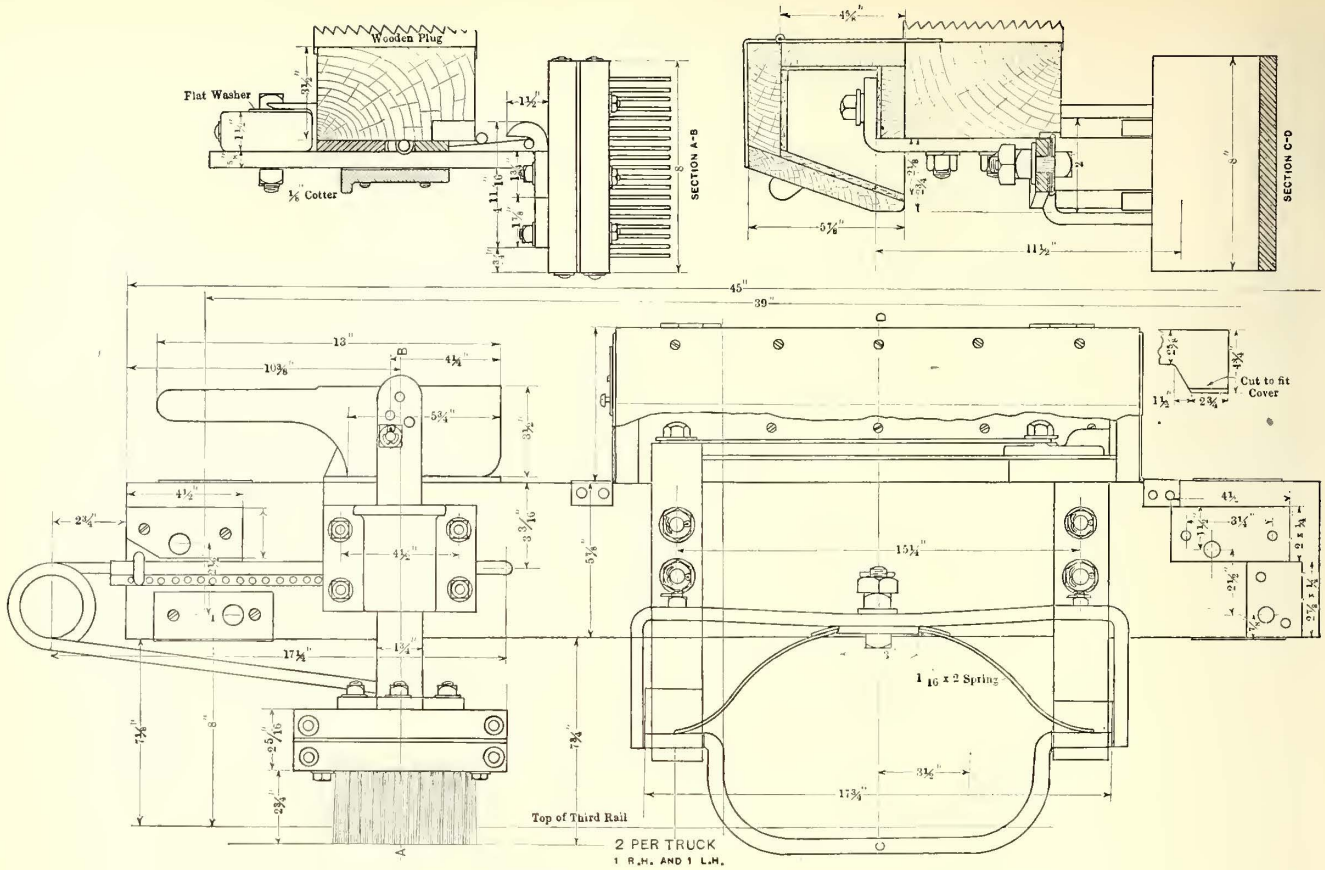


Fig. 9—Brooklyn Power Equipment—Sleet Brush and Third-Rail Shoe

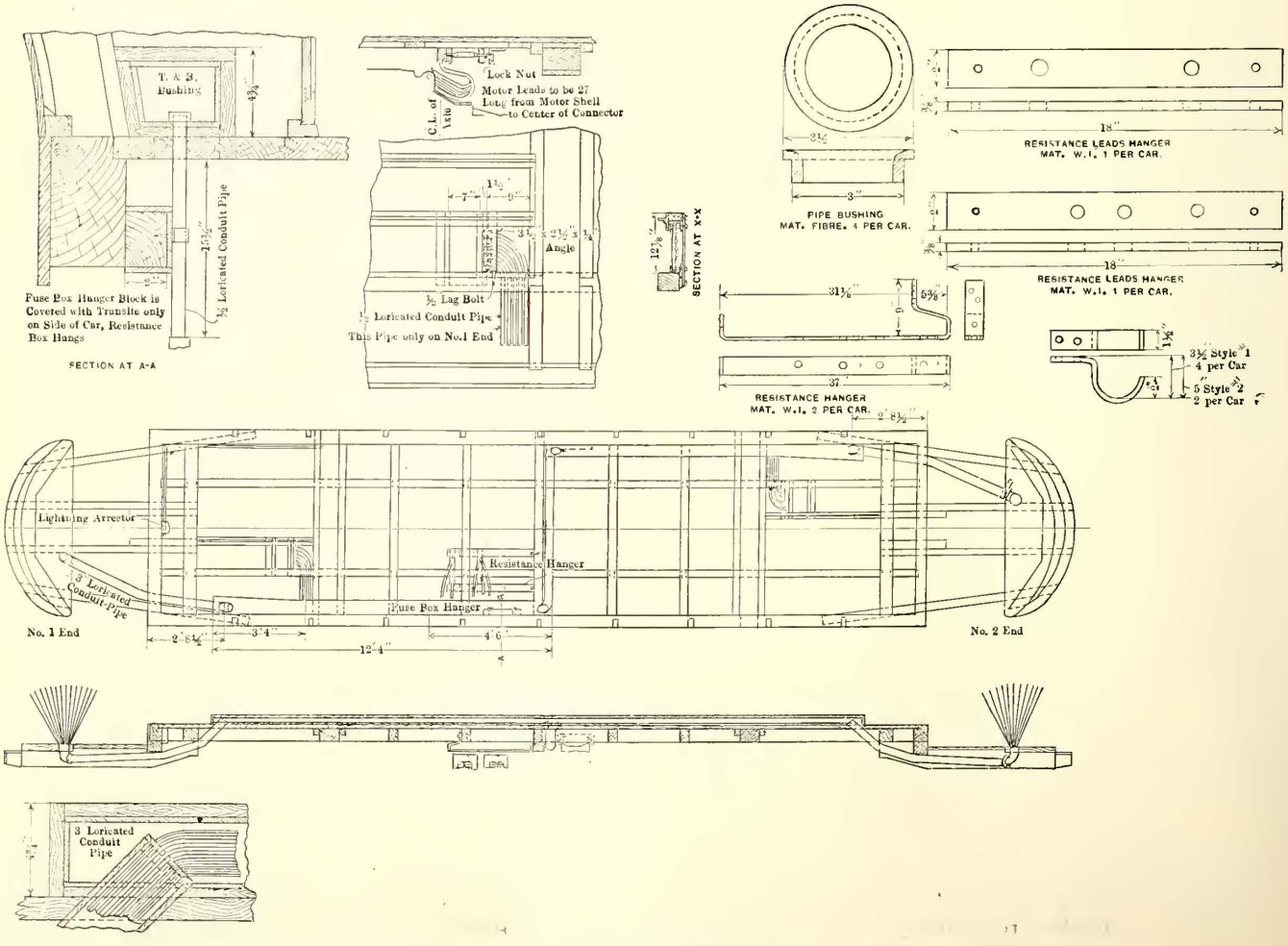


Fig. 10—Brooklyn Power Equipment—Control Wiring of Semi-Convertible Surface Passenger Cars, 1907 Type

impurities of 3.3 per cent. Its average mileage is 1500 and its cost per 1000 car-miles is 54 cents to 55 cents. This cost is based on a net price of 82 cents per wheel, as there is 50 cents scrap value in wheels which cost $1.32 when new.

The standard contact shoe for elevated service has lately been redesigned, as per Fig. 9, to eliminate all links and castings. The shoe is manufactured simply of wrought iron forged in the company's shops. It is designed for a maximum height variation of 2½ in. The former shoe consisted of castings which were continually breaking. It was a link-suspended shoe with copper shunts, but in the new type enough contact is secured through the flat spring and the shoe pressure, without using shunts. Fig. 9 also shows the sleet brush. This is made of No. 23 B & S gage wire, which is renewed practically every season.

SUSPENSION OF APPARATUS, POWER WIRING AND FUSES

Several improvements have been made in the method of carrying power equipment and circuits from the underside of the surface cars, the latest cars being wired as shown in Fig. 10. The iron hangers, which replaced those of wood, are bent to overlap the tops of the car sills so that the strain will be taken off the bolts. In some cases, however, the only way of carrying the hangers is to bolt them to the side of the sills. By changing from wooden to iron hangers, all trouble from decayed wood is eliminated and a material reduction is attained in the amount of combustible material under the car floor. These metal hangers are coated with a black anti-corrosive paint, which avoids the danger of rust. Strap iron of different thickness is used for all material except the resistance hangers, which are of angle iron. There is no excessive leverage of the resistances, as only enough room to reach the wiring readily has been left between them and the car underside. In fact, all the apparatus is hung as close to the car body as practicable. Johns-Manville vulcabeston insulated bolts are used for insulating the electrical apparatus and resistances from the hangers.

Loricated conduit in place of canvas hose for the surface power wiring was first applied on a large scale in the class 2500 semi-convertible built in 1907. Fig. 10 also shows the layout of these conduits. These are 3 in. diameter for the control cables to the platforms and across the middle of the car and ½ in. diameter from that part of the cables carried in transite-lined boxes under the longitudinal seating of the cars. The resistance leads are also carried in loricated conduit.

Another important betterment was the substitution of the old wood motor lead junction boxes by Westinghouse standard knuckle-joint connectors. The original wood junction boxes required 16 set screws for their connections, and their frequent loosening resulted in troublesome if not dangerous arcing. The knuckle joints are covered with a piece of circular loom for insulation. The motor and car body ends of the leads are supported by two cleats attached to the car body. About 2½ in. beyond the second cleat and 2 in. below the under side the loricated conduits pass through 3½-in. x 2¼-in. x ¼-in. angles, where each conduit is held by a lock nut. To disconnect the motor circuits when a truck is taken off, the cleat supporting the motor end of the leads is removed, the circular loom slid back and the knuckle-joint connectors separated. To insure ample flexibility, the leads are 27 in. long between the motor shells and connectors.

Figs 11 and 12 show respectively the latest elevated wiring and equipment practice as adopted on a car having two

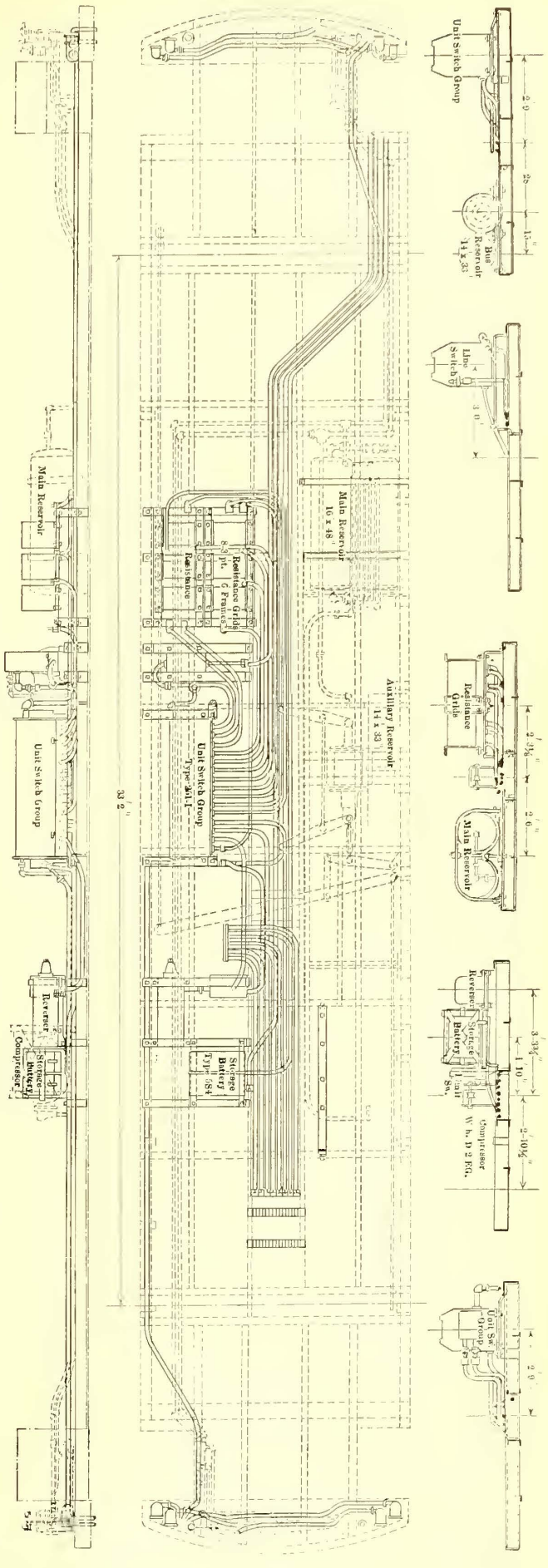
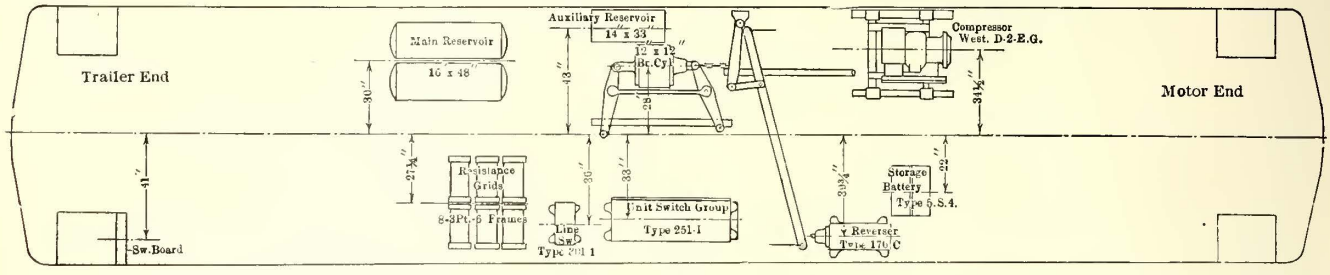


Fig. 11—Brooklyn Power Equipment—Conduit, Control and Brake Apparatus on Elevated Car

Westinghouse 300 interpole motors and 251-I-3 unit switch group control. Fig. 11 shows the general plan and floor sections taken at the unit switch group resistance guide, line switch and compressor. The underside of this car is protected by ¼ in. transite. The problem of balancing the under-car equipment has been very successfully handled in the case of the car shown in Fig. 12. It will be noted that the difference in weight between the air-brake and

EQUIPPING NEW CARS

All car bodies, trucks and motor equipments purchased by the Brooklyn Rapid Transit Company are delivered separately to the Thirty-ninth Street shops to be assembled and equipped for service. This work is done under the several maintenance foremen, who have charge of the additional men engaged for the occasion. Thus about 200 men were hired specifically to equip 100 elevated motor



Air Brake Side				Unit Switch Control Side			
Apparatus	Weight in Pounds	Distance From Ctr. Line	Moment Inch-Pounds	Apparatus	Weight in Pounds	Distance From Ctr. Line	Moment, Inch-Pounds
Compressor and Cage	1,070	34½″	36,915	Unit Switch Group	802	33″	26,446
Cylinder and Supports	479	28″	13,412	Line Switch	169	36″	6,084
Cylinder Levers	85	14″	1,190	Resistance Grids	636	27½″	17,330
Push Bar	15	18″	270	Reverse	189	39¾″	7,513
Multiplying Lever Support	35	25″	875	Storage Battery and Cage	149	22″	7,678
Multiplying Lever, with Bracket, Links and Chain	54	30″	1,620	Switch Board	80	41″	3,280
Cylinder Lever Supports	35	9″	315				68,331
Main Reservoirs	283	30″	8,490	68,331 lbs.	30″	2,277 lbs.	
Auxiliary Reservoir	69	43″	2,967	66,054 "			
			66,054	2,277 lbs.		75.90 lbs. at Side Bearings	

Fig. 12—Brooklyn Power Equipment—Balancing of Brake and Control Equipment on Elevated Car

unit switch control sides is only 2277 lb. This makes the pressure against the side bearings not more than 76 lb.

The protection of electrical equipment on the surface cars has been bettered and standardized by replacing the open fuses by Noark enclosed fuses on all cars and circuit-breakers in addition on all but the smallest cars. All fuses are carried in iron boxes. The several types of rolling stock are equipped as follows: Single-truck cars with K-11 controllers, 150-amp fuse; double-truck, two-motor cars with K-11 controllers, 200-amp fuse and circuit-breakers; double-truck, two-motor cars with K-28 controllers, 250-amp fuse and circuit-breakers; double-truck, four-motor cars with K-28 controllers, two 300-amp fuses and circuit-breakers. Contact shoe fuses only are installed on the elevated cars. This shoe fuse consists of two strands of No. 8 soft drawn, bare copper wire 13 in. between terminals, and it is carried in a box of asbestos wood.

cars of the 1400 type, but the mill, blacksmith and machine-shop labor was handled by the regular forces. The job was started Sept. 20, 1907, and ended June 30, 1908.

As shown in the accompanying table, it is the custom to record the progress of every car included on a given order from the day erection of the car began in the builder's shops until it was delivered to the operating department. Fifty of these cars were made by the Jewett Car Company, and the balance by the Laconia Car Company.

Car No.	Builder	Erection Begun	Bottom Frame Erect'd	Side and End Frame Erect'd	Flooring in Place	Roof Canvas in Place	Wiring Begun	Outside Painting Begun	Outside Paint'g & Varnishing Comp'd	Brake Rigging Completed	Inside Trimmings Completed	Wiring Completed	Ready to Ship	Shipped	Rec'v'd at 39th Street Shop	Del'v'd to Operating Department	Car No.
1400	THE JEWETT CAR COMPANY.	7-1	6-19	7-3	6-25	7-25	7-15	7-13	8-24	8-26	9-3	7-19	9-5	9-11	9-20	2-11	1400
1401		6-27	6-20	6-29	7-1	7-23	7-13	7-10	8-23	8-31	"	7-16	"	"	"	2-9	1401
1402		7-1	7-5	7-11	7-8	7-29	7-27	7-22	8-28	"	9-5	7-29	"	"	"	2-12	1402
1403		7-2	7-6	7-9	"	7-27	7-26	7-18	8-27	"	"	7-27	"	"	"	2-13	1403
1404		7-5	7-1	7-8	7-3	7-26	7-23	7-15	8-26	"	"	7-25	"	"	"	"	1404
1405		7-7	7-8	7-16	7-9	7-31	8-1	7-24	9-9	9-12	7-13	8-1	9-16	9-21	9-30	2-5	1405
1406		7-8	7-9	7-13	7-10	7-30	7-31	7-22	9-12	"	"	7-31	"	"	"	1-31	1406
1407		"	7-10	7-19	7-11	8-2	8-3	7-29	9-11	"	"	8-5	"	"	"	2-3	1407
1408		7-9	7-11	7-20	7-12	8-1	8-2	"	9-7	"	"	8-3	"	"	"	2-7	1408
1409		7-10	"	7-22	7-13	8-5	8-6	7-31	9-10	"	9-14	8-7	"	"	"	2-5	1409
1410		"	"	7-24	7-15	8-7	8-8	8-1	9-16	9-19	9-25	8-9	9-25	9-26	10-3	1-31	1410
1411		7-11	7-12	7-29	7-16	8-13	"	8-2	9-14	"	"	8-10	"	"	"	1.29	1411
1412		7-12	7-17	7-30	7-19	8-14	8-10	8-8	9-17	"	"	8-16	"	"	"	"	1412
1413		7-13	7-18	7-31	7-20	"	8-16	8-10	9-18	"	"	8-17	"	"	"	"	1413
1414		"	"	8-1	"	8-15	8-17	8-8	9-19	"	"	8-19	"	"	"	6-8	1414
1415		7-16	7-20	8-3	7-22	8-16	8-20	8-9	9-24	9-26	10-2	8-21	10-2	10-5	10-12	5-25	1415
1416		"	7-25	8-8	7-27	8-18	8-22	8-17	9-25	"	"	8-23	"	"	"	4-4	1416
1417		7-17	7-26	"	7-29	8-20	8-21	8-15	9-26	"	"	8-22	"	"	"	4-7	1417
1418		"	7-22	8-9	7-24	8-23	8-22	"	9-27	"	"	8-24	"	"	"	6-5	1418
1419		"	"	8-10	7-23	8-26	8-24	8-17	9-28	"	"	8-26	"	"	"	"	1419
1420		"	7-23	8-15	7-25	8-30	8-31	8-24	10-5	10-8	10-9	9-3	10-10	10-12	10-22	6-8	1420
1421		7-20	7-27	8-17	7-30	8-28	8-26	8-23	10-1	"	"	8-28	"	"	"	4-18	1421
1422		7-22	"	"	"	8-29	8-28	"	10-5	"	"	8-30	"	"	"	4-22	1422
1423		7-23	7-29	8-19	7-31	9-3	9-4	8-24	10-7	"	10-10	9-5	"	"	"	4-18	1423
1424		7-24	"	8-24	"	9-6	9-7	9-1	10-8	"	"	9-9	"	"	"	3-23	1424
1425		7-27	8-10	"	8-14	9-5	9-5	8-29	10-10	10-15	10-18	9-6	10-18	10-21	10-31	3-28	1425

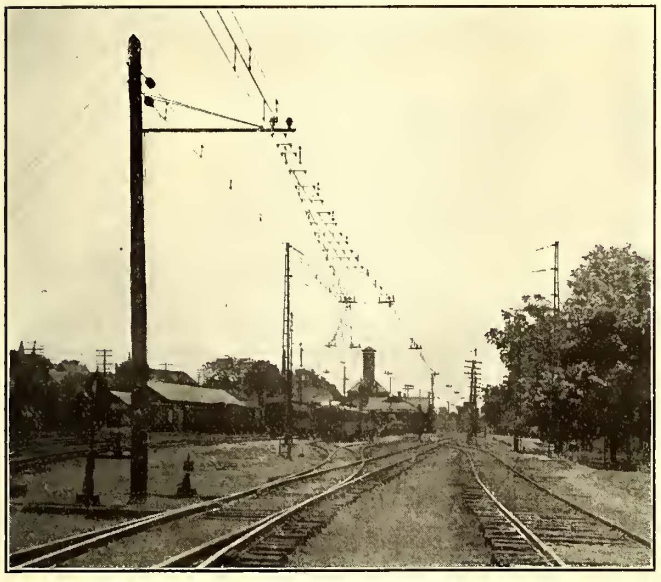
Part of Progress Sheet of 100 1907-Type Elevated Passenger Cars

The new cars are equipped in accordance with standard blueprints prepared in advance by the drafting room of the mechanical department, and no variations are permitted. The drawings call for the exact amounts of non-contract material which is to be furnished by the storeroom. Consequently, the construction gangs find the exact amounts of conduits, hangers, etc., ready for them in every case, thereby avoiding waste and numberless requisitions.

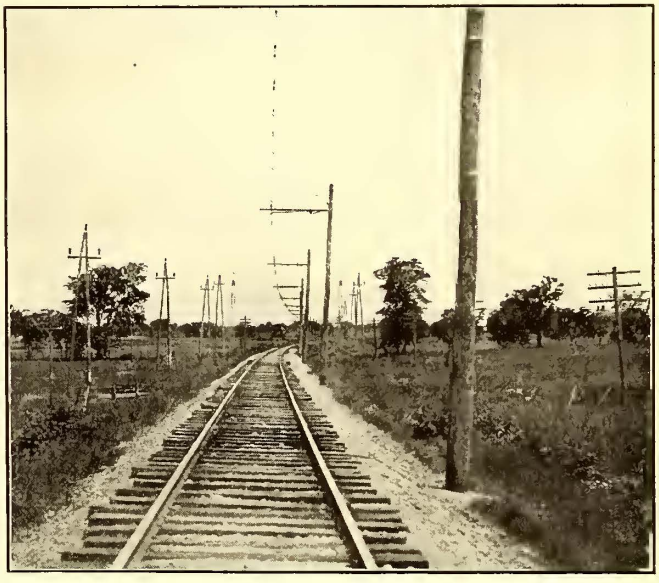
NOTES ON SINGLE-PHASE OPERATION ON THE ERIE RAILROAD

The Erie Railroad placed in operation on June 18, 1907, a 34-mile, single-track, alternating-current line between Mt. Morris and Rochester, N. Y. This was the first single-phase line operated over a steam railroad in the United States, slightly antedating the electrification of the New York, New Haven & Hartford Railroad, although the latter began conversion first. Current for the operation of this Erie division is received from a Niagara Falls 60,000-volt transmission line and transformed to the trolley potential of 11,000 volts at the Avon station, about midway on the line. The motor equipments are operated at 256 volts, single-phase throughout, because the line is on right-of-way and runs only to the outskirts of Rochester, so that there was no necessity for using a combination a.c.-d.c. motor.

On the Rochester-Avon section there are now operated 14 electric and 9 steam trains, and on the Avon-Mt. Morris section 19 electric and 2 steam trains. On the Mt. Morris branch there were formerly 6 steam trains, which have been taken off. On the Rochester-Avon section the steam trains are about the same as they were



Erie Single-Phase Line—Deflector and Bracket Construction



Erie Single-Phase Line—View of Trolley and High-Tension Transmission Poles

before electric operation went into effect. The electric service takes care of a through mail car from Buffalo to Mt. Morris from Avon, and also handles a milk car from Mt. Morris to Rochester and return each day. Since electrification the passenger travel, as based on local ticket sales, has increased 40 to 50 per cent.

For dispatching purposes the rolling stock operated over this section is divided as follows: First class, electric passenger; second class, steam passenger; third class, fast steam freight; fourth class, local steam freight. The electric service is usually operated with trains consisting of one motor car and one trailer, and on special occasions with trains of two motor cars and two trailers, using the Westinghouse multiple-unit system. The average daily run of such trains is about 160 miles. The motor cars weigh 48 tons and the trailers 27 to 28 tons. Including all flag stations, there are 32 possible stops in 34 miles, but only seven scheduled stops. The motor equipments are geared for a maximum speed of 55 m.p.h. and an acceleration of 1.55 m.p.h.p.s. The schedule time for the distance is 80 minutes.

LINE DELAYS

The number of delays from failures in line or car equipment has been very small, and even during the earlier periods of operation there were not more than four or five failures a month. The best record made was during the month of October, 1908, when there was not a single delay from any cause whatsoever. It is noteworthy that the entire steam history of this division fails to show a single perfect month. The causes for delay are rather interesting to mention, although further operating experience has obviated their repetition. So far as the overhead work is concerned, it was found that the frequent high winds in this district made it advisable to add steady strains at every third pole, or 360 ft. Previous to this there were several accidents from the swaying of the line in wind storms. At one time a pantograph broke by striking a cross-arm, and on a second occasion the line was grounded through the breaking of a cross-arm. A third delay was caused by the breaking of a tie-wire on an insulator, thereby allowing the messenger to fall on the cross-arm.

The composition insulators which were originally used for dead-ending wires were replaced by the engineers with porcelain spool insulators at the beginning of operation, as it was found that the earlier insulators were cracked by weathering which made them liable to short-circuits.

On Sept. 21, 1908, a pantograph became tangled up in a deflector and lost its shoe. Investigation showed that the accident was due to the distortion of the deflector. There have been no further accidents of this kind, as the deflectors are not permitted to become badly bent.

Interruptions from heavy snow and sleet storms have been few. The worst one was a 20-minute delay which occurred on Feb. 15, 1909, when so much snow and ice accumulated on the pantograph that it had to be cleaned by one of the crew to prevent it from losing contact. However, this was only necessary on the first run in the morning, as the succeeding cars found the wires less heavily coated. There were three other shorter delays during February from the same cause.

It may be of interest to note that the original copper shoes in the pantograph have been satisfactorily replaced

by steel. The copper shoes cost from $5 to $6, and ran about 10,000 miles. The steel shoes cost about $1.80 each, and give a life of 15,000 miles without burning or excessive sparking. The shoes are 48 in. long, with 5-in. face, and are held against the wire with a tension of 8 lb.

It is worth mentioning that there has been no line trouble whatever from corrosion by the blasts from steam locomotives. Current was formerly on for 15 hours only, but is now in use 24 hours. The first electric car starts at 6:40 a. m. and the last completes its trip at 12:40 a. m.

The telephone system, which is a complete metallic circuit, with an induction coil at each end, and which is transposed every third trolley pole, has proved entirely satisfactory. The overhead work, including the telephone line, is inspected daily by a single lineman. If necessary, in special cases a steam work train with roundhouse men can be secured from Avon.

CAR EQUIPMENT

The car equipment changes have been of very slight character, such as the substitution of cambric insulated cable by the engineers for the rubber-insulated cable originally installed for the high-tension circuits which was done at the beginning of operation. The only transformer breakdown was caused through the grounding of a high-tension coil which made current jump across to a low-tension coil in the auto-transformer. Due apparently to the high starting currents of 1600 to 1800 amp, the built-up mica and paper insulation of the auxiliary motor windings broke down several times. Excessive heat has sometimes resulted in the burning out of auxiliary windings of the field and has been held responsible even for hot axles. The normal running current is about 192 amp per motor at 256 volts. There has been no trouble from burned or flat commutators, and only one armature band has been torn off.

Some little difficulty was experienced with the original carbon brushes used with the motors, but the defect has since been corrected by replacing them with the No. 15 National brush. These brushes are ⅜-in. x 2¼-in. face, and are installed 12 to a motor at 4-lb. tension. This tension is somewhat light, but is very suitable for this line because of the excellent roadbed. The brushes average a life of over 10,000 miles. The brushes in the motor compressors were also replaced by the No. 6 Columbia type. The compressors are operated from the 123-volt tap of the auto-transformer. Nuttall cast-steel gears have been in successful use ever since the line was electrified. Only four have been broken, while others have been in continuous service for over 125,000 miles.

CAR INSPECTION AND OPERATING COSTS

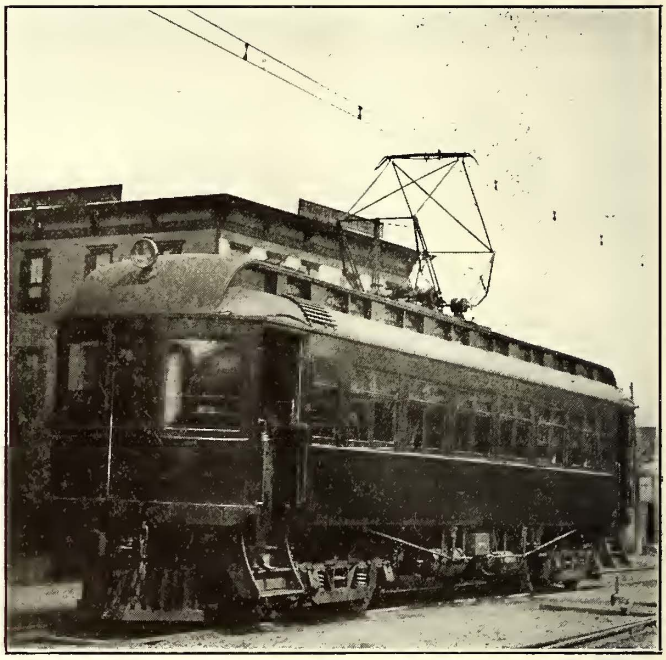
Of the six motor cars now used on the Rochester-Mt. Morris division, five are in service while the sixth car stays in the shops. The car control system is inspected about every three days, or 480 miles, while the motors are inspected every sixth day. The schedule is so arranged that the car to be inspected can end its run at Avon every third day, without obliging the passengers to transfer. The electrical inspection and repairing is done at Avon by two day men and one night man, who also look after the substation. The car cleaning, sweeping and occasional lubrication of motor and journal bearings are done at Rochester.

The total cost of operating the electrified division is 15.6 cents per car-mile and 21.8 cents per motor-mile. This covers maintenance of overhead line, the rolling stock, the substation and power. The right-of-way is maintained by the steam division. Not counting, therefore, the car crews and the track men, this 34-mile electric railway is maintained by three car inspectors, one line man and a general supervisor.

POWER SERVICE

As previously stated, the electric service of the Rochester-Mount Morris branch of the Erie Railroad depends for power on a hydro-electric transmission system from Niagara Falls. In the past some severe delays have resulted from interruptions in this transmission circuit. The worst one was experienced April 10, 11 and 12, of this year, when it was necessary to return to the steam service for two and one-half days on account of the Niagara Falls ice blockade. The transmission company's only reimbursement for most delays is to deduct a sum equivalent to the cost of the power which the railroad company would have purchased under average load conditions during the time that power was off the line. Twice the amount is deducted only in such cases where the power company interrupts the service of its own accord to clean intake pipes and inspect machinery or negligence in maintaining the line can be proved.

The contract with the transmission company calls for a minimum of 914 hp. The average peaks for one minute are



Erie Single-Phase Line—Motor Car at Avon

about 973 hp. In March of this year the railroad used 130,617 kw-hours at a load factor of 24.19 per cent. The cost of power delivered at Avon averages slightly over 1 cent per kw-hour, as appears from the following figures: December, 1908, $0.0103; January, 1909, $0.0106; February, 1909, $0.0119; March, 1909, $0.0107. The power company's invoice is based on daily load curves made by the station wattmeter at Avon.

The three-phase-two-phase connection of the transformers at Avon makes it possible to operate with one phase from Avon to Mount Morris and with the other phase from Avon to Rochester. It has been found that with one car starting up at the Rochester end of the line and no other cars on the same phase, the loss in the line is about 10 per cent for a distance of 20 miles.

MANAGEMENT

The Mt. Morris-Rochester electrified division was equipped by Westinghouse, Church, Kerr & Company, engineers, of New York. The line was finally turned over to the Erie Railroad about Sept. 1, 1907, and has since been operated under R. C. Thurston, electrical superintendent.

TRANSMITTING TRAIN ORDERS BY TELEPHONE

The practice of transmitting train orders by telephone was one of the most important points discussed at the recent conference called by the committee on interurban rules of the Transportation & Traffic Association, which was held at Washington, D. C., on May 25. The discussion developed wide difference of opinion as to procedure, and it was thought that interurban railway managers would be interested in the practice of such steam roads as had adopted telephone dispatching to replace the Morse telegraph. Letters were addressed by the editor of this paper to the officers of six steam railway companies which are using the telephone for train dispatching, asking them to state what differences, if any, existed in their practice of transmitting train orders to operator and non-operator stations by telephone and their former practice with telegraph dispatching. Replies have been received from all of the six companies to which letters were sent, and they are reprinted below. Comment on some features of the practice outlined in these letters will be found on the editorial pages of this issue.

PRACTICE OF THE CHICAGO & NORTH WESTERN RAILWAY COMPANY

W. E. Morse, general superintendent, sends a copy of the special rules governing train dispatching by telephone, with the following comment:

There is no difference between our method of delivering and acknowledging receipt of train orders submitted by telephone to train crews and the method outlined in the standard code of the American Railway Association for dispatching by telegraph. If, however, orders are given direct to train crews by the dispatcher by telephone, the person in charge of the train performs the same functions as would the operator and in the same way as is prescribed by the standard code of the American Railway Association.

The special rules governing the movement of trains by telephone are as follows:

RULES GOVERNING TRAIN MOVEMENT BY TELEPHONE

1. Rules 201 to 222, inclusive, as well as all other rules and regulations governing the movement of trains by telegraph must be complied with, and in addition thereto the following:

2. In transmitting or repeating an order by telephone the names of the stations, conductors, train and engine numbers and time must first be pronounced plainly, then spelled out, letter by letter, and figures duplicated, naming each figure separately; the train dispatcher writing it in the train order book as it is being sent and underscoring it as it is being repeated.

EXAMPLE 1

Order No. 49.

To C. & E. No. F-i-f-t-y F-i-v-e (Five Five):

Extra E-l-e-v-e-n S-i-x-t-y S-i-x (Double One Double Six) and No. F-i-f-t-y F-i-v-e (Five Five) will meet at O-s-h-k-o-s-h (Oshkosh) instead of N-e-e-n-a-h (Neenah).

EXAMPLE 2

Order No. 5.

To C. & E. No. T-w-e-n-t-y T-w-o (Double Two):

No. T-w-e-n-t-y T-w-o (Double Two) will meet No. T-h-i-r-t-y F-i-v-e (Three Five) at S-p-a-r-t-a (Sparta).

NOTE.—The parentheses and separations between letters, shown in Examples 1 and 2, are to illustrate the transmission or orders and do not appear in a written order.

3. Each operator receiving an order should observe whether the others repeat correctly.

4. The train dispatcher's telephone circuit is to be used exclusively for handling trains, and no message or other business will be allowed upon it except as may be directed.

5. The train dispatcher's receiver is in the circuit at all times, but stations are not.

6. Intermediate stations cannot call each other except through the train dispatcher's office.

7. When the train dispatcher wishes to call an office he will electrically ring a bell in the particular office desired. The person in charge will answer promptly by taking his receiver off hook and speaking his name and station.

8. A person desiring to communicate with the train dispatcher will remove the receiver from hook and speak his name and station.

9. In speaking, keep the mouth about one inch from transmitter and speak in a natural tone of voice.

10. Receivers must be placed on hook immediately conversation is finished and kept there at all times except when in use.

11. In reporting trains, take down the receiver, and if wire is not being used, send report without waiting response from the train dispatcher. The bell will not be rung except in case of important business and when the train dispatcher fails to respond in the usual manner.

12. Do not put receiver against the transmitter, as it interferes with the proper working of the line.

13. When offices are closed, the telephone must be cut off the line by a switch provided for this purpose, and restored again when resuming work. When leaving office for meals or similar intervals during regular hours, cut the telephone off and restore it upon return.

RELAYING TELEGRAPH TRAIN ORDERS BY TELEPHONE

1. To relay a train order through a telegraph station to a train at a telephone station, the train dispatcher will transmit it to the operator at the relaying point, from which it will be transmitted by telephone to destination. The person receiving it must repeat it to the relaying point, and each word and number must be underscored by the receiver at that point. It must then be repeated to train dispatcher, and if correct the train dispatcher will respond "correct." After the parties addressed at destination have signed the order the signature must be given to relaying office, and from there to train dispatcher, and "O. K." time, and chief train dispatcher's initials will be given, as per rule 210.

2. An order relayed to a superior train restricting its rights or superiority must be sent and "O. K." given and acknowledgment received before the "O. K." is given to the inferior train.

3. A copy of every telephone order must be filed at the point of relaying, also at the point of destination, bearing the name of the person receiving and repeating the order. After executing the order the conductor must mail his copy to the superintendent.

4. Upon the arrival of a train at a closed telephone station, where a train is to be met or passed, if it is not in sight the conductor must immediately communicate with the train dispatcher through the relaying operator, and report arrival of his train, giving his name, number of train or engine and name of station or siding.

PRACTICE OF THE ATCHISON, TOPEKA & SANTA FE RAILWAY COMPANY

J. E. Hurley, general manager, describes the practice and experience with telephone train dispatching of this railway as follows:

We do not have a different practice in delivering and acknowledging receipt of train orders transmitted by telephone from that governing the handling of train orders transmitted by telegraph. In the transmission of telephonic train orders we require the spelling out of all numerals and names. The use of the telephone for the transmission of train orders is comparatively new to us, having been in use only a few months. However, the results are very satisfactory, and we are preparing to enlarge upon the use of the telephone instrument.

PRACTICE OF THE ERIE RAILROAD COMPANY

A. J. Stone, general superintendent, writes:

In the application of the telephone in train dispatching we have made no change whatever in our method of handling train orders. The train orders are transmitted in exactly the same language and copied in exactly the same form by telephone as was done by telegraph, and when the orders are handed to the engineer and conductor there is

absolutely nothing in regard to same to indicate that any change has been made in the method of transmission. We have been for several months past dispatching trains by telephone on our Delaware division, which is one of our main line divisions, extending from Port Jervis to Susquehanna, a distance of 104.7 miles. The operation of the telephone has been eminently successful, and we are much pleased with the results experienced from its use. All train orders are transmitted by the dispatcher to the telephone operator, and are not sent direct to enginemen or trainmen.

PRACTICE OF THE PENNSYLVANIA RAILROAD COMPANY

W. H. Myers, general manager, outlines the practice of this company in the following letter:

It is our practice generally to transmit train orders by telephone to stations where we have operators in exactly the same manner as by telegraph, the only difference being in the means of communication, the train order being transmitted by the dispatcher, repeated by the operator, and made complete in the regular way in accordance with the standard code of the American Railway Association.

At outlying places, where we do not have an operator, train orders are transmitted directly to the train crew. It is the practice for the dispatcher to send a train order to the conductor, who receives it, repeats it back, and it is made complete in accordance with the standard code. In some instances where conditions are possibly a little more exacting than others, we require the conductor to receive the train order and the engineman to repeat it back, but in either case the rules for transmitting train orders by telegraph, as shown in the standard code, are followed in transmitting train orders by telephone.

In order to secure accuracy in the transmission of the names of stations and numbers of engines or trains, the name or number is first pronounced by the sender and then spelled out. Thus in transmitting the number 7, it would be pronounced "seven" and then spelled out (s-e-v-e-n).

PRACTICE OF THE CHICAGO, BURLINGTON & QUINCY RAILROAD COMPANY

F. E. Ward, general manager, replies as follows:

We are following out literally the rules of the standard code of the American Railway Association in the handling of train orders. Where the telephone is used by a conductor at a station where no operator is on duty, the conductor handles the order in identically the same way as would the operator.

PRACTICE OF THE CHICAGO, ROCK ISLAND & PACIFIC RAILWAY

F. O. Melcher, general manager, includes in the following statement the special rules which have been adopted by this company:

The Chicago, Rock Island & Pacific Railway is using the telephone for transmitting train orders on two operating districts, and will immediately extend its use to four more operating districts. We are convinced that there are many advantages in the use of the telephone for train dispatching, the principal features being rapidity and general efficiency, which, of course, result in economy. Information is gathered by the telephone with but little effort. The dispatcher can talk personally with the conductor or the engineer relative to his work in connection with which information is desired.

We do not make any difference in the method of delivering and acknowledging receipt of train orders transmitted by telephone from that employed in the use of the telegraph. Below is given a memorandum of the instructions issued by this company governing the movement of trains by telephone:

(1) Rules 201 to 222, inclusive, which agree with the American Railway Association standard code, and other rules and regulations governing the movement of trains by telegraph, must be complied with in moving trains by telephone.

(2) In transmitting and repeating a train order by telephone the order, train and engine numbers, names of stations and (in time orders) time must be pronounced, then spelled out; these numbers and time being duplicated in numerals, the dispatcher writing the train order in the book provided, during transmission, and underscoring the words and numerals as each is repeated.

EXAMPLE 1

(31) Order No. (One) O-n-e (1)
To Second (2-d) No. Four (4) Herington.
To No. Three (3) McFarland.

No. (Three) T-h-r-e-e (3) Eng. (Eleven Naught One) E-l-e-v-e-n N-a-u-g-h-t O-n-e (1-1-0-1) meet (Second) S-e-c-o-n-d (2-d) No. (Four) F-o-u-r (4) Eng. (Eight Sixty Five) E-i-g-h-t S-i-x-t-y F-i-v-e (8-6-5) at (Alta Vista) A-l-t-a V-i-s-t-a.

EXAMPLE 2

(31 and 19) Order No. (Two) T-w-o (2)
(31) To No. Nineteen (1-9) Bureau,
(19) To Extras Fifteen Nineteen (1-5-1-9) and Fifteen Sixty Two (1-5-6-2) West, Geneseo.

No. (Nineteen) N-i-n-e-t-e-e-n (1-9) Eng. (Eight Fifteen) E-i-g-h-t F-i-f-t-e-e-n (8-1-5) run (Twenty) T-w-e-n-t-y (2-0) minutes late (Bureau) B-u-r-e-a-u to (Silvis) S-i-l-v-i-s.

EXAMPLE 3

(31) Order No. (Fifty Seven) F-i-f-t-y S-e-v-e-n (5-7)
To No. Six (6) Atlantic.
To No. Seven (7) Valley Junction.

No. (Six) (6) Eng. (Eight Twenty One) E-i-g-h-t T-w-e-n-t-y O-n-e (8-2-1) meet No. (Seven) S-e-v-e-n (7) Eng. (Ten Twenty Two) T-e-n T-w-e-n-t-y T-w-o (1-0-2-2) at (Van Meter) V-a-n M-e-t-e-r.

(3) The brackets and spacing between letters and figures shown in examples must not be used in train orders.

(4) The dispatchers' telephone circuit is to be used only for moving trains and business pertaining thereto, unless otherwise directed.

(5) The dispatcher is cut in on the telephone at all times, and operators may report trains without saying "dispatcher," but will first give name of station.

(6) Operators must not handle the receiver roughly when taking it off or placing it on the hook, as this interrupts the transmission of business on the line.

(7) In talking, a natural tone of voice should be used, with the mouth about 1 inch from the transmitter, promptly placing the receiver on the hook when through and keeping it there except while in use.

(8) When operators are relieved by the dispatcher for a short time or for meals, or when they close their offices for the night, their telephones must be cut out of circuit by the switch provided.

(9) When an operator answers his telephone he will give the name of his station instead of saying "Hello." Before repeating train orders he will make sure that he has the dispatcher by taking off the receiver, saying "dispatcher," and receiving the response "dispatcher."

The telephones are on the superintendents' and train masters' desks, and frequent opportunity is given for checking the work of the operators and the dispatchers.

I do not know of any case of discourtesy or inaccuracy, and cannot cite any incident which would indicate that the telephone is not a desirable arrangement. It is absolutely necessary that all concerned follow the prescribed forms and not "short cut," as to abbreviate or depart from the outlined procedure might result in misunderstandings. We have experienced no trouble up to the present time, and have been transmitting train orders by telephone for more than a year.

CAR WEIGHTS AS AFFECTING OPERATING COSTS

At the regular monthly meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, on June 10, Milan V. Ayres, electrical engineer of the Boston & Worcester Street Railway Company, read a paper on "Car Weights as Affecting Operating Costs." He began by referring to the constant tendency to increase both the size and weight of electric car units in late years, stating that cars for urban service have risen from weights of 6 or 7 tons to 28 tons, while for interurban service cars as heavy as 40 tons are frequently encountered, and a 56-ton car for purely fast interurban traffic is not uncommon. Much of this increase has been necessary, and has been brought about by the desire to obtain greater seating capacity and higher speed, and to a lesser extent by the introduction of devices intended to secure greater safety and more comfort to the passengers. While this increase of weight has been in progress the cost of power has been dropping, due to improved machinery; hence the cost of power has not gone up in quite as striking a manner as the increase in car weights would lead one to expect. It has become evident, however, that the general expenses of operation of electric roads have increased in an alarming manner, and it is therefore timely to investigate the effects of car weights on the cost of operation, to see if there is a prospect of effecting substantial savings by reducing them.

Fig. 1 shows the performance of one of the surface cars of the type used by the Boston Elevated Railway Company, weighing 28 tons empty and equipped with four G. E. 202 motors having a gear ratio of 4.73. The passenger load is assumed to be four tons. The speed-time curve shows that the car accelerates at the rate of about 2 m.p.h.p.s until all resistance is cut out, then at a constantly decreasing rate until a speed of 33 m.p.h. is reached at the end of 140 seconds, during which time the car has

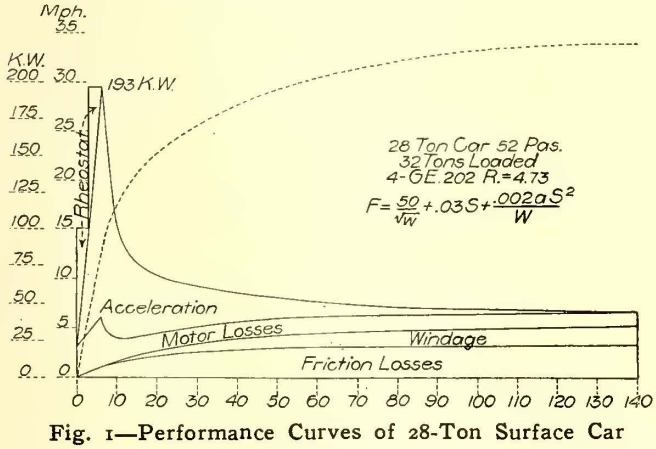


Fig. 1—Performance Curves of 28-Ton Surface Car

passed over 5900 ft. The areas enclosed by the solid lines represent the power consumption. The curve was computed by the Armstrong formula:

$$F = \frac{50}{\sqrt{W}} + .03S + \frac{.002\ a\ S^2}{W}$$

where F = train resistance, S = speed in miles per hour, a = area of car end in square feet and W = weight of car in tons. The first two terms represent track and bearing friction and the third term wind friction.

In Fig. 1 the car takes power at the rate of nearly 100 kw while the motors are in series, and then at 193 kw when they are in parallel, after which the power falls off first rapidly and then slowly, to a constant value of 44 kw. The division of losses under the power curve is indicated.

The usual type of run is shown in Fig. 2. Six stops per mile are allowed here, with a schedule speed of 12 m.p.h. Coasting begins after 20 m.p.h. has been reached, with a stop at the end of 40 seconds. The losses are totalized in watt-hours in Table I:

TABLE I.—DIVISION OF LOSSES IN TYPICAL RUN.

	Watt Hrs.	Per Cent of Total.
Acceleration	345	65.3
Rheostatic	70	13.3
Motor losses	81	15.4
Windage	5	.9
Friction	27	5.1
	528	100.00

The importance of acceleration is clearly evident from this. It is not safe, however, to assume that nothing much

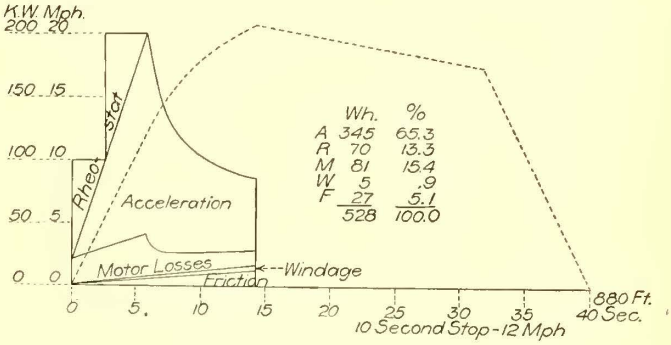


Fig. 2—Curves of Typical Run of 28-Ton Surface Car

would be gained by the elimination of friction, were that possible. Much greater savings than the 5.1 per cent indicated could be made through the reduction of electrical losses following quickened acceleration. Mr. Ayres particularly emphasized the fact that most of the demands for power are proportional to the car weight. Table II shows the result of reducing the car weight one-half, and running it upon the same schedule:

TABLE II.—POWER REDUCTION FOR 50 PER CENT WEIGHT REDUCTION.

	Car Weights.		Reduction
	32 Tons.	16 Tons.	Per Cent.
Acceleration	345	173	50
Rheostatic	70	37	47
Motor losses	81	42	48
Windage	5	5	0
Friction	27	19	30
Total	528	276	47.8

Here for all practical purposes the power consumption is proportional to the weight. For the run shown in Fig. 2 the watt hours per ton mile are 100, which is a fair average for rapid transit service. Table III shows the cost of power on this basis:

TABLE III.—COST OF POWER.

Watt hours per ton mile at car	100
" " " " " " station	125
Miles per car per day	150
Cost per kw-hour at car	1.5 cts.
Cost per pound per year	5 cts.

This gives a yearly cost of power at $100 per ton per car weight. This is based on the assumption of an average mileage of 150 per car per day, which is probably high, and a cost per kw-hour at the car of 1.5 cts., which may or may not be high, according to circumstances. For companies that make their own power 1.5 cts. per kw-hour is high as an operating cost, though probably not if fixed charges are included. Any complete estimate should include fixed charges in the cost of power. Of the other expenses of operation, platform labor is evidently unaffected by car

weights, while car repairs and track maintenance unquestionably increase with car weights. Mr. Ayres concluded that the cost of car repairs is very nearly proportional to car weight, and therefore to power consumption. He reached this opinion partly from his own observation of the comparative cost of repairing heavy and light cars and from a study of the reports of the Massachusetts Railroad Commission. Fig. 3 shows the relation between the cost of repairs and the cost of power on several of the most important street railways of Massachusetts. The roads selected were chosen to eliminate erroneous deductions on

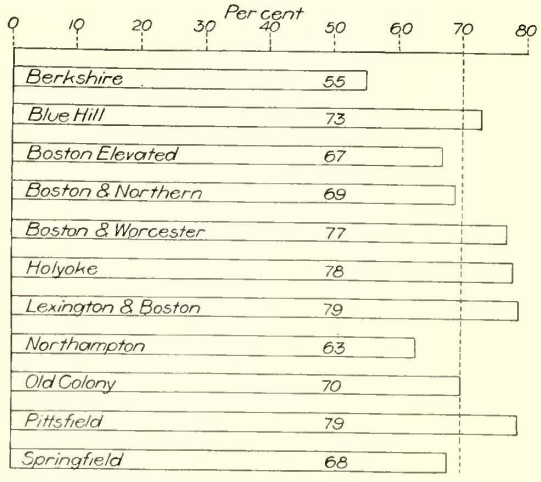


Fig. 3—Relation Between Cost of Repairs and Cost of Power

account of companies buying or selling power. A fair average of the figures is that the cost of repairs is 70 per cent of the cost of power, when only operating cost enters into the latter figure.

To illustrate how these deductions could be fitted to a particular case Mr. Ayres submitted Table IV, which was calculated to find the comparative value of open cars and semi-convertible cars for summer service on a moderate

TABLE IV.—OPEN VERSUS BOX CARS IN INTERURBAN SERVICE.

Assumed: 40-Mile Line; 2-Hour Run.

Cars, semi-convertible..... 72,800 lb.; cost, $10,500; seat, 60
Cars, open..... 38,000 lb.; cost, $7,000; seat, 70

Winter schedule, 30 min. time, 2720 m.p.-day, 12 cars.
Summer schedule, 15 min. time, 5400 m.p.-day, 24 cars.

	Case 1.	Case 2.	Case 3.
Semi-convertible cars	24	12	12
Open cars	..	12	24
Size power station, kw	3,640	2,770	1,900
Size substation, kw	4,560	3,850	2,380
Investment cars	$252,000	$210,000	$294,000
Investment power plant	$568,800	$432,600	$297,500
Cost power per year	$57,540	$51,635	$45,730
Cost platform labor	31,600	31,600	31,600
Cost repairs	40,200	36,200	32,000
Total operating cost	$129,340	$119,435	$109,330
Adding 10 per cent fixed charges on cost of cars	$154,540	$140,435	$138,730
Adding 10 per cent fixed charges on power plant cost	$211,420	$183,695	$168,480

speed interurban line. The line assumed was 40 miles long and the schedule speed 20 mph., requiring 2 hours for a one way trip and 8 cars to fill the schedule on half-hour service. It was assumed that 50 per cent more cars than the schedule called for were on hand to meet contingencies, including laying up of rolling stock for repairs. It was further assumed that the summer business requires twice the frequency of service and twice the mileage of the winter service, and that the summer period lasts 100 days and the winter period 256 days. The cost of power was taken at 1 ct. per kwh. at the substation switchboard, exclusive of fixed charges. The power station required was figured at twice the average killowatt demand at the time of the 15 minute schedule, which is a low estimate; and sub-station capacity at 25 per cent above the power station rating. The power station cost was assumed at $125 per kw, and the substation investment $25 per kw. Three different cases were assumed. In the first case 24 semi-convertible cars constitute the entire equipment, to be used the year around. In the second case 12 semi-convertibles are provided for constant service, with 12 open cars in addition for summer use only. In the third case 12 semi-convertibles are provided for winter only, with a complete outfit of 24 open cars for summer use with full equipment.

The full semi-convertible equipment is the most expensive to operate, and the full double equipment the least. This would naturally be expected for operating cost alone, but Mr. Ayres stated that it would no doubt be a surprise to many that it can be figured as more economical to pay fixed charges on a full double equipment, which is the result, even if the fixed charges are figured on the investment in cars alone. It is evident that the increased investment in power plant ought also to be taken into account; and when that is done the difference in favor of the open car equipment becomes very pronounced. Besides being cheaper the double equipment gives 16 per cent more seating capacity than the semi-convertible apparatus. There would be a somewhat increased expense for car houses with the double equipment; but that would be more than offset by the additional cost of feeder copper for the full semi-convertible equipment. The difference in track maintenance would also be considerable. For city service the size of the power equipment will usually be determined by the winter, and not by the summer load, so that the double car equipment will not exhibit as great an advantage as in the case assumed. It will still, however, show the lowest operating cost, and it is a serious question whether the increased liability to accidents is enough to outweigh this, especially in view of the undoubted superiority of the open car in attracting pleasure riding. Another question is the lightness of the single track car compared with the double truck equipment. If the oscillating motion which we have come to regard as inseparable from the single truck design has been as successfully overcome as some manufacturers now claim, there will be a large field for the use of that type of car.

Mr. Ayres stated that in the direction of new designs appears to be the best chance of reducing weights, as soon as the real importance of lightness is appreciated. Table V represents an effort to appraise the quality of lightness in a money equivalent:

TABLE V.—COST PER YEAR PER POUND OF CAR.

Average daily mileage	150
Power cost taken at 1 cent per kw-hour	$0.0342
Fixed charges, power plant, 7 cents per kw-hour	.024
Repairs, at $0.000875 per ton mile	.024
Total cost per ton per year	$0.0822
Present value of $0.0822 for 15 years	.855

This indicates that one can afford to pay 85 cents for every pound of permanent reduction in the weight of a car, or $8,500 for every 5 ton reduction in weight. In any individual case correction must obviously be made for varying conditions. If the average car mileage throughout the year is to be less than 150 miles per car per day, the total charge should be reduced proportionally. For this reason it is the cars for all the year service which should be made especially light, rather than those for seasonal use only. Mr. Ayres stated that after making the most drastic reduction in the above figures it is clear that in any case

one can afford to pay much more than double the price for any car, if the weight can be cut in half. This ratio will also hold for any reduction in the weight of a permanent fixture. If one can save 50 lbs. per seat in a car containing 24 seats one can afford to pay about $1,000 extra for those seats. If the motor manufacturers and truck builders can each save a ton in weight by the use of a better steel the railway company can afford to divide about $3,400 between them. Even if the factors are reduced greatly, lightness will be worth all it costs.

In conclusion Mr. Ayres suggested that the use of the rounded or turtle back roof would give a car less weight than the customary double deck roof, which is not a success as a ventilator. Steel is lighter than wood, strength for strength. Fig. IV. shows the comparative size of a 6 in. I beam and a hard pine timber, 6 in. high, and of the same strength. The wooden beam is 15.6 in. wide and weighs 29.2 lbs. per foot against 12.5 lbs. per foot for the I beam. The figure below shows a common floor framing construction for cars—a steel beam with wood fillers. In this case the wood adds 80 per cent to the weight and only 35 per cent to the strength. When the steel has to be used in simple rectangular forms, instead of in special shapes to which it is particularly adapted, it does not exhibit so great an advantage. Such a case is shown at the right of the drawing, where a ⅜-in. by 18 in. steel plate is compared with a hard pine timber 4.8 in. x 18 in. When used as beams on edge these are of the same strength. The wood weighs 27 lbs. per foot and the steel 23 lbs. One-tenth of

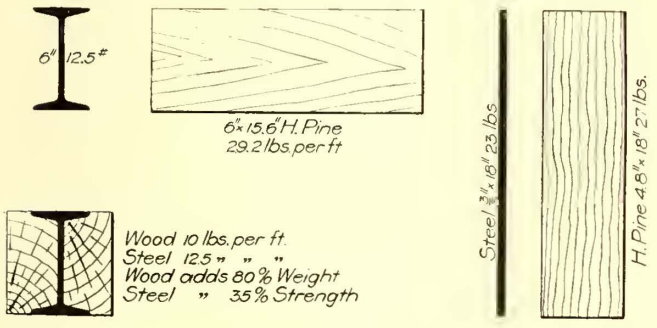


Fig. 4—Graphic Comparison of Strength and Weight of Steel and Wood Sills

an inch of steel has about the same weight as an inch of wood, and about 20 per cent more strength. There is much room for saving in the weight of the car furniture and fittings.

Pressed steel can take the place of cast iron with advantage to strength, appearance and lightness. When wiring is run in conduit thin steel tubing is preferable to wrought iron pipe. Steel should be depended upon in place of wood for strength. Probably it would pay well to use the high strength alloy steels for some parts in place of ordinary steel. Aluminum will probably prove to be a very valuable metal, both in the form of sheets to replace wood and sheet iron, and as castings in place of brass fittings. A truss form of side frame, using extra strong steel for tension and compression members, and pressed sheet aluminum for siding and panelling, might prove very efficient. Hard wood is heavy material, and double floors, heavy posts and siding three layers thick run into weight rapidly. It will ultimately be desirable to abolish wood altogether from car construction on account of fire risk. The manufacturers can probably reduce the weights of electric and air equipments if it is made worth their while, but such incentive must come from the operating companies.

DISCUSSION

In the brief discussion which followed the paper E. W. Holst, Superintendent of Equipment of the Boston and Northern and Old Colony Street Railway Companies, stated that in a recent specification of cars for his roads, 4,000 lbs. were saved by the use of a steel underframe. A 28-ft. four motor semi-convertible car weighed 2 tons more than a 30 ft. four motor car with straight sides. W. D. Wright, of the Rhode Island Company, Providence, emphasized the good points of open cars, and pointed out the importance of steel underframing in future work. J. W. Corning, of the Boston Elevated Railway Company, described the inverse relations between power station load and temperature which have been observed on that system, the average variation in load being from .6 to .8 per cent per degree F.

REPORT OF INDIANA RAILROAD COMMISSION

The third annual report of the Railroad Commission of Indiana, relating to the year 1908, has been issued. Inspections as to the physical condition and operation of 21 electric lines, with a total mileage of 1087 miles, were made during the year by the inspectors of the commission. The following work has been done on electric railways:

On the electric lines, cases of unsatisfactory management corrected	5
Shelter sheds erected	3
Safety devices installed	1
Bridge defects corrected	10
Unsatisfactory shelter sheds corrected	20
Unsatisfactory switch stands corrected	68
Unsatisfactory switch stands pending	10
Switch lights installed	69
Dangerous highway crossings-interlocks installed	2
In complying with the law in stopping at railroad crossings	1
Highway crossing signs erected, on miles of road	496
Whistling posts erected, on miles of road	142
Highway crossing bells installed	2
Highway crossing bells pending	7
Obstructions to signals corrected	2
Defects on bridges corrected	6
Defective derails corrected	2
Defective depot corrected	1
Defective track corrected	5

The uniform rules for interurban roads have been placed in force, with one probable exception, by all the lines of the State.

Electric lines are building shelter sheds and some substantial depots. The report includes a cut of a concrete shelter shed of the Evansville, Suburban & Newburgh Railway, "which is very creditable to that company and most useful to its patrons."

The commission will enlarge upon the practice of making addresses by its members and inspectors to railroad men at various points in the State.

In some cases, including those concerning interchange of traffic between interurban and steam roads, the steam lines have resisted the orders of the commission by proceedings instituted in the State courts.

A number of recommendations for new legislation are made by the commission, including the following:

The safety appliance law should be so amended as to provide punishment for wrongful destruction or interference with the operation of safety appliances or appliances used to protect highway crossings, such destruction or interference being made a misdemeanor.

A statute should be passed to prevent trespassing upon railway tracks, and punishing all persons who use such tracks as a footway. The railway employees, including section men, trainmen and inspectors, should be given constabulary powers in the enforcement of the law.

The safety appliance law should be so amended as to require adequate and properly working hand brakes to be placed upon all cars, both freight and passenger, including interurbans, and as to the latter the hand brakes should be required to operate independently of the air or power brakes.

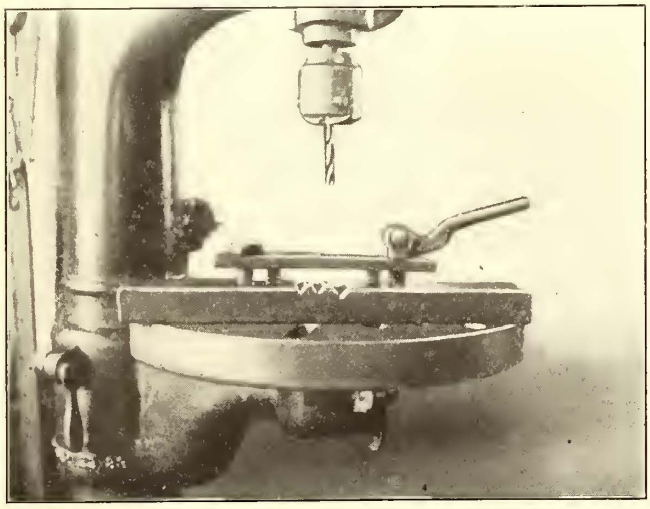
A law should be enacted providing for the elimination of grade crossings throughout the State by requiring the steam and electric railroads to separate a specified number of grades each year, for each 100 miles of railroad or fraction thereof, owned or operated by them. The expense of separation should be divided between the railroads and the counties, cities or towns wherein the crossings are located according to some fair basis.

In an appendix to the report Alexander Shane, chief inspector of the commission, states:

On the part of the traction systems our work has been very gratifying. At the beginning of the work of this commission there was very little uniformity of operation, so that it was deemed advisable to recommend to them that they compile a standard code of rules, which they readily did, and which all the roads of the State, with one or two exceptions, have adopted, and while all of their men are not as conversant with those rules as they should be, yet an effort is being made to have them post themselves, and they are continually being urged to literally comply. This is being done not only by the officials of the road, but by your inspectors, who take advantage of every opportunity to impress upon these men the importance of this thing and the responsibility that rests upon them. What few defects have been located on the interurban lines have been promptly corrected, their physical condition and equipment have been found in very good condition generally, so that few exceptions have been taken, and your inspectors have not been able to report to the commission a single instance where railroad men have been arbitrary or have declined to heartily co-operate with us in our work.

CLAMP USED IN DRILLING COTTER-PIN HOLES

The accompanying illustration shows a clamp devised by E. C. Barnes, of the Newport News & Old Point Railway & Electric Company, Hampton, Va. This clamp is used for holding bolts and brake rigging pins while drilling the cotter holes. The base consists of a piece of 1½-in. x 3-in. iron and the top piece of ½-in. x 2-in. iron. The top



Clamp for Drilling Cotter-Pin Holes

piece is held up by two coil springs set in holes drilled in the bottom piece to keep them in place. The clamp on the upper piece permits rapid adjustment for rods varying from ½ in. to 1½ in. By using the holes drilled in the top piece over the centers of the V-slots in the bottom piece no centering is required.

VALUATION OF STREET RAILWAY PROPERTIES

During the last few years the subject of valuation of various semi-public properties has assumed great importance, not only to owners of securities in these corporations, but also to their customers, and indirectly to the business, politics and social economics of the community. Heretofore such infrequent valuations as have been made have been usually for the purpose of acquiring such properties for public ownership and operation. These, for example, were the conditions surrounding the valuations of railroads, tramways and other utilities in Great Britain and Continental Europe and in many cases of water works in this country. The recent development of the subject of valuation in the United States has been in connection with proposed rate making and taxation for steam railroads and with the adjustment of terms in the extension of expiring franchises for street railways and other public utilities.

The methods of valuation of street railway properties in Chicago and Cleveland have been so widely quoted that they are often assumed to be the only ones which can be used in valuating this class of property. Briefly, the method was to make what was practically an inventory of the properties, with prices as of date of inventory, then to add small percentage allowances to cover certain overhead charges, such as engineering, superintendence and incidentals. The value of the remaining life of the franchises was then determined by a capitalization of estimated net earnings for the remaining term, discounted to date of the valuation, such earnings being based upon existing rate of fare, taxation and service rendered.

The subject is an active one in New York City at present owing to the valuations being carried on by the Public Service Commission of the First District. This commission has been confronted with several rate problems, in the solution of which the valuations now being secured will undoubtedly be used, although the commission has not yet announced the weight which will be given to the several valuations in determining what constitutes an equitable fare.

The attention which is being given to the relative influence of valuations and other elements bearing upon the question of what is a reasonable rate recalls the speech of ex-President Roosevelt on Decoration Day, 1907, at Indianapolis. Mr. Roosevelt said:

At the outset let it be understood that physical valuation is no panacea; it is no sufficient measurement of a rate; but it will be ultimately needed as an essential instrument in administrative supervision. * * * Therefore the physical valuation can never be more than one of many elements to be considered; but it is one element, and at times may be a very important element, when taken in connection with the earning power, franchises, original cost, character of management, location and business possibilities in reaching an estimate on the property and rights of a corporation as a going concern.

The effect of such valuation and supervision of securities cannot be retroactive. Existing securities should be tested by the laws in existence at the time of their issue. This nation would no more injure securities which have become an important part of the national wealth than it would consider a proposition to repudiate the public debt. But the public interest requires guaranty against improper multiplication of securities in the future.

President Taft has also referred to this subject. In his speech of acceptance of July 28, 1908, he said:

It is clear that the physical value of a railroad and its plant is an element to be given weight in determining its full value; but as President Roosevelt in his Indianapolis speech and the Supreme Court have in effect pointed out, the value of the railroad as a going concern, including its good-will, due to efficiency of service and many other cir-

cumstances, may be much greater than the value of its tangible property, and it is the former that measures the investment on which a fair profit must be allowed. Then, too, the question what is a fair profit is one involving not only the rate of interest usually earned on normally safe investments, but also a sufficient allowance to make up for the risk of loss both of capital and interest in the original outlay. These considerations will have justified the company in imposing charges high enough to secure a fair income on the enterprise as a whole. The securities at market prices will have passed into the hands of subsequent purchasers from the original investors. Such circumstances should properly affect the decision of the tribunal engaged in determining whether the totality of rates charged is reasonable or excessive. To ignore them might so seriously and unjustly impair settled values as to destroy all hope of restoring confidence and forever to end the inducement for investment in new railroad construction which, in returning prosperous times, is sure to be essential to our material progress. * * *

From what has been said the proper conclusion would seem to be that in attempting to determine whether the entire schedule of rates of a railway is excessive the physical valuation of the road is a relevant and important, but not necessarily a controlling, factor.

It has been generally assumed that the valuations in New York, being for rate-making purposes, would embody different principles from those employed in Chicago and Cleveland. Not only are the legal points involved, such as powers of the authorities, methods of regulation and methods of corporate organization not the same, but the entire physical, financial and operating structures of these properties are dissimilar. For instance, the New York franchises are perpetual, whereas those of Chicago and Cleveland were expiring, and it would be manifestly impossible to value a perpetual franchise by the methods used where franchises are for limited terms. In the one case the physical valuation is for the purpose of fixing a present reasonable rental for a perpetual leasehold and in the other the valuation is largely for the purpose of determining the physical value to be turned over to the owner at the expiration of the leasehold.

The positions taken by the representatives of the railway companies in regard to the valuations and their use indicate that they recognize and mean to insist on this difference. Thus in the case of the Coney Island & Brooklyn Railroad, for which Ford, Bacon & Davis are the technical advisers, Frank R. Ford early in the year submitted to the Public Service Commission a list of seven methods by which a valuation could be made. They were as follows:

1. Amount of cash capital actually invested in the property.
2. Amount of securities outstanding allowed to be issued by the State or other authority.
3. Valuation of State franchise tax assessing board of physical and other property in streets, plus estimated value of physical property not in streets.
4. Commercial valuation based on market value of securities as used by Prof. H. C. Adams for census report.
5. Capitalization of average net earnings as adopted by Swiss and French laws of appropriation of railroad property for national ownership.
6. Methods used in water-works valuations in New England.
7. Physical valuation or present cost of reproduction new.

"Physical valuation" for rate-making purposes, according to Mr. Ford, should be based on the present cost of reproduction new of not only the physical property, but also the rights to construct such physical property together with certain costs of development, as follows:

a. Cost of acquiring public rights under conditions of competition.
b. Cost of development of business (organization, financing, etc.).
c. Cost of development of physical property (superseded construction, etc.).
d. Overhead charges on construction.
e. Physical value (inventory-priced).

To emphasize the large amount of intangible property value of a street railway company Mr. Ford submitted to the commission the following memorandum outlining the various items of expenditure necessary from the inception of the street railway enterprise to the completion of the project and operation of cars:

COST OF REPRODUCTION OF STREET RAILWAY PROPERTY

1. Cost of promotion.
    1. Preliminary technical expenses.
        1. Survey and location of line.
        2. Estimate of cost of construction and equipment.
        3. Estimated gross earnings and operating expenses.
    2. Preliminary legal and miscellaneous expenses.
    3. Preparation of prospectus.
2. Profits of promotion.
3. Cost of organization.
    1. Legal expenses.
        1. Incorporation.
        2. Legal organization (minutes, directors' fees, etc.).
        3. Form of securities.
        4. Mortgage.
    2. Organization expenses.
        1. Engraving stock certificates.
        2. Engraving bonds.
        3. Registration of stock and bonds.
        4. Services of trustee in certification.
        5. Officers' salaries and general expenses.
4. Cost of charter and franchises under conditions of competition.
    1. Fees to State for charter.
    2. Consent of State commission.
        1. Legal expenses.
        2. Technical expense of presenting project.
        3. Organization expense of presenting project.
    3. Property owners' consents, original and for change of motive power.
        1. Legal expense (vacation of injunctions, etc.).
        2. Technical expense (maps, etc.).
        3. Organization expense.
        4. Cost of consents.
    4. Consent of local authorities (franchise).
        1. Legal expenses.
        2. Technical expenses.
        3. Organization expenses.
        4. Payments for franchise.
            1. Lump sum.
            2. Franchise requirements other than car service, capitalized.
                1. Grading and widening streets.
                2. Removing sub-surface street obstructions.
                3. Paving, first cost.
5. Cost of development.
    1. Technical.
        1. Past supersession and obsolescence.
            1. Changes in art and experiments, such as
                1. Stage coaches.
                2. Horse system.
                3. Cable system.
                4. Storage battery system.
                5. Compressed air system.
            2. Improvements in art, such as
                1. Double-truck cars.
                2. Improved motors.
                3. Improvement of grade and alignment of track.
                4. Girder rails.
                5. Improved paving.
                6. Steel poles.
                7. Underground conduit.
                8. Fireproof barns and shops.
                9. Steam turbines in large units and other power-house developments.
                10. Alternating-current distribution.

2. Extra cost of construction due to non-interference with operation.
3. Piecemeal construction.
4. Solidification of roadbed.
5. Adaptation of construction and equipment.
6. Development of park and amusement enterprises.

2. Suppression of intangible capital due to consolidation.
3. Cost of corporate consolidation.
1. Premium paid for securities.
2. Legal and organization expenses.
3. Payments to State or city.
4. Business and organization.
1. Loss of early operation.
2. Loss of outlying sections of line.
3. Loss of inefficient managements during original organization.

6. Cost of financing.
1. Legal and organization expenses of obtaining permission for issue.
1. State.
2. State commission.
3. City authorities.
2. Legal and organization expenses of submission to bankers.
3. Cost of sale of securities, commission to bankers.
4. Discount on securities.

7. Company's overhead charges upon construction.
1. Organization, accounting department and office expenses.
2. Storeroom and stable expenses.
3. Permits of authorities and city inspection.
4. Engineering, organization, consulting engineers and architects.
5. Interest during construction.
6. Taxes during construction.
7. Legal expenses during construction.
8. Wear and tear during construction.

8. Contractors' overhead charges and profit.
1. Organization and office expenses.
2. General superintendence, watching and lights.
3. Insurance during construction, fire, accident and liability.
4. Maintenance and use of tools.
5. Profits.

9. Physical extras, incidentals and contingencies.
1. Incomplete inventories.
2. Loss and wastage of material during construction.

10. Cost of material and labor of present physical construction.
1. Inventory priced on basis of sub-contracts.

11. Cost of reproduction of land, such as right of way and sites for power houses, car houses, shops and terminals.
1. Assessed value.
2. Additional sales value.
3. Additional value for railroad purposes.
1. Contiguity factor.
2. Necessity of discarding part of real estate purchased.
3. Necessity of discarding buildings purchased.
4. Additional cost of condemnation.
5. Monopoly value due to location.
4. Overhead charges for acquisition of real estate, comprising brokerage, legal expenses, cost of search, title insurance and other similar expenses.

12. Working capital.
1. Cash.
2. Cost of current materials and supplies.
3. Accounts receivable.
4. Accounts payable.
5. Prepaid accounts.

13. Reserve funds and special deposits.
14. Investments, including contracts and leases.
15. Good-will, earning power, franchise value and patent rights.

In previous valuations some of the overhead charges included in this list have been lumped together as a percentage of the physical value, but most of the other intangible items were omitted altogether. For instance, this percentage charge was taken as 5½ per cent in Cleveland and about 20 per cent in Chicago. If each of the items in this list is carefully figured out and an allowance made therefor, the total will represent, with most properties which have been in operation for any considerable length of time, a much larger percentage of the value of the physical property than these figures.

In the valuation of real estate, for example, in some instances the assessed value has been taken and in others an appraisal has been made based on the sales value of surrounding real estate. Generally, the additional cost or value of such real estate for railroad purposes is considerably more than the sales value of surrounding property for general purposes. In some of the railroad commission valuations in Western States a large additional value has been allowed, for instance, in the right of way of a railroad, due to the contiguity factor, or the location of land in a long strip. This is somewhat similar to plottage value for a large piece of real estate in the center of a city. The value of this contiguity factor has been placed by the Minnesota commission at three times the sales value. In other words, it is well recognized that there is an additional value to real estate suitable for and used for railroad purposes due to the necessity of acquiring large tracts of land or to the necessity of location. In cities it is almost always necessary to discard the buildings purchased with the land, although in some cases they have borne a large proportion of the total cost of the real estate. This is the case with many of the car barns, power houses and substations in New York City. Furthermore, in case of some kinds of buildings, such as power houses, which have to be located on or near the waterfront and be provided with railroad facilities, there may be only one location available, and this, in consequence, possesses a monopoly value. In addition, for purposes of valuation on a reproduction basis, all of the necessary overhead charges on real estate, such as brokerage, title insurance and legal expenses, should be included.

Other items which have not usually been given careful consideration are "Supersession of intangible capital due to consolidation" and "Cost of corporate consolidation." Most of the large city systems have been built up by consolidation of a number of small competing companies, each one of which has usually spent a considerable portion of its capital in acquiring property rights and in developing its corporate and financial organization. Upon the consolidation of these properties some of this cost was superseded, and consequently would not appear at present in the cost of reproducing this property. There is also the actual cost of corporate consolidation, such as premium paid for securities and the expenses of consolidation, all of which benefited not only the security holders of the consolidated corporation, but also the traveling public through the extension of the transfer privilege and the betterment of operating conditions and service.

The list of these intangible items may be amplified to cover each particular case, and when included in a valuation should represent the difference between cash investment and strictly physical value.

The secretary of the American Street & Interurban Street Railway Engineering Association has sent to all members blanks for submitting subjects for discussion in the "Question Box." It is requested that replies be sent in early, so that the questions and answers can be printed in time for distribution before the convention meets.

DETROIT RIVER TUNNEL LOCOMOTIVE

A series of acceptance tests has been completed recently by the General Electric Company and the Detroit River Tunnel Company, jointly, upon electric locomotive No. 7500, the first of six locomotives for the Michigan Central Railroad, one of the New York Central lines, and to be operated in the tunnel under the Detroit River now under construction. The electrical equipment of this locomotive, which is the most powerful in point of tractive effort ever designed for operation by direct current, was built and installed by the General Electric Company. The mechanical details, including the trucks and cab structure, are the product of the Schenectady works of the American Locomotive Company.

The Detroit River tunnel will connect the West Detroit yards of the Michigan Central Railroad with the new Windsor yards in Windsor, Ont. The electrified zone, embracing the tunnel with its approaches, terminal tracks and sidings, will cover a distance of approximately 33,000 ft. Maximum grades are encountered on the approaches, where a 2 per cent grade extends for approximately 2000 ft. at each end of the tunnel.

Articulated Electric Locomotive for Service in Detroit River Tunnel of the Michigan Central Railroad

The locomotives are designed for hauling both freight and passenger trains through this tunnel, and also for switching service at the terminals. The specifications under which they were built demand a maximum service, consisting of hauling an 1800-ton trailing train up the 2 per cent grades at a speed of not less than 10 m.p.h., with two locomotives operating as multiple units. Their capacity is such that they are capable of repeating trips with this weight of train continuously with a lay-over of 15 minutes at each end without undue heating of the motors.

The locomotive is classified by the builders as of the 0440-E-200-4GE209 type, which is the conventional method of stating that it is an articulated four-axle type of electric locomotive, weighing 200,000 lb. and equipped with four GE-209 motors.

The articulated running gear may be considered as consisting of two four-wheel trucks coupled together; but the method of coupling and the relation of the equalizing systems on the two trucks make it necessary to consider the two trucks together. The truck side frames, as will be seen from the illustrations, are heavy steel castings of a truss pattern. In order to obtain the necessary weight on drivers the members of this frame are made heavier than actually required for strength, the top member having a section 5 in. x 7 in., while the other members are proportionally heavy. This gives a peculiarly massive and substantial appearance to the whole running gear. The truck end frames and bolsters are castings of heavy box girder type, rigidly bolted to the side frames and fitted in such a manner as to relieve the bolts of shear. Draft gear, buffers and all truck frame members are calculated for buffing stresses of 500,000 lb. and pulling stresses in proportion.

The system of spring suspension is of the locomotive type, the weight being carried on semi-elliptic springs resting on the journal box saddles. The system of equalization by which these springs are connected together is ingenious and interesting. The *A* end of the running gear—or what may be called the forward truck—is side equalized, the two springs on each side being connected together through an equalizer beam. This equalizes the distribution of weight between the two wheels on one side, giving to this truck a two-point support, and consequently leaving it in a condition of unstable equilibrium as regards tilting stresses—that is, stresses tending to tip the truck forward or backward. The *B* end of the running gear, or what may be called the rear truck of the locomotive, is cross-equalized, the two springs on the rear axle being connected together through an equalizer beam. The other two springs on this truck are independent and are connected directly to the truck frame. This results in a three-point suspension on the rear truck, leaving it in a condition of stable equilibrium, capable of resisting stresses in any direction, whether rolling or tilting. The two trucks are coupled together by a massive hinge, so designed as to enable the rear truck to resist any tilting tendency of the forward truck. This hinge combines the two trucks into a single articulated running gear, having lateral flexibility with vertical rigidity. It will be noted from the above description that the running gear has what may be called a compound three-point suspension. The rear truck has in itself a three-point suspension, while the forward and rear trucks together form an articulated frame having a three-point suspension, consisting of the two-point support of the for-

ward truck and the independent equalization of the rear truck.

The braking equipment is arranged so that the action is mechanically independent on each truck. Two pairs of 12-in. brake cylinders apply the brakes, and separate valves and cutout cocks are supplied, so that the pair of cylinders controlling either truck may be cut out without affecting the other.

The draft rigging consists of a standard M.C.B. vertical plane coupler, with yoke, springs and follower plates, designed to comply with the railroad company's specifications. This draft rigging, as well as the spring buffers, is mounted upon the outer end frames of the trucks. This arrangement insures that all pulling and buffing stresses are transmitted on the same horizontal line through the draft rigging, side frames and connecting hinge pin of the trucks. The center pins and cab platform framing are entirely relieved of all longitudinal stresses except those due to the weight of the cab, platform and equipment.

Center pins and side bearings are provided on the running gear for the support of the cab. The center pin on the

Detroit River Tunnel Locomotive—End View

A end is a swivel pin, having a turning motion only, while that one the *B* end has a turning and sliding motion. This construction allows the longitudinal motion necessary to take care of the variation in distance between the truck center pins occurring as the locomotive passes around curves. The side bearings on the *A* end have a clearance of about ⅛ in. when the cab is level, while those on the *B* end have a clearance of about ½ in. The result of this arrangement is that under ordinary circumstances the cab is carried on a three-point suspension, since the side bearings on the *A* end support all normal rolling action of the cab, the side bearings on the *B* end coming into play under abnormal conditions only.

The cab platform is built of four 10-in. longitudinal channels running the whole length of the locomotive, which are tied together by the end channels and bolster plates. Such ballast as is necessary to bring the weight of the locomotive up to the required amount is bolted to the two center sills, and the space remaining between them forms a passage leading from the blower to the motors for carrying the air for forced ventilation. A floor plate, consisting of two sheets of ⅜-in. steel, is riveted to the platform sills, and serves to stiffen and square the platform framing. In the operating cab a ⅞-in. wood flooring is placed over this steel floor.

The sides and ends of the cab are built of ⅛-in. steel plate, supported by a framework of small angles, while the roof is of No. 8 gage steel. The main operating cab occupies the central portion of the locomotive and covers a floor space of 15 ft. 6 in. x 10 ft. It is fitted with windows on each side and two windows and two glazed doors in each end, allowing a practically unobstructed view in every direction. The cab contains the engineer's seat, and such apparatus as is required in the operating compartment of the locomotive. Auxiliary cabs extend from the main cab to the ends of the locomotive, and occupy a floor space of 9 ft. x 6 ft. each. These cabs house the air tank, sand boxes, rheostats and contactors. Hinged perforated doors in the sides of the auxiliary cabs, clearly shown in the illustration, give access to the rheostats and the connections back of the contactors, while folding doors between the auxiliary and main cabs allow access for inspection of the contactors. The edges of the auxiliary cabs are bolted to the platform and main cab, so that they can be readily removed when it is necessary to make heavy repairs.

The difference in width of the auxiliary and main cabs allows room for a narrow platform or running board, extending from the main cab along the sides of the auxiliary cabs to the ends of the locomotive. This running board is protected by hand rails running around the outside of the locomotive from one side of the main cab to the other. The doors of the main cab open to this platform, and the steps reaching the ground are located near the doors. One marked advantage of this construction is the unobstructed view given the engineer, both ahead and to the rear.

A type C-79 controller and the operating handles for the air brakes are located in the cab within easy reach of the engineer's seat. Sander valves are located beside the engineer, and over his head are switches for the headlight and control circuits. Directly in front are illuminated air gages, ammeter and a foot-operated trolley valve for raising and lowering the overhead trolley. Sanders are arranged to sand the rails in front of the leading wheels on either truck.

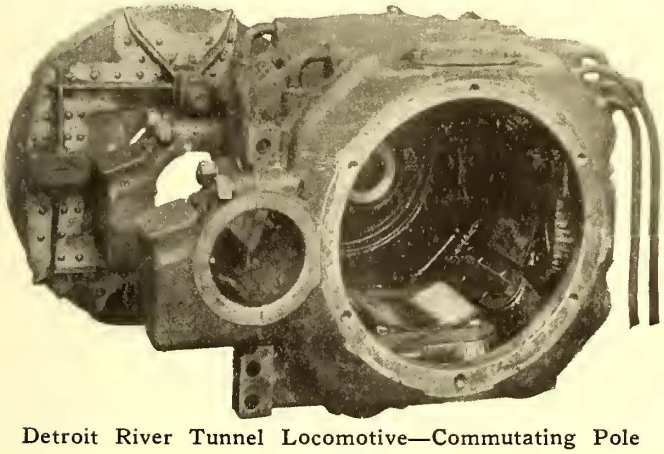
A CP-26 air compressor is located in the center of the main cab. This is a two-stage, four-cylinder compressor, geared to a 600-volt, direct-current series motor. The compressor has two low-pressure and two high-pressure cylinders so arranged as to divide the work of compression into four equally distributed stages per revolution. It has a capacity of 100 cu. ft. piston displacement per minute when pumping against a tank pressure of 135 lb. Ample circulating pipes are provided for cooling the air between stages and between pump and tanks, in order that a moderate temperature may be maintained. The compressor is controlled by a governor, consisting of a pneumatically operated piston controlling the contact of the motor circuit switch, and so arranged as to close or open this circuit at any predetermined limits of pressure.

The motor equipment consists of four GE-209 motors. This is a standard General Electric box frame, commutating pole type of motor, and has a rating of approximately 300 hp. At its one-hour rating the motor will develop a torque of 4050 lb. at 1-ft. radius. The gearing between

motor and axle has a 4.37 reduetion, and the driving wheels are 48 in. in diameter. With this reduction, each motor will develop a tractive effort of 9000 lb. at the rail head, which gives a total tractive effort for the four motors of 36,000 lb. at 12 m.p.h. The motors have an overload capacity sufficient to slip the driving wheels, and the locomotive can develop at the slipping point of the wheels an instantaneous traetive effort of 50,000 lb. to 60,000 lb. The maximum speed of the locomotive, running light upon a level track, is about 35 m.p.h.

There are two gears and pinions per motor, one at either end of the armature shaft. This eonstruetion was used on account of the unusually heavy torque and the excessive overloads that the motors will be ealled upon to carry. In large sizes of motor equipments, with a gear and pinion at only one end of the shaft, it has often been elaimed that a large proportion of the wear and breakage of pinions is due to the tilting of the motors under heavy loads, whieh eoneentrates the pressure at one end of the tooth. The form of construction adopted in the Detroit locomotive will eliminate any such danger.

The motors are designed for foreed ventilation. Air is delivered into the motor frames at the end farthest from the



Detroit River Tunnel Locomotive—Commutating Pole 300-Hp Motor

commutator, passes between the field eoils and around the armature, and finally eseapes through suitable diseharge openings over the commutator. The blower used for this purpose has a eapacity of 2000 eu. ft. of air per minute at 2¼ in. of water pressure, and is driven by a direct-eurrent series motor. This blower delivers air to the passage between the two eenter sills above described, from whieh the ventilating ducts are tapped off to the motors at appropriate points.

The eontrol system used is the Sprague-General Eleetric multiple unit type, with two master controllers in the main eab and the eontactors in the auxiliary eab. Multiple unit conneetions have been supplied, so that three locomotives may be operated in unison, if neeessary. The problem of starting and accelerating a train of from 1000 tons to 1500 tons weight, whieh may eonsist of 40 or 50 cars, is a rather delieate one. Sueh a train is not a rigid mass, but a long, elastic body, and any inequality in the starting torque results in waves of jerking and buffing strains, which may reach abnormal values in some parts of the train. Consequently, the control for these loeomotives was designed especially to produce a uniform increase of speed and torque during the period of aeeeleration. The eontrol combinations are arranged so that the motors may be operated four in series, two in series and two in parallel, or four in parallel. There are nine resistanee steps in series, eight in series-parallel and seven in the parallel position. In a test run with a train of 1578 tons weight, consisting of one loeomotive and 26 freight ears, the aeeeleration from a standstill to 10 m.p.h. was aeeomplished with marked smoothness. The maximum increase of drawbar pull was about 6500 lb. on the first few steps, after which the maximum throughout the remainder of the acceleration was from 2000 to 3000 lb. To an observer standing in the caboose of such a train the rear end of the train is started so gradually that the beginning of the motion is almost imperceptible. The contrast with the results obtained with a steam locomotive is very striking.

The locomotive is equipped with third-rail shoes to take current from an inverted third-rail. It is also fitted with an overhead trolley, whieh, as stated previously, ean be raised or lowered by a foot-operated valve in front of the motorman.

General data of the locomotive are given in the following table:

Number of motors	4
Gear ratio	4.37
Number of driving wheels	8
Diameter of driving wheels	48 in.
Total wheel base	27 ft. 6 in.
Rigid wheel base	9 ft. 6 in.
Length inside coupler knuckles	39 ft. 6 in.
Length of main cab	15 ft. 6 in.
Height of cab	12 ft. 6 in.
Maximum height, trolley up	15 ft. 6 in.
Maximum height, trolley retracted	14 ft. 10⅛ in.
Maximum width	10 ft. 2⅝ in.
Width of eab	10 ft. 1 15/16 in.
Total weight	199,000 lb.

REDUCING POWER CONSUMPTION OF TRAINS ON THE METROPOLITAN WEST SIDE ELEVATED, CHICAGO

B. I. Budd, general manager, Metropolitan West Side Elevated Railway Company, believing that the useless waste of power eould be largely cut down by stating to the motormen the exaet money loss from eareless operation of trains, recently had tests made and obtained comparative figures, whieh showed that with a two-car train poorly operated there was an exeess of power eonsumption of 26 per eent over the amount required properly to operate such a train. The results of this test were incorporated in a form letter addressed to each motorman on the road, whieh ealled to their attention the existing conditions and the improvements that might be expected, and asking their co-operation. The text of one of these letters follows:

THE METROPOLITAN WEST SIDE ELEVATED RAILWAY COMPANY

CHICAGO, June 1, 1909.

MR. R. R. JONES, Motorman,

Logan Square Division.

DEAR SIR:—Your personal interest and aetive eo-operation are desired in bringing about a reduetion in the amount of power eonsumed in train operation.

We have made certain tests and collected information on the subjeet of power consumption in order that you may have an intelligent understanding of the problem. We are all equally interested in bringing about a high standard of operation, and therefore, with the following facts before you, I feel sure that you will endeavor in every way to be economical and eareful in operating your train.

The following tests were eondueted with the same train, carrying passengers and making all stops eaeh day and during the same hours. Train consisted of one motor car, No. 848, equipped with two Westinghouse No. 114 motors, 160 hp each, eleetro-pneumatic automatic acceleration eon-

trol, and one coach, No. 514. Weight of motor car, light, 33 tons; weight of coach, light, 16 tons.

TEST "A"—ECONOMICAL AND EFFICIENT OPERATION

May 11, 1909, weather clear, average temperature 50 deg., no heat and no light, all current used being recorded by wattmeter connected to main leads and placed under seats in the middle of motor car. Motorman used care in observation of coasting signals, making good stops with no needless waste of air in order to reduce pump motor consumption, drifting as much as possible through curves, and generally using good judgment in the operation of train. Seven round trips were made, and the total average kilowatt hours per trip consumed was 74.5; 14.7 being consumed on the Loop and 59.8 on the Metropolitan structure. On the Loop the average kilowatt-hours per car-mile was 3.67. On the Metropolitan, 2.30. Average, including both the Metropolitan and Loop, was 2.48. The higher consumption per car-mile on the Loop was due to frequent stopping and starting.

TEST "B"—CARELESS AND WASTEFUL USE OF POWER

May 11, 1909, weather clear, average temperature 50 deg., no heat and no light. Motorman used as much power as possible, paying no attention to coasting signals, running in full multitple close to station and then making heavy applications in order to make stops; running in full multiple close to the entrance of curves, making heavy application, slowing train nearly to a stop, and then requiring additional power to pull through curve. Wasteful in the use of air at all station and other stops, and generally using poor judgment in the operation of train. Seven round trips were made, and the total average kilowatt-hours per trip consumed was 92.5, 17.2 being consumed on the Loop and 75.3 on the Metropolitan structure. On the Loop the average kilowatt-hours per car-mile was 4.29 and on the Metropolitan 2.90. Average, including Metropolitan and Loop, 3.09.

The average time gained per trip of test "B" over test "A" amounted to 2 per cent.

The excess power consumed per trip of test "B" over test "A" amounted to 26 per cent.

Taking the results of these two tests, the first one being termed proper operation and the second improper operation, we have used the consumption per car-mile in each case as a unit to base a calculation of what our current consumption and cost would be, applied to our total mileage for one month.

The excess kilowatts used by improper operation amounts to 736,000; figuring this quantity at the average cost of production per kilowatt, amounts to $5,000 per month.

These figures are interesting, as they show clearly what a vast amount of power could be wasted by careless and inefficient operation, with no material gain made in time or other advantage to any one concerned.

The efficiency of a locomotive engineer is based on his cost of operation, which means cost of fuel, oil, waste, etc., per ton mile in case of freight, or per car-mile in case of passenger service, and his record as an engineer is largely formed from these figures, together with the showing of good judgment, freedom from accidents, making his time, etc., and this will soon be true of a motorman operating an electric train, although at the present time the matter of power consumption has not been given as much attention as the subject deserves.

In view of the above facts, and effective this date, the operating efficiency of each motorman, as regards power consumption, will be hereafter entered on and made a part of his record of service, and a copy of each entry will be sent to him. These entries will be made from personal observation of each man's work by the trainmaster and inspectors, and approved by the superintendent. Hereafter this phase of a man's work will be given attention when his record is under inspection.

Thanking you in advance for your personal interest in this matter, I am

Yours very truly,

B. I. Budd,
General Manager.

A general strike of street railway employees in St. Petersburg, Russia, is in progress.

TRACTION REHABILITATION IN CHICAGO*

BY GEORGE WESTON, MEMBER BOARD OF SUPERVISING ENGINEERS

The traction ordinances of Feb. 11, 1907, authorized the Chicago City Railway Company and the Chicago Railways Company to construct, maintain and operate systems of street railways in the streets of Chicago and also created the board of supervising engineers to administer these ordinances. Owing to the magnitude of the work to be undertaken the working force of the board of supervising engineers was organized into divisions, each division being in charge of a division engineer as follows:

Division D—Track and roadway.
Division E—Electric power distribution.
Division G—Buildings and fixtures.
Division I—Power plant equipment.
Division K—Cars and car routing.
Division P—Tunnels and subways.
Division of Drafting—in charge of a chief draftsman.
Division of Accounts—in charge of a certified public accountant.

The working force of the chief engineer's organization comprises 137 persons, consisting of engineers, accountants and general office employees.

On March 30, 1908, the City Council passed a similar ordinance in favor of the Calumet & South Chicago Railway Company, providing for the rehabilitation of about 40 miles of single track. This company is a consolidation of the Calumet Electric Street Railway Company and of the South Chicago City Railway Company and has 98.44 miles of single track. A similar ordinance was passed March 15, 1909, in favor of the Southern Street Railway Company (formerly the Chicago General Street Railway Company) covering about 7 miles of track, but providing that the Chicago City Railway Company was to conduct the work of rehabilitation and operate the road as a part of its own system. The Southern Street Railway Company owns about 18 miles of single track.

TRACK AND ROADWAY

The division of track and roadway was organized in May, 1907, and track construction work was commenced June 17, 1907, by the Chicago City Railway Company. Three types of track, differing principally as regards the foundation, have been designed and approved by the board. They are:

Type 1—Steel ties in concrete.
Type 2—Wooden ties in concrete.
Type 3—Wooden ties on a rolled stone foundation with concrete between the ties and on top of the ties to provide a foundation for paving.

The rails, tie fastenings, paving, etc., of these different types are practically the same except that screw spikes are used with wooden ties, while with steel ties a special clip is employed to fasten the rail to the tie. With both the rails can be removed and replaced without disturbing the track foundation or damaging the ties.

The tracks so far constructed are principally Types 2 or 3. The greatest mileage has been of Type 2 construction or a modification styled 2-A, which differs from Type 2 only in respect to the spacing of the ties.

The Chicago City Railway has completed to date about 84.7 miles or 90 per cent of the ordinance requirements for track reconstruction; the Chicago Railways Company about 93 miles or 68 per cent. The Calumet & South Chicago Railway Company has rebuilt to date but 2.5 miles of the 40 miles required by the ordinance, but its schedule for the year of 1909 comprises 12.5 miles of single-track rehabilitation work and about 4 miles of new extensions. The 7 miles of track rehabilitation for the Southern Street Railway Company is scheduled for this year.

SPECIAL TRACK WORK

Specifications covering the manufacture of special work have been prepared and all special work for the companies under the jurisdiction of the board of supervising engineers is manufactured under these specifications. To date

* Abstract of paper presented at joint meeting of the Electrical Section, Western Society of Engineers, and Chicago Section, American Institute of Electrical Engineers, May 28, 1909.

132 special work layouts and crossovers have been installed by the Chicago City Railway Company and the Chicago Railways Company. In a large percentage the curved frogs, crossings, switches and mates are solid manganese castings. All curves have been designed for safe operating clearances between cars of all types passing in any direction.

During the past year specifications have also been prepared covering the manufacture of open-hearth steel rails. All rails contracted for during the current year will be manufactured under this specification.

POWER DISTRIBUTION

The division of electric power distribution was organized during May and June, 1907, and has charge of the underground and overhead transmission lines, trolley wire and its connections, bonds, auxiliary cables and telephone system and includes the testing of track joints for conductivity. Plans and specifications have been prepared by this division for typical underground conduit construction of three general types as follows: Type A, square bore multiple duct; Type B, round bore single duct installed in cable slot; Type C square bore single duct.

The manholes for the most part are being constructed of brick because this type of construction is considered more flexible than concrete construction so far as working around other conduit lines, water pipes, gas pipes and other street obstructions is concerned. Most of the manholes are of the barrel shape because this form is economical and leaves a good wall face for the training of cables. In the early part of the work some multiple-duct conduit was constructed, but it was later decided to make the single-duct square-bore construction standard for all power distribution work. Specifications have been prepared for the various cables required.

In calculating the feeders for the d.c. distribution system the various lines have been divided into trolley sections and the maximum two-hour schedule of cars upon each trolley section has been taken. With this as a basis and making a liberal allowance for average current consumption at the car, based upon actual observation, the circular mils of cable for each line have been determined. The maximum drop allowed for heavy traffic sections is 50 volts, but this is increased somewhat on remote sections. In figuring the negative return system a drop of 25 volts at extreme points from the source of supply has been taken as a basis. In calculating the negative return it is assumed that all current returns to the station from which it originates.

At all special work each straight track rail is supplemented by a copper cable throughout the entire length of the special work and the ends are welded to the rails on each side of the special work.

BUILDINGS

The division of buildings and fixtures was organized in May, 1907, and took up the inspection of the construction of three new substation buildings and four new fireproof car houses of the Chicago City Railway Company. Plans for all of these buildings had previously been approved by the chief engineer of the board and they have a capacity for 1076 large double-truck cars.

In September, 1907, this division began to keep in touch with the building work of the Chicago Railways Company, and after the acceptance of its ordinance by the Chicago Railways Company Jan. 28, 1908, this division, in conjunction with the engineers of the Chicago Railways Company, prepared plans and specifications for new fireproof car houses of the double-end type and for fireproof substation buildings. Five new car houses are in course of construction by the Chicago Railways Company at this time. Together they are capable of housing 834 double-truck cars.

POWER PLANT EQUIPMENT

The initial work of this division was to inventory and value the betterments to the power plants and substations of the Chicago City Railway Company since the date of the original valuation, June 30, 1906. In July daily inspection of the work in progress at every substation was commenced and daily reports made of the labor and materials used.

At the time of the organization of the board of supervising engineers the Chicago City Railway Company had in operation three steam plants, one of which ran only during the winter months. It also obtained a large amount of electrical energy from the Commonwealth station of the Chicago Edison Company through two rotary converter substations. Since the organization of the board additional substations have been built and a contract has been entered into with the Edison Company whereby all of the current required for the operation of the railway is purchased. The five substations of the company will have a capacity of 50,400 kw, exclusive of the storage battery at Plymouth Court substation. All substation buildings of this company are designed of substantial fireproof construction with pressed-brick walls both inside and out, book-tile roofs carried on structural steel trusses, composition roof covering, concrete floors with a red tile wearing surface and are architecturally first class. The Plymouth Court substation of the Chicago City Railway is in one of the Edison Company's buildings in which the railway has been given space and contains two 1200-kw rotary converter equipments and a storage battery with a rated capacity of 2240 kw for one hour.

At the time of the organization of the board the Chicago Railways Company had two steam power plants in operation; one at Hobbie Street, on the North Side, and one at Western Avenue and Washington Street, on the West Side, both generating direct current. In addition some current was purchased from the Consolidation Traction Company and the old cable plant at Van Buren Street and Washington Street was converted into a substation. Since the organization of the board this substation has been enlarged and three new substations are in the course of construction located at Sheffield and Lill Avenues, on the North Side, Leavitt Street and Blue Island Avenue, on the Southwest Side, and at Grand and Fortieth Avenues, on the Northwest Side. Each substation has a capacity of 6000 kw. The equipment at the Van Buren outstation is being increased. The total substation capacity of the company, when the work is completed, will be 44,000 kw.

The new substations that are being constructed by the Chicago Railways Company are designed of fireproof construction, with pressed-brick walls, both inside and out, book-tile roofs, carried on structural trusses, composition roof covering and concrete floors with composition wearing surface.

CARS

The cars adopted as standard by both companies are of the pay-as-you-enter type seating 40 passengers. That of the Chicago City Railway Company is 48 ft. 3 in. in length and 9 ft. wide over all. The platforms are 7 ft. 11 in. long over all and 6 ft. 8 in. long inside. The Chicago Railways Company is building 650 pay-as-you-enter cars 49 ft. 2 in. in length and 8 ft. 9 in. wide over all with vestibules 8 ft. 4½ in. long over all. Special attention has been given to lighting and heating. The lamps for interior illumination are placed one over each seat and have frosted globes. The heaters are electric and there are special heaters on the platform for the comfort of the motorman and conductor. The cars are equipped with sliding or folding steps and both air and hand brakes. The motor equipment consists of four 40-hp motors per car. Of the 650 cars under construction by the Chicago Railways Company 600 are of wood and 50 are steel cars and are being built by the Pressed Steel Car Company. General interior arrangement and appearance are identical with the new wooden cars.

TUNNELS AND SUBWAYS

The division of tunnels and subways was organized in February, 1908, after the acceptance of its ordinance by the Chicago Railways Company. The ordinances to that company provide that it shall rebuild the tunnels under the Chicago River at La Salle Street and at Washington Street. Plans and specifications have been prepared for a double-bore reinforced concrete tunnel at La Salle Street so designed that it can be connected with and become part of any subway system that may be built in the future and that provision be made for temporary approaches from the surface so that the surface cars operating between the North and South divisions of the city can have the benefit of this tunnel to relieve the present congestion on the

bridges. It is expected that contracts will be let in the near future covering the construction of this tunnel.

Plans and specifications are also under way for the complete reconstruction of the Washington Street tunnel, which will be designed for connection to any system of subways that may be built in the future and also with temporary approaches to the surface.

Plans have been completed for a section of this tunnel on the west side of the river between Clinton and Canal Streets and a contract has been awarded for this part of the work to be carried on in conjunction with the construction of the terminal station of the Chicago & Northwestern Railroad, which crosses Washington Boulevard at that point.

DRAFTING

The drafting department was organized under a chief draftsman who has general supervision of the work performed in the department and of the various systems and records required. Reporting directly to the chief draftsman are a clerk and four squad foremen, each of whom is held directly responsible to him for the correct and proper execution of the work performed under his supervision.

All drawings are made on standard size sheets and all sizes are multiples of the regular letter size sheet, 9½ in. x 11 in. as follows: No. 1, 8½ in. x 11 in.; No. 2, 22 in. x 34 in.; No. 3, 34 in. x 44 in. Drawings that are larger than size No. 3 are called "rolls" and are designated in size as "R." drawings. For convenience each division has a classification letter which corresponds with the letter used in the classification of accounts by the American Street & Interurban Railway Accountants' Association.

Drawings are indexed to denote the size of sheet and division as follows: Track and Roadway—Division D drawings—1-D, 2-D, 3-D, R-D. Electrical Transmission—Division E drawings—1-E, 2-E, 3-E, R-E. The drawing number for each drawing follows.

The filing system consists of six groups or divisions as follows: Domestic tracings, domestic blueprints, folios, foreign prints, catalogs and miscellaneous.

ACCOUNTING

The division of accounts was organized in May, 1907, and has charge of checking all expenditures that relate to the cost of rehabilitation and of determining, with the assistance of reports from the engineering divisions, whether such expenditures are reasonable and are proper charges to capital account. The division also ascertains whether proper reserves have been created and are maintained by the companies as set forth in the ordinances and keeps account of all expenditures made by the board in the carrying out of its duties. These expenditures, in accordance with the terms of the ordinances, are to be added to capital accounts of the railway companies during the period of rehabilitation and after that period are to be charged to operating expenses.

The ordinances provide that out of the gross receipts of the company shall be paid:

First—The operating expenses, including taxes.

Second—The ordinary repairs to the physical property for which a sinking fund is provided, the minimum amount of which shall be 6 per cent of the gross receipts per annum.

Third—The renewals or depreciation of the physical property for which a sinking fund is provided, the minimum of which shall be not less than 8 per cent of the gross receipts per annum.

Fourth—Out of the gross net earnings remaining after deducting the above charges, the company may retain 5 per cent upon the capital account as approved by the board of supervising engineers.

Fifth—The remaining net earnings are divided, 55 per cent to the city and 45 per cent to the respective company.

During the rehabilitation period of three years from the date of the acceptance of this ordinance a special manner of accounting is provided covered by the following quotation from the ordinances:

"The said Board of Supervising Engineers shall have power to determine what work shall be treated as construction, reconstruction, equipment, re-equipment, extensions, new lines, underground trolleys or additions to plant or property to be paid for by the company out of the capital funds to be provided by it for that purpose and what shall be treated as maintenance, repairs and renewals, to be paid for out of the gross receipts of the company from the operation of the street railway system hereby authorized. But any such determination of said board shall be governed by the following provisions:

"During the three-year period of 'Immediate Rehabilitation' 70 per cent of the gross receipts shall be set apart and shall be used so far as required in defraying the operating expenses, including maintenance and repairs, and the residue of said 70 per cent shall be applied to the cost of renewals and no part of the cost of any renewal paid for out of such 70 per cent shall be charged to additional capital and all expenditures for renewals during said three years in excess of such residue of said 70 per cent shall be charged to capital account.

"After such three-year period of 'Immediate Rehabilitation' the cost of renewals shall be paid as provided in Section 16 hereof, but such expenditures (and only such expenditures) as are made for the purpose of extensions of or additions to property shall be thereafter considered as additions to capital, provided, however, that in the replacement of any principal part of the property, either existing or hereafter acquired, there shall be charged to capital the excess amount that the new property cost over the original cost of the property displaced, excepting that the value of property contained in the appraisal inventory of the property of the company, referred to in Paragraph 1 of Section 20 hereof, shall be used instead of first cost for all property listed in such appraisal inventory."

Each division engineer has, as a part of his organization, inspectors, who, in addition to their other duties, render to him on forms daily, semi-monthly and monthly reports of the quantities and amounts of material used and hours of labor expended on each piece of work in progress. These reports are used by the division engineers as a basis for their monthly estimates and also as a check upon the expenditures made by the railway companies and reported by them to the division of accounts. Thus counter checks from two entirely independent sources are secured—from reports of the railway companies checked and summarized by the division of accounts and from the field reports of the division engineers.

DESTRUCTION OF POLES BY INSECTS

Insects play a most important part in timber destruction. The injury done is generally underestimated as their depredations go on gradually, but forcibly, attracting little observation. When they bore into the timber they open up air chambers and channels which make it easy for rainwater to seep in and thus keep the wood in a moist condition. Fungus spores floating through the air are enabled to germinate with greater rapidity and with increased effectiveness and the decomposition of the pole consequently is materially hastened.

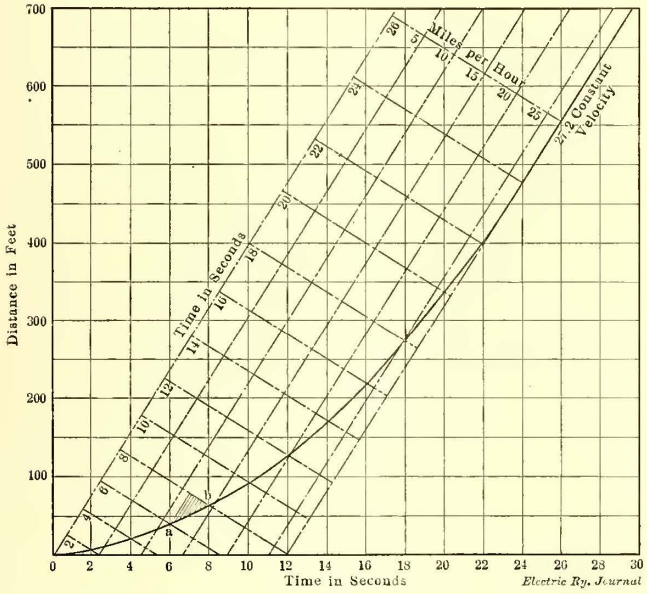
Several years ago the Forest Service co-operated with one of the large telephone companies in Georgia and Florida to experiment with various preservatives in protecting the butts of telephone poles from decay. These preservatives were simply painted upon the wood and, of course, did not sink in to any great depth. A recent examination made of this pole line showed that wherever the preservative had entered the wood no destruction due to insect attack had taken place, but where the wood was unprotected such injury was frequently quite serious. Poles in which the preservatives had seeped through a crack were often more or less fluted on the surface—that is, the oil saturating the wood in the immediate vicinity of the crack protected it from the attacks of the insects. It is essential, therefore, particularly in the warmer portions of the United States, to protect timber from the attacks of insects as well as of fungi, if the longest life is to be secured.

NEW METHOD OF PLOTTING SPEED CURVES

BY THOMAS FARMER, JR.

It is very desirable in laying out the time schedule on which the cars are to run and in ascertaining whether the proper gear ratios are being used to know the rates of acceleration of various types of cars. A very simple device can be made use of and has been employed for this purpose. It consists merely of a second clock, which records a dot on a traveling paper for every second of time elapsed, while another pencil records a dot for every revolution of the wheels. From this record the distance traversed up to any instant can be very readily read.

It has been generally the custom to plot first from the records thus obtained the distance curve, which has as co-ordinates the distance in feet and the time in seconds. This curve in form resembles somewhat a parabola. To obtain the velocity curve, this curve has to be integrated. The acceleration curve is obtained by integrating the



Distance-Time Curve, with Second Set of Co-ordinates for Reading Velocity

velocity curve. This entails considerable work and introduces an element of error on account of the two integrations, one of which depends on the other for its accuracy. The object of this article is to set forth a simple method of utilizing the distance-time curve for obtaining the velocity and acceleration readings direct.

The laws of uniform velocity are summarized in "Kent's Mechanical Engineers' Pocket-Book," page 423, in the following discussion, which has been somewhat abbreviated:

"If s = space in feet passed over in t seconds, v_1 = the velocity at the beginning of t, v_2 = the velocity at the end of the time t, and v_0 = the mean velocity, then $v_0 = \frac{v_1 + v_2}{2}$ and $s = \frac{v_1 + v_2}{2}\ t$.

"If a = the acceleration, and the acceleration is a constant quantity, then

$t = \frac{v_2 - v_1}{a}$, or if the body start from rest, $v_1 = 0$; then $t = \frac{v_2}{a}$ and $s = \frac{v_2}{a}\ t$."

It will be seen from the above that the final expression for $s = \frac{v_2}{2}\ t$ is that of a triangle. In other words, if we plot a velocity-time curve, the space or distance traversed by the car up to any point on the curve will be equal to the area under the velocity-time curve for the corresponding point.

The diagram herewith shows an actual distance-time curve of an elevated railway car, in which after a given time has elapsed—in this instance 24 seconds after the start—the curve becomes a straight line. This means that the rate of acceleration has been reduced to zero and that a uniform velocity has been reached. From the dot and dash curve which has been made by the instrument we can now determine the velocity at this point, which in this instance is 27 m.p.h. If we now draw an ordinate parallel to the straight portion of the distance-time curve, we can construct a new scale of co-ordinates, by reference to which the distance-time curve can be read as a velocity-time curve. The time scale on the new ordinates will be a variable one, and is obtained by projecting points from the distance curve, as shown in the diagram. The velocity ordinate can be scaled into equal divisions of miles per hour, starting from the point of constant velocity. We can now read velocities direct from the distance-time curve.

The tangent to the velocity curve will give the acceleration rate at any point on that curve, or, using the equation, $a = \frac{v_2 - v_1}{t}$, we can approximate the value of acceleration, as follows:

At the point b on the curve the velocity is 14 m.p.h., and at a it is 11.2 m.p.h., the difference being 2.8 m.p.h. The time elapsed during this change in velocity is two seconds; therefore, substituting these values in the above equation, we obtain $a = \frac{2.8}{2} = 1.4$ m.p.h.p.s. This value corresponds with the area of the shaded triangle at a and b.

It will thus be seen that the distance-time curve has been made to serve the purpose required of it in a very simple manner.

ELECTRIFICATION COMMITTEE OF THE NEW YORK RAILROAD CLUB

The New York Railroad Club has appointed a special committee to study the subject of steam railroad electrification, which will render a report of its work for consideration at the annual electrical meeting of the club next March. Following are the members appointed: W. J. Harahan, assistant to the president of the Erie, New York, chairman; L. F. Fritch, consulting engineer of the Illinois Central, Chicago; H. H. Vaughan, assistant to the vice-president of the Canadian Pacific, Montreal; J. H. Davis, electrical engineer, Baltimore & Ohio, Baltimore; George Wildin, mechanical superintendent of the New Haven, New Haven; Messrs. William McClellan, C. O. Mailloux and H. M. Warren, electrical engineers, New York.

The committee is to collate and tabulate such general data as may be of interest to railroad men, and make such suggestions as may appear pertinent to them with reference to the direction in which it would be desirable to have further investigation and information. The Maintenance of Way Association and the American Railway Association are considering the subject of electrification along substantially the same lines.

RECENT IMPROVEMENTS IN UNDERGROUND CONDUIT CONSTRUCTION

BY S. B. WAY

During the year 1906 the electric light and power interests of St. Louis, Mo., found it desirable to install considerable conduit incidental to an extension of the system of distributing electricity for general use and for extending high-tension feeders to reach distant street railway substations. A fairly large stock of multiple-duct tile conduit was on hand, but not in sufficient quantity for the requirements of the work contemplated. An investigation of the conduit market developed a condition not at all encouraging to those responsible for the completion of the work in hand within the required time, in that all of the conduit manufacturers were then already sold out of the kind of duct desired. This made it necessary for the engineers in charge of the work to choose between completing the work with such conduit as could be purchased and delivered within the time limit or to devise some means of building a conduit without the usual tile or other pipe. The engineers chose to make an attempt to get along without the pipe, and incidentally save money in the cost of construction. This resulted in building a conduit entirely of concrete. Upward of 170,000 duct-ft. of all-concrete or monolithic conduit has been laid in St. Louis within the last three years, fulfilling every requirement for all uses, including heavy isolated runs for high-tension cable.

It has been found that all-concrete or monolithic conduit possesses many advantages over a conduit built up of pipes

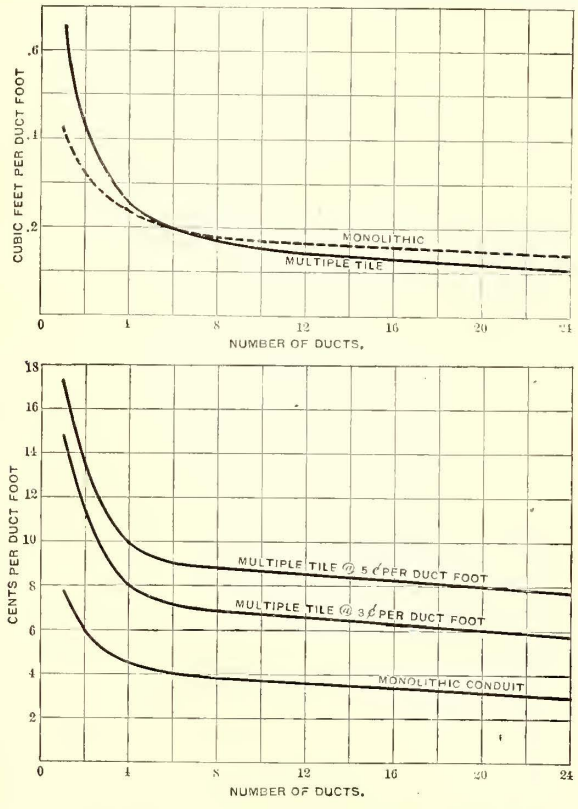


Fig. 1—Comparison of Multiple Tile and Monolithic Duct

of whatever nature, in that with such construction the structure becomes homogeneous; occupies less space for a given number of ducts of equal size; permits perfect inspection of each duct from end to end incidental to the laying of each tier; provides smooth, straight, clear, jointless and fireproof duct openings from manhole to manhole; eliminates handling, fitting, breakage and cost of pipe; requires no factory, and but few and simple special tools, and for average duct sections uses no more material (concrete) than is required for the armor or envelope of pipe construction. The amount of concrete per duct-foot required for various duct sections for multiple-duct tile and for monolithic conduit and the cost per duct-foot of completed work, exclusive of trenching, refilling and repaving, are shown by curves in Fig. 1. These curves were plotted from results obtained in actually laying a considerable quantity of each type of conduit under the same supervision and by the same men. The multiple-duct tile was laid with a 3-in. armor of concrete and with the interstices between the tiles filled with fine concrete, while the monolithic conduit was provided with 2½ in. of concrete between the ducts and the bottom and sides of the trench, with a cover or top 3 in. thick. The items of trenching, refilling and repaving are nearly constant for each type of conduit, except a small differential of about ½ cent per duct-foot in favor of monolithic conduit, due to the smaller trench and consequent reduced excavation and hauling of displaced earth required by the monolithic construction. Typical cross-sections of multiple-duct tile and monolithic conduit are shown in Fig. 2.

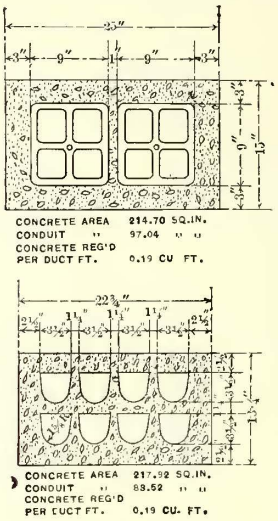


Fig. 2—Cross Sections of Multiple Tile and Monolithic Duct

The construction of monolithic conduit involves only the comparatively simple methods of good concrete work. After a trench of suitable width and depth has been excavated, duct-form supports are set to grade and perfect alignment on 16-ft. centers in the bottom of the trench. These duct-form supports serve to hold the forms or molds for producing the duct openings rigidly in place and in true alignment while the concrete is worked into place in the bottom of the trench. The duct forms or molds consist of 16-ft. sections of clear, straight-grained lumber previously dressed to the shape of a "U," and are held down in the duct-form supports against the buoyancy of the plastic concrete by suitable cast-iron, or other, weights. When the duct forms are set concrete of the proper mixture for good concrete work is dumped into the trench and suitably rammed and puddled around the forms, and finally struck off level with the tops of the molds. The concrete is then allowed to take its initial set, which in favorable weather requires about three hours, when the duct forms may be removed by simply lifting them upward and out of the concrete, leaving smooth, straight, continuous U-shaped grooves in the bed of concrete just laid, which, when covered, constitute the duct openings. Fig. 3 shows the trench with forms set ready for the concrete to be dumped in.

After the duct forms are removed from the concrete the smooth, continuous grooves molded in the concrete by the forms are open to the daylight for the full length of the construction, and every possible facility is afforded for perfect and rapid inspection. Any faults in the work may be instantly detected, and this in itself is a potent factor in securing first-class work.

The open top ducts are closed in by laying across the top of the structure thin, smooth plates, or slabs, of concrete

molded on the site of the work. These slabs or plates of concrete are made of just sufficient width to lap over each outside duct a short distance, and are laid as illustrated in Fig. 4, with a small quantity of mortar to seal the joints. The thin concrete slabs, or plates, serve the double purpose of closing in the top of the newly formed ducts and as a foundation or support for the next layer of concrete, in which an additional tier of ducts may be formed in the same manner as the preceding tier, this operation being repeated as often as necessary to produce the required number of duct openings. The top of the conduit is closed in in the same manner, with the exception that the top layer of concrete contains no duct forms and acts simply as an armor or envelope to protect the conduit construction from future excavators. Monolithic conduit has been laid under a great variety of street conditions and during all seasons of the year with perfect success and with a material saving in cost over the various forms of pipe duct.

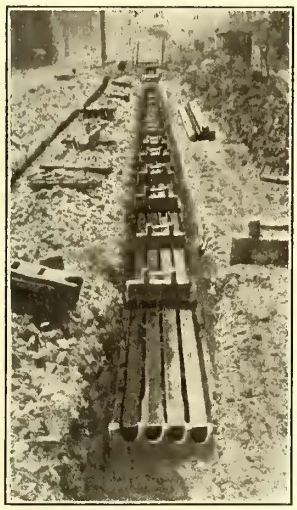


Fig. 3—Forms in Place

Fig. 4—Completed Conduit

IMPROVEMENTS AT SAPULPA, OKLA.

The Sapulpa & Interurban Railway is now operating a line 3 miles long with four cars, and work is under way toward extending this line to Kiefer and Glen Pool. It is expected that additional extensions to be completed during the present season will increase the trackage of the company to 18 miles. This road is of particular interest because it uses gas engines to generate power for operating the cars. The four cars now operated are single-truck equipments for city service, but the St. Louis Car Company is constructing for this road four 46-ft. interurban equipments, one of which will be an electric locomotive equipped with 50-hp motors. The passenger cars will be equipped with four 35-hp motors each. The electrical equipment of the cars is designed for 1200-600-volt operation, with two pairs of motors connected in series on the 1200-volt interurban section of the line and the usual series-parallel connections on the 600-volt city line.

The power plant equipment now comprises two 150-hp Bessemer gas engines, which drive both railway and lighting generators. Contracts have been made for additional gas-engine-driven units to include two 300-hp Bessemer engines driving the lighting generators and two 200-kw Bessemer gas engines belted to General Electric 600-volt railway generators. These two generators will operate in series to furnish 1200-volt current for the interurban road.

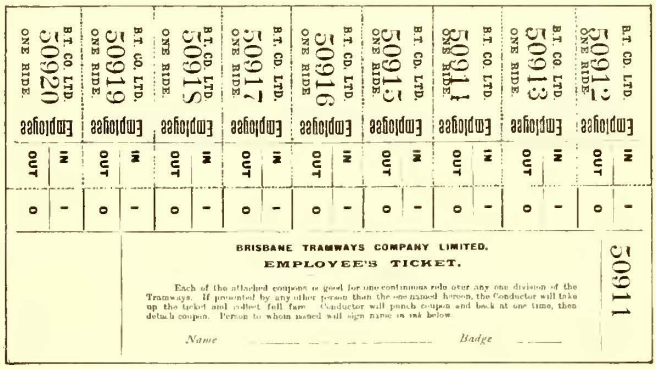
COMMUNICATIONS

STRIP TICKETS WITH COUPONS AT BRISBANE

BRISBANE TRAMWAYS,
BRISBANE, AUSTRALIA, April 15.

To the Editors:

I notice an account in your issue of Nov. 14, 1908, page 1392, of a strip ticket in which six tickets are attached to an identification strip and that "the tickets are not good for passage unless presented with the strip with which they were originally printed." A number of advantages are claimed for this ticket. The idea is not a new one, as the Brisbane Tramways Company has had a ticket of this kind in use for employees for some time. I enclose a sample



Employee's Strip Ticket Used in Brisbane

ticket. As will be seen, the strip contains nine coupons, each of which is good for a ride by an employee when presented with the strip, when his name is signed to the strip and when it contains his badge number. The in-and-out feature of the ticket is a simple way of recording the direction in which the ticket is used. As will be noticed from the instructions, the conductor punches the coupon and back at one time in either the in or out space and then detaches the coupon.

J. S. BADGER, General Manager.

RETURN ON THE INVESTMENT IN PUBLIC UTILITIES

SOUTHERN WISCONSIN RAILWAY COMPANY,
MADISON, WIS., May 29, 1909.

To the Editors:

In a primary enterprise involving the construction of a street railway one-half of the actual amount of cash invested might be represented by 5 per cent first-mortgage bonds, and I think these bonds would sell at 90; the other portion, being an equity, would have to be represented by bonds or stocks yielding at least 15 per cent. The risks involved in the operation of a street or interurban railway are too numerous to warrant capitalists in assuming the junior security end of the enterprise unless they can earn fully as much or more than can be earned in trade.

We can obtain 6 per cent, 8 per cent and even 10 per cent on our capital without assuming any risk. In the West, and especially in this section of the West and beyond here, bankers and men who have money to invest find it possible to realize 8 per cent and 10 per cent without any trouble whatever. If this be true, as it undoubtedly is, why should men of means enter into an extra hazardous undertaking when the returns are likely to be no greater?

No man of means would think of investing his funds in any public service, assuming all the risks, unless he was assured of such returns as would be equal to or greater

than he can obtain in, say, a profitable manufacturing industry. The time has come when capital declines absolutely to enter into the development of public-service enterprises until it is assured that the Federal and State governments are going to deal with these matters in a liberal way. The manifest disposition of the law-making powers in many States to impose additional burdens in the way of taxes and to curtail returns by reducing rates has resulted in a positive determination to await more reasonable and equitable enactments. It is a good saying that "you can lead a horse to water, but you cannot compel him to drink." You can enact all sorts of laws regulating public-service corporations, but you cannot compel capital to invest in such enterprises.

There is much to be said upon both sides of the question, but the final outcome will be determined by the investor and not by the public.

F. W. Montgomery, President.

A HYGROSCOPIC GROUNDING DEVICE

The Lord Electric Company, New York, is meeting with considerable success in the sale of a rather unusual type of grounding device known as the "Hydro-Ground." This is made up of ovoids or egg-shaped units mounted on a central conductor rod. The units are formed of an absorbent composition which attracts and retains moisture indefinitely. Besides its hygroscopic and capillary properties, this composition is non-metallic and is unaffected by acids or alkalies. The fact that it is non-electrolytic insures a permanent earth contact and the retention of maximum capacity. The whole device is so simply constructed that it can be installed with an ordinary post-hole auger, the one matter of prime importance being to set the grounder deep enough in the soil.

Hygroscopic Ground

The manufacturer states that when placing the "Hydro-Ground" in the earth it should be accompanied by at least one pail of very strong brine. Ordinary water should be highly charged with salt and thrown in on the grounding device. Then as the earth is filled in more salt and water should be added to increase the contact and conductivity of the surrounding earth. This inexpensive practice is said to give the best results. If water is not readily obtained, salt alone can be used about the grounder and the adjacent soil. In this case, of course, the salt only improves the contact, whereas it would be detrimental to metallic contact points or plates.

The device as sent out for installation is supplied with a metal stem 12 in. long. This stem is threaded and has a coupling into which can be secured a ¾ in. galvanized iron pipe, or it can be supplied with a terminal to which a copper wire can be soldered. If copper wire is used it should be thoroughly taped and coated with insulating paint or asphaltum. If pipe is used, a piece of 1 in. cotton hose should be put around it and this hose thoroughly saturated with insulating paint or asphaltum. The insulation of such connections will overcome electrolytic actions. If a wire or pipe is employed to connect the ground point to the rail in the case of street railway line lightning arresters, all wires coming in contact with or under the earth should have some insulating covering and be thoroughly painted with insulation as previously noted. It is believed that if this practice is followed out far better results will be secured and the ground will be found to be permanent and satisfactory.

TRANSPORTATION COMMITTEE FOR DENVER CONVENTION

Considerable enthusiasm has already been shown in various sections of the country relative to the Denver convention. President Shaw is about to appoint a comprehensive transportation committee, which will have in charge the matter of the working up of special trains, special cars and parties from various points in the country. It is expected that very attractive rates, not only to Denver, but also to various Pacific Coast points, will be announced in the near future.

At a preliminary meeting to discuss various transportation matters, held at the association office in New York on June 16, the following named gentlemen were present: James F. Shaw, president, American Association; Thomas N. McCarter, president, Public Service Railway Company; J. N. Shannahan, general manager, Washington, Baltimore & Annapolis Electric Railway Company; J. H. Pardee, operating manager, J. G. White & Company; J. M. Wakeman, vice-president, McGraw Publishing Company; Chas. S. Clark, secretary, Massachusetts Street Railway Association, and B. V. Swenson, secretary, American Association.

It is expected that a party of at least 100 people will go direct from New England points to Denver, and after attending the convention will continue to various Pacific Coast points, taking advantage of the attractive Alaska-Yukon rates. Two special trains will probably start from New York City, one going up through New York State, and the other down through Pennsylvania points. Plans for a special train from Chicago are already under way, and the probability is that another special train will run from St. Louis and Kansas City. In addition, it is planned to arrange for special cars from various other points, taking care of those who go to the convention from Canada, the Southeastern States, the Southwestern States and Pacific Coast points. A further announcement in regard to these trains will be published as soon as the details are decided upon.

SUGGESTED MONORAIL LINE FOR BERLIN

August Scherl, of Berlin, Germany, has published an elaborate volume on high-speed city and trunk line traffic with special reference to the use of his monorail system. Mr. Scherl states that his monorail system will involve the use of cars which will be balanced by interior gyroscopic apparatus. He suggests the arrangement of city railway systems as combinations of ring and radial lines, and presents plans for constructing them either as elevated or surface installations. Many pages are devoted to descriptions of the proposed rolling stock, stations and line construction. The author also considers the social and economic aspects of high-speed transportation.

At the shops of the Hot Springs Street Railway Company the same lathe is used for turning iron parts and babbitted bearings. By the use of a large magnet it is found practicable to separate the babbitt from the iron turnings, and thus effect a substantial saving in the total amount of babbitt used for bearings.

News of Electric Railways

Cleveland Traction Situation

On the evening of June 11 Mayor Tom L. Johnson began his campaign in favor of the Schmidt 3-cent grant in his tent on Superior Street. He admitted that the Municipal Traction Company had not given good service, but said that the strike and bad faith on the part of others who entered into the leasing contract were responsible for this. He again said that the Payne Avenue line and its extensions would connect with the original 3-cent lines on the West Side and that transfers would be given from one to the other, although the properties formerly belonging to the Forest City Railway have been purchased by the Cleveland Railway.

At a meeting of the council committee of the whole on the evening of June 9 the Mayor explained that all 3-cent fare lines, both original and new, would be unified into one system, under the plans that have been made by the administration, if the Payne Avenue franchise is not voted down in the referendum election. In this way, he said, the stockholders of the Forest City Railway will be cared for. Herman J. Schmidt, he stated, desires the privilege of taking over the stock of the Forest City Railway, which has not been replaced by stock of the Cleveland Railway. When the Mayor secures a sufficient amount of this stock to cover a majority of the holdings his plan is to demand a restoration of the property. A nominee named by the city may make this demand, he said.

Councilman Haserodt said he thought that the way should be left open after the vote is taken on the Payne Avenue grant for a proposition from the Cleveland Railway. Admitting that there is some merit in the plan, Mayor Johnson stated, however, that he would have to oppose it. He said he is willing to consider a better proposition from the company before the vote is taken; but if the grant is sustained by the people he thought that the company should not be allowed to present another offer.

Mayor Johnson attacked the ordinance prepared by Judge Tayler and said that its terms were worse for the people than those included in the ordinance submitted some time ago by the company. Councilman Walz, who has heretofore stood with the Mayor, defended the Tayler ordinance, and said that it is what the people want, and that they do not want the Schmidt 3-cent scheme which the Mayor and the Council have recently been trying to establish. He has also 'defended the ordinance' in newspaper interviews, and has stated that the Mayor is interpreting the ordinance to suit his own views and has not accepted the legal meaning of the various features of the ordinance because he does not want the old company to have the right to operate its property under any circumstances. Mayor Johnson signed the Schmidt ordinance immediately after its passage.

The Tayler ordinance was referred to the street railway committee without consideration or comment. Mayor Johnson said that the fatal defect in the ordinance is that it substitutes control by arbitration for control by the people. He also criticised it because Judge Tayler removed the clause referring to the Mayor's grievance against East Cleveland by putting Euclid Avenue upon the same basis as all the other streets named in the grant. The Tayler ordinance does not make it possible for the Council to force the company to redeem the promises made by the Forest City Railway and the Municipal Traction Company on guaranteed stock, and this is not to the liking of those who made the guarantees. Other obligations, however, may be met. The Tayler ordinance provides that the city shall not name another corporation to take over the property for 10 years, and this did not meet with the Mayor's approval.

The communication of the Cleveland Railway refusing to accept the ordinance tendered it says in part:

"This company has publicly agreed to accept a renewal ordinance embodying the Tayler plan, so-called, and drawn or approved by Judge Tayler. The ordinance now offered the company was not drawn, nor is it approved, by Judge Tayler, and its provisions, in many substantial respects, are radically different from the Tayler plan.

"The maximum rate of fare, as fixed in this ordinance, would make it impossible for the company to sell additional stock or bonds to raise the requisite money to provide cars and other needed improvements.

"While the property of the company was in the hands of the Municipal Traction Company that company, through a stock exchange and public advertisement, sold stock of this company upon representations that it was worth par, and upon its guarantee to make good the investment of purchasers at par and interest. The ordinance offered requires this company to make these obligations so incurred by the Municipal Traction Company a part of its capital. The board cannot believe that such obligations can legally or properly be made part of the capital of this company, upon which interest is to be earned at the expense of the patrons of the road.

"The ordinance, as to many of its provisions, is to be void if any one of them is illegal. As we are advised, at least two of these provisions are clearly illegal, viz., the provision that requires the company, under certain conditions, to become the purchaser of its own stock, and the provision that contemplates discrimination among the stockholders in the matter of the capital valuation upon which dividends are hereafter to be paid. And, as we are advised, other provisions of the ordinance are of doubtful legality. So that we are asked to accept something that is void upon its face.

"This ordinance, while purporting to grant a renewal of the company's franchises in the streets of Cleveland, omits to grant any renewal upon an important part of the system, viz., the Euclid Avenue line.

"While this ordinance provides for the arbitration with respect to many questions, by section 21, it is in effect provided that, unless the city and the company so agree, there shall not be, during the life of the ordinance, any increase or decrease in the allowances per car mile for operating expenses and depreciation, it being in this section expressly provided that no such questions shall be submitted to arbitration. The effect of this provision is to require that the property shall be maintained and operated for a fixed sum per car mile for the full period of 25 years, entirely irrespective of changing conditions—a provision which might work great injustice to the traveling public, as well as to the company.

"We beg again to assure the Council that the company is willing and anxious to co-operate with the Council in an effort to bring about a just and fair settlement of its relations with the city, in a manner approved by Judge Tayler, and to ask respectfully that it be given an opportunity to accept such a grant, and that the voters and car riders of the city be given a chance to express their views upon such an ordinance at a referendum election."

The subway grants extending over a period of 75 years were made without the least trouble and before the report of the committee of the Chamber of Commerce could be prepared. Since then the officers of the company have realized the dangers ahead and agreed to most of the provisions and limitations suggested in that report, with the exception of making two separate grants for the upper and lower level subways. W. R. Hopkins, one of the men at the head of the belt line railway, is occupying the same kind of a place with the Cleveland Underground Rapid Transit Company. No one knows whether or not there is any connection between the underground and the 3-cent grants.

George H. Earle, Jr., Elected Director of Philadelphia Rapid Transit Company

The Councils of Philadelphia have elected George H. Earle, Jr., as a representative of the city on the board of directors of the Philadelphia Rapid Transit Company, to succeed Clarence Wolf, who, as stated last week, has been elected to the board of directors as a representative of the stockholders. Mr. Earle has long been prominent in financial and business affairs in Philadelphia. Once before he has served on the board of directors of the Philadelphia Rapid Transit Company. Mr. Earle wrote to Mayor Reyburn on June 12 accepting the appointment. In his letter he said:

"I feel that I can best show my appreciation of the honor that you tender me by dealing with you and the public that you represent with perfect frankness. In accepting I wish also to tender you a resignation, to be constantly under your control, should my views of duty or policy not concur with your judgment as to what will best subserve the welfare of the city. It is my present purpose frankly to state my views. While I shall have but one vote, I think it your right to know exactly how that vote will be cast.

"In the first place, I have long believed that nothing is so absolutely essential to the welfare of this city as that the Rapid Transit Company and the city should work in complete amity. Whether he be within or without the com-

pany, he is a public enemy who unnecessarily stirs up discord between them, and should be equally despised.

"There must be harmony and good will if there is to be satisfying success. I repeat that the greatest service the management can render is to study, understand and, if possible, meet every wish of its patrons. It is imperative that the public aid, not impede, this necessity of public welfare, and to aid they must approve what is done, and to do this the people must be given full information. We must have amity. That is an absolute public necessity.

"In the second place, I may be mistaken, but I think the time has come when, with such a fine body of men as man our cars, we should be able, with their assent and approval, to fix a sliding scale of wages that would assure their participation in the enjoyment of a prosperity that their care and faithfulness can do so much to assure. I am one of those who are convinced that it would be bad for this country if any of our citizens should so lack independence as not to resent a refusal to give great bodies of men a fair and sympathetic hearing, whether their demands be possible of fulfilment or not. And that must continue to be my attitude. But beyond this, it is very injurious to a great city to have its transit facilities disturbed, and no mere question of personal pride can ever justify it.

"And now I come to the third and most difficult matter, and that is the question of strip tickets. On this subject I particularly feel that you and my fellow citizens should know just where I have stood and must always stand. It does not demonstrate that the merchants' plan is a bad thing that no one has yet seen the wisdom of giving it a fair trial. The underlying principle of that plan I advocated. I believe in, though I had nothing to do with the drafting of its details, and would make changes if I could. But I wish it again plainly understood that I believe in the principle involved, and shall work for it just as long as I serve you. If that belief incapacitates me from serving you I will withdraw with the best good will to all of you. But that is my belief.

"However others have felt, it has always been my highest desire that the company should take no important action without full consultation with your honorable bodies. May I once more trespass to explain this matter? You at least will remember how all this difficulty and agitation arose. The company, in the earnings of which the city was to have a one-half interest, was being slowly bled to death by frauds upon the transfer system, and no one can measure the harm, the ruin, the unrest, the misery and disorder that might follow to the whole city. Men would not lightly pay three fares to reach their work or return from it.

"Needing money to develop our transportation facilities more than any city in the United States, it would be an act of insanity to so treat capital already invested as to make the procurement of further necessary means an impossibility. But even facing all this, I thought that before adopting a system to check such frauds it was our duty to consult Councils. Even if under no legal obligation I felt that to be the underlying spirit of the merchants' plan, that must be abided by if it were to accomplish any high purpose. My plan and only plan, and from the beginning my sole and only ambition, was to get the city and company to work in such complete and sensible harmony as to enable them to remedy all abuses, and thus be able, in times of serious difficulty for the poor, not to increase the burdens of the honest public.

"This plan I laid before all whom I felt could advance it, and I have secured the earnest support of leading men in both parties. I am confident that I would have succeeded in it, and without trouble, had it not been for the interference of senseless agitators, or those selfishly seeking after notoriety or office at any cost. Under these circumstances the frantic appeal made to me to favor strip tickets, to be 'the people's champion,' coming largely from men whose folly defeated all my efforts to prevent any such question ever arising, would be ludicrous were it not so painful. I want to say to them that real friends of the people, real reformers, have in all ages more often appeared as martyrs than as candidates for office; for the highest sacrifice that can be made to our fellow men is to forfeit their liking rather than their interest.

"For strip tickets to continue, not transfers but fraud on transfers had to be stopped. That was, then, all that I thought necessary; but I wanted the spirit of the merchants' plan tried on the simple and business question. So finally we met a committee of Councils to devise methods. And that was the real crisis of this matter. Its majority showed every inclination to consider this a business and public question. But all its efforts were frustrated by an attitude of obstruction on the part of the minority that represented those now so loudly complaining of the results of their own folly, and that while professing to be the special friends of the people would not permit what the people's welfare so imperatively required to be done.

"Whether intended or not, I cannot say, but this gave no alternative but ruin of the company and city's interests, or the independent action that I deprecated. And counsel advised the company that such action could be legally taken. It therefore became a duty to take it. But that, of course, made confidence and co-operation impossible, made my own plan and efforts useless, and I retired from the board. Instead of sane adjustment and helpful co-operation, litigation and legal definition were forced; and when that definition did not suit, agitation and disorder followed. As a consequence the company is to-day less able to decrease its fares, and the difficulties of honest directors have been enormously increased. Until I again examine the matter, I cannot say what can be done.

"There is one other matter of which I should perhaps speak—the pay-within cars. I favored and still favor them. One reason has been all compelling, they save human life. So long as I believe that they will save one child or one woman each year from serious injury or death—and I understand they save a great many—I shall earnestly favor them.

"I have but one favor to ask, and that is, that you will be good enough to realize the enormous pressure of duties under which I struggle, and as soon as possible fill my place with some one more able to serve you."

The demand for the restoration of the strip tickets, sold by the Philadelphia Rapid Transit Company at the rate of six tickets for 25 cents, resulted in the passage by the Councils on June 9 of a resolution calling upon the city solicitor to bring legal proceedings to determine whether the company has the right to discontinue the sale of strip tickets without the consent of the Councils, this despite the fact that the Supreme Court of the State has already passed upon this point.

Fifty-Year Franchise Drafted in Kansas City

An ordinance which provides for the extension of the franchise of the Metropolitan Street Railway in Kansas City, Mo., for a period of 50 years has been drawn up and submitted to the West Traffic Way Commission of Kansas City as a basis for negotiations between the company and the city prior to its introduction into the Council. The present franchise grant of the Metropolitan Street Railway expires on June 1, 1925. The new franchise will make the date of expiration of the grant June 1, 1959. A digest of the principal provisions of the ordinance follows:

The company is to pave between its tracks and for 18 inches outside of the outside rail with the same material as the rest of the street and shall keep this in good repair and repave when the rest of the street is repaved. In the case of cable roads, paving in good repair now may remain until the line is electrified. Where extensions are built on unpaved roads, the Board of Public Works is to specify the paving to be laid by the company, but the company shall not be required to change paving if subsequently the city decides on paving for the street which is different from that laid by the company. Flagmen shall be stationed at grade crossings at the expense of both the street railways and the railroads. Cars are to stop on the near side of the street for passengers. Arc lights are to be suspended at all railroad intersections, the cost to be divided between the street railways and the railroads. Power to charge the batteries of the police and fire alarm systems is to be furnished by the street without cost to the city.

The Metropolitan Street Railway is to agree to permit interurban cars to enter the city over its tracks, but is to man the interurban cars with its own employees. Passengers on interurban cars are to have the same transfer privileges as passengers of the Metropolitan Street Railway. The Metropolitan Street Railway is to collect a fare of 5 cents from each interurban passenger within the city, of which it is to pay the interurban companies 1 cent. The Metropolitan Street Railway is to have the right to handle light express, subject to the supervision of the city. The Board of Public Works is to approve all locations for poles and all construction and repair work is to be done under the supervision of this Board. On the fifteenth of each month, this board is to report to the comptroller the amount of work done during the previous month. The company must agree to operate its cars according to regulations imposed by the City Council under the supervision of the Board of Public Works. No trail cars are to be operated. (A conditional schedule is printed in the proposed ordinance.)

The fare is to be 5 cents for all passengers more than 12 years old and 3 cents for passengers less than 12 years

old when unaccompanied. Nothing is to be charged, however, for children less than 12 years old when accompanied by their parents or a guardian. The present transfer system is to continue, subject to such minor regulations by the Council as may be deemed advisable. Policemen, firemen and employees of the company only shall be carried free. The company shall spend 12 per cent of its gross receipts yearly in maintenance or, if 12 per cent is not necessary properly to keep up the property, the balance is to be deposited and a fund created from which subsequent extraordinary expenditure may be made. The depository holding this fund shall release it only on the order of the company signed by the Board of Public Works. Four per cent per month of the gross receipts shall be set aside for depreciation and renewals, subject to conditions to be imposed by the Board of Public Works. The company shall set aside for liquidation of accident claims a sum to be decided by the Board of Public Works. This sum, however, shall merely be sufficient properly to protect the city should it exercise its right to buy the property.

The city is to have a minority representation in the board of directors and is to have the right to purchase the property any time after 1924 on 6 months' notice at a valuation which has for the present been conditionally fixed at $33,000,000, and to which the cost of extensions and improvements as made from time to time shall be added. If the city does not purchase the property by the expiration of the franchise, it is to have the right to designate a person, firm or corporation as its licensee to take over the property. The company is to make a full and complete report to the city by March 1 of each year covering its operations for the previous year and is to settle with the city on the first of March of each year on a basis of net receipts, 50 per cent of which shall go to the city. It is stipulated that an amount not less than $400,000 shall be paid to the city for the period from the present to Dec. 31, 1910. Reports of gross receipts shall be made to the city comptroller once a week. A bond of $100,000 shall be filed to insure compliance with the terms of the ordinance. After the ordinance has been passed, the company shall cause a resolution to be adopted by its directors within three days accepting the ordinance and shall file such resolution with the city clerk for record. Sixty days thereafter the ordinance shall be submitted to the people for approval.

Transit Affairs in New York

On June 8 Mayor McClellan signed the franchise giving the Hudson & Manhattan Railroad permission to extend its subway from Thirty-fourth Street and Sixth Avenue up Sixth Avenue to Forty-second Street, and thence to Fourth Avenue at the Grand Central Station. William G. McAdoo, president of the company, said that he hoped to be able to begin the construction of the extension within six months, and that unless unforeseen delays were encountered the entire system between New Jersey and Grand Central Station, New York, would be in operation by Jan. 1, 1911.

Justice Hendrick, in the Supreme Court, heard argument on June 10 in the suit instituted by the Public Service Commission against Adrian H. Joline and Douglas Robinson, receivers of the Metropolitan Street Railway, for not filing an annual report with the commission on Sept. 30, 1908, as provided by law. The commission seeks to recover damages from the receivers at the rate of $100 a day. The receivers demurred to the complaint. Justice Hendrick reserved decision and gave both sides until June 21 to submit briefs.

The bondholders of the Fulton Street Railroad have applied to the Public Service Commission to submit a plan by which the operation of the road may be resumed.

Judge Lacombe of the United States Circuit Court has issued an order continuing Frederick W. Whitridge as receiver of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad during the pendency of the suit instituted by the Union Trust Company against the railroad company, the Central Trust Company and the Barber Asphalt Company.

A conflict has arisen between the Board of Estimate and the Public Service Commission over the South Shore Traction Company's franchise to operate cars across the Queensboro Bridge. The Board of Estimate granted the company a franchise recently, but the commission refused to approve the grant. The board, as a result, has passed a resolution, which concludes: "Resolved, That the Board of Estimate and Apportionment of New York, as the local authority under and pursuant to the provisions of the charter, intended to maintain all the rights and privileges conferred upon it, and to that end the Corporation Counsel is hereby directed to take all necessary steps to prevent what the board believes to be a usurpation by the Public Service Commission of the power conferred upon the board by the charter, and which in effect nullifies the action of the board in fixing terms and conditions in the granting of franchises and renders the performance of the duties imposed upon it by the provisions of the charter a mere idle ceremony, and to secure from the courts by any means open to the city a construction of the provisions of section 53 of the Public Service Commissions law which would definitely determine the powers of the said commission under such law."

By the terms of the order issued by the Public Service Commission the Staten Island Midland Railway and the Richmond Light & Railroad Company, Staten Island, are required to exchange transfers at three new points on a complaint made by Charles H. Blair, chairman of a transit committee of the Staten Island Chamber of Commerce.

Fire Destroys Indianapolis Car House.—The West Washington Street car house of the Indianapolis Traction & Terminal Company, Indianapolis, Ind., was destroyed by fire on June 10. The blaze was discovered by a watchman at 4 a. m. and an alarm was promptly sounded. The plot on which the barn was located contains the repair and paint shops, but a fire wall prevented the flames from spreading to these buildings. An interurban limited car of the Terre Haute, Indianapolis & Eastern Traction Company, an interurban freight trailer, a large double-truck closed city car, three small single-truck closed cars and 10 single-truck open cars were destroyed.

Franchise Ordinance at Columbus Vetoed.—In the ELECTRIC RAILWAY JOURNAL of June 12, 1909, page 1095, mention was made of the passage by the City Council of Columbus, Ohio, of a 25-year franchise to the Ohio Electric Railway. The company was also granted permission to lay T-rails. Acting Mayor Rightmire has since vetoed the franchise. He says that provision should be made in the grant for the purchase of the property of the company at the expiration of the franchise and that T-rails are a menace and should not be permitted to be laid in Columbus. The ordinance was originally carried by a vote of 10 to 4, and can be passed over the veto by the same vote after 10 days.

Meeting of Central Electric Accounting Conference.—In view of the importance of the subjects to be discussed, a good attendance is expected at the meeting of the Central Electric Accounting Conference, at Columbus, Ohio, on June 19. The program in full was published in the ELECTRIC RAILWAY JOURNAL for June 5, 1909, page 1055. It includes an address by P. V. Burington, secretary and auditor, Columbus Railway & Light Company, and discussion on the subjects of the difficulties experienced with the Interstate Commerce Commission classification of operating expenses; traffic statistics; and payrolls, timekeeping and the best method of paying employees. R. N. Wallis, president of the American Street & Interurban Railway Accountants' Association, will attend the meeting.

Mayor of Bridgeport Suggests Cheaper Fare.—Mayor Lee of Bridgeport in a message to the Common Council of that city urges that a committee be appointed to take up with the Connecticut Company the question of selling six tickets for 25 cents. Mayor Lee in his message says: "I would recommend that efforts be made, by the appointment of a committee of conference, with the Connecticut Company, to obtain the consent of said company to the sale of six tickets for 25 cents, to all who desire to purchase tickets in that manner. This is done in other cities throughout the country, and I have been informed that where such a practice is in operation it has not only proved beneficial to the public, but also advantageous to the street railway companies that have authorized it. We ought at least to make an effort to bring about the operation of this system here."

Undeveloped Areas in Western Massachusetts.—L. S. Storrs, president of the New England Investment & Security Company, Boston, Mass., recently delivered a very interesting lecture before The Club of Springfield about undeveloped Western Massachusetts. Mr. Storrs said that electric railways are divided into three grand divisions, city lines, suburban lines and interurban lines, and that the interurban lines are usurping the business of the steam lines because they offer greater facilities for ready communication. Mr. Storrs also said that there are many abandoned farms in Western Massachusetts which with proper cultivation and the facilities which electric railways would afford for ready communication with places of distribution could be made to return a handsome profit on the investment and labor, and concluded "that the territory between the Berkshires and the Connecticut River, and especially that in the southern portion, should receive attention not only from those interested in transportation but from all who have the ultimate welfare of the commonwealth at heart."

Additional Report on Chicago Subways.—The final report of the subway bureau of the city of Chicago, supplementing the elaborate preliminary report abstracted in the Electric Railway Journal of March 27, 1909, page 562, has been made public. It contains four sets of plans for subways for street railways in the central downtown district of Chicago, ranging in estimated cost from $100,000,000 to $112,000,000. Each of the plans is so arranged that it may be made to include, besides the subway itself, galleries for public utilities. The plan which appears to meet with most favor provides for the construction of six through routes. Two of these will connect the north and south sides, two the north and west sides and the others the south and west sides. This plan also contemplates a so-called "depot loop"—a subway which will run around the heart of the city in close proximity to nearly all of the railroad stations. The capacities are said to provide for the growth of the population of Chicago at the present rate of increase, until the year 1932. Including standing room, the system will not reach its ultimate maximum capacity until 1950. The plans are not worked out in detail, and as it will be some time before an actual decision is reached in the matter of constructing street railway subways in Chicago, the proposals are largely tentative in form.

Outing of the New England Street Railway Club.—As mentioned on page 1094 of the Electric Railway Journal of June 12, 1909, the New England Street Railway Club will hold its annual June outing on June 22, 1909, on Narragansett Bay. The party will leave Boston from the South Station on special cars at 10:03 o'clock a. m. and is due to arrive in Providence at 11:08 o'clock a. m. At 11:25 o'clock the steamer *Warwick* of the Providence & Fall River Steamboat Company will leave Providence for Field's Point, where dinner will be served at 12 o'clock. At 1 o'clock the *Warwick* will sail down Narragansett Bay by way of the east passage to Newport, passing Newport, Fort Adams, etc., and will return to Providence by way of the west passage at 5:30 o'clock p. m. The special cars will leave for Boston at 5:58 o'clock p. m., and are due to arrive at the South Station, that city, at 7 o'clock p. m. Tickets, including transportation from Boston, dinner at Field's Point and the ride by steamer down Narragansett Bay, are $3. Tickets for members who join the party at Providence and who do not use the transportation ticket between Boston and Providence and return are $1.75. Members are requested to notify John J. Lane, 12 Pearl Street, Boston, Mass., the secretary of the club, of their intention to go on the outing.

LEGISLATION AFFECTING ELECTRIC RAILWAYS

Connecticut.—The hearing before the joint legislative committee of the House and the Senate to consider the question of public utility legislation was continued on June 8. The session was an open one, the special subjects previously assigned having all been covered. It was intended at this session to give the members of both houses an opportunity to present any amendments, but none was offered. The principal speakers were George M. Wallace and Arthur C. Graves, New Haven. Mr. Wallace said that he represented stockholders in public service corporations who felt that the enactment of a bill creating a public service commission would work greatly to their detriment by hampering the operations of the companies in which they were interested. His opinion was that the creation of a commission would establish a precedent for bodies of that kind with sweeping powers, and might result in a demand for other governing bodies that would affect corporate interests even more directly. Mr. Wallace said that he had studied the proposed measure very carefully, and had come to the conclusion that it would simply be "a garden for the raising of plums for politicians." Mr. Graves said that he represented stockholders in public service corporations whose sentiments were similar to those of the clients of Mr. Wallace. He said that the power to regulate rates should be vested in a body with judicial functions.

Massachusetts.—Two important matters now under consideration, the railroad merger or holding bill of Gov. Draper and the new Boston city charter, make the date of adjournment uncertain. The House bill to authorize street railway companies to issue securities for supplying working capital has been passed to be engrossed by the Senate. The House has accepted the report of the committee, leave to withdraw, on the Richardson petition and bill relative to the distribution of the franchise tax on street railway companies. The committee on rules has referred to the next Legislature the petition of Frederic J. Stimson for legislation relative to judgments for damages against street railway companies, and the House has given this report a first reading.

Financial and Corporate

New York Stock and Money Market

June 15, 1909.

Although the stock market has lost none of its activity, during the past week there has been a pause in the advance movement of prices. Exceptions to the general weakness to-day were the traction stocks, which were active and higher on rumors that the reorganization plan of the Metropolitan Street Railway system would outline a scheme which would be much more advantageous to the owners than has heretofore been believed possible. Interborough-Metropolitan preferred gained 2 points to-day, while the common advanced with Metropolitan and Third Avenue securities.

The money market continues to be easy, with a very healthy demand for bonds. Quotations to-day were: Call, 1¾ to 2 per cent; 90 days, 2½ to 2¾ per cent.

Other Markets

In the Philadelphia market during the past week there has been very heavy trading in Rapid Transit stock. More than 100,000 shares have changed hands and the price has been forced down as low as 26⅞. The close to-day was 27¾. Union Traction has been weak around 52. Philadelphia Traction has been about 91.

Little was done in traction securities in the Chicago market. There has been some trading in Kansas City Railway & Light and a little business in Chicago Railways issues, especially Series 2 and 4.

In the Boston market, Massachusetts Electric preferred has been almost the only traction issue in the market. A few shares have been sold around 68. The common stock continues to sell in the neighborhood of 12½.

In Baltimore, the United Railways bonds continue to be active. Prices remain practically unchanged—4s, 87½; income 5s, 56½, and funding 5s, 80½.

Quotations of various traction securities as compared with last week follow:

	June 8.	June 15.
American Railways Company	a46	a46
Aurora, Elgin & Chicago Railroad (common)	a39¾	a41
Aurora, Elgin & Chicago Railroad (preferred)	a87	a88
Boston Elevated Railway	130¼	129
Boston & Suburban Electric Companies	*16	*16
Boston & Suburban Electric Companies (preferred)	70	*70
Boston & Worcester Electric Companies (common)	10	10
Boston & Worcester Electric Companies (preferred)	54	54
Brooklyn Rapid Transit Company	81¼	79¼
Brooklyn Rapid Transit Company, 1st ref. conv. 4s	89	87½
Capital Traction Company, Washington	*136	*134
Chicago City Railway	a190	a190
Chicago & Oak Park Elevated Railroad (common)	*3	*4
Chicago & Oak Park Elevated Railroad (preferred)	*14	*14
Chicago Railways, ptcptg. ctf. 1	a109	a107
Chicago Railways, ptcptg. ctf. 2	a38	a37
Chicago Railways, ptcptg. ctf. 3	a26½	a26½
Chicago Railways, ptcptg. ctf. 4s	a10	a10
Cleveland Electric Railway	*78	*78
Consolidated Traction Company of New Jersey	a79	a78
Consolidated Trac. Co. of N. J. 5 per cent bonds	a107	a106⅛
Detroit United Railway	59½	61⅝
General Electric Company	159½	161
Georgia Railway & Electric Company (common)	90⅜	91
Georgia Railway & Electric Company (preferred)	85	*85
Interborough-Metropolitan Company (common)	16¼	17⅛
Interborough-Metropolitan Company (preferred)	45¼	48⅜
Interborough-Metropolitan Company (4½s)	78⅜	79⅛
Kansas City Railway & Light Company (common)	a50⅜	49⅜
Kansas City Railway & Light Company (preferred)	a86	a86
Manhattan Railway	a148	a148
Massachusetts Electric Companies (common)	12½	12¼
Massachusetts Electric Companies (preferred)	67	58
Metropolitan West Side, Chicago (common)	a19	a18
Metropolitan West Side, Chicago (preferred)	a55	a53
Metropolitan Street Railway	a27½	29
Milwaukee Electric Railway & Light (preferred)	*110	*110
North American Company	83½	85¼
Northwestern Elevated Railroad (common)	a24	a24
Northwestern Elevated Railroad (preferred)	a70	a69½
Philadelphia Company, Pittsburg (common)	a41¾	a42½
Philadelphia Company, Pittsburg (preferred)	a43½	a43¾
Philadelphia Rapid Transit Company	a30¼	a27¾
Philadelphia Traction Company	a92	a91½
Public Service Corporation, 5 per cent col. notes	*100¾	a100½
Public Service Corporation, ctfs.	a89¼	a89¼
Seattle Electric Company (common)	*108	*112½
Seattle Electric Company (preferred)	102	103
South Side Elevated Railroad, Chicago	a56½	a55
Toledo Railways & Light Company	10	a9
Third Avenue Railroad, New York	30	27½
Twin City Rapid Transit, Minneapolis (common)	*104½	105
Union Traction Company, Philadelphia	a56	a53⅛
United Railways & Electric Company, Baltimore	a12½	a12¾
United Railways Inv. Co., San Francisco (common)	38½	37½
United Railways Inv. Co., San Francisco (preferred)	56	a56
Washington Railway & Electric Company (common)	*42⅝	a43½
Washington Railway & Electric Company (preferred)	*90¼	a91
West End Street Railway, Boston (common)	a93	92
West End Street Railway, Boston (preferred)	107	*107
Westinghouse Electric & Manufacturing Company	85	85
Westinghouse Elec. & Mfg. Company (1st pref.)	a124	*124

aAsked. *Last sale.

Annual Report of the American Cities Railway & Light Company

The third annual report of the American Cities Railway & Light Company, covering the year 1908, contains a combined income statement of the subsidiary local companies. This report, which indicates that operating expenses and taxes required 60.3 per cent of gross earnings in 1908 and 62 per cent in 1907, is as follows:

COMBINED INCOME STATEMENT OF LOCAL COMPANIES.

	1908.	1907.	Increase.
Gross earnings	$5,435,494	$5,437,796	*$2,302
Operating expenses and taxes	3,280,248	3,371,703	*91,455
Net earnings	$2,155,246	$2,066,093	$89,153
Interest charges	1,228,215	1,140,662	87,553
Surplus	$927,031	$925,431	$1,600
Sinking funds	25,500	15,342	10,158
Surplus over sinking funds	$901,531	$910,089	*$8,558
Dividends declared and paid	617,176	604,676	12,500
Surplus over dividends	$284,355	$305,413	*$21,058

*Decrease.

The income account of the American Cities Railway & Light Company for the years 1907 and 1908, follow:

Income.	1908.	1907.
Dividends on stocks of local companies	$533,031	$521,965
Interest on loans to local companies	13,474	496
Interest on bank balances	1,391	4,293
Income from other sources	1	368
Total income	$547,897	$527,122
Expenses, including taxes	29,501	17,348
Net earnings	$518,396	$509,774
Dividend (6 per cent) on outstanding preferred stock	414,366	414,371
Surplus above preferred stock dividends	$104,030	$95,403
Previous surplus	200,125	104,722
Total surplus, Dec. 31,	$304,155	$200,125

The report states the following as the proportionate interest of the company in the undivided surplus earnings of the local properties and the actual cash surplus earnings of the company for the last two years:

	1908.	1907
American Cities Ry. & Light Co.'s share of surplus earnings over dividends	$259,686	$274,716
Surplus earnings collected as above	104,030	95,404
Total	$363,716	$370,120

J. K. Newman, the president, states in his report:

"Out of the undivided surplus earnings, the local companies set aside as reserve funds for renewals, betterments and contingencies, $218,875 in 1907, and $158,141 in 1908.

"The American Cities Railway & Light Company now owns in the aggregate 84.1 per cent of the preferred stock and 88.9 per cent of the common stocks of the following companies: Birmingham Railway, Light & Power Company, Memphis Street Railway, Little Rock Railway & Electric Company, Knoxville Railway & Light Company, Houston Lighting & Power Company, 1905.

"The results achieved by all the companies during the past year are remarkable, considering the extent of the industrial depression through which we have passed. The slight decrease in gross earnings was considerably more than counterbalanced by reductions in operating expenses, so that in spite of an increase in taxes, the combined net earnings of the five companies were $89,152 greater in 1908 than in the previous year.

"In the face of the material losses in earnings, both gross and net, experienced during the past year by nearly all the steam railroads, this showing cannot but be recognized as another demonstration of the fact that electric railways and lighting companies have in times of depression a distinct advantage over the steam roads, by reason of the fact that the demand for the public necessities which they supply is fairly constant and is not materially affected by business depression.

"In all the properties the tide seems now to have turned. December, 1908, showed an increase in both gross and net earnings over December of the previous year; while January and February, 1909, show further marked improvement, which will result in a very substantial increase in net earnings, as the economies in operation instituted during the last year will continue to bear fruit.

"The item which has absorbed practically the entire increase of $89,153 in net earnings is interest charges. The increase in this item is due to paying interest on nearly $1,500,000 put into new construction, which was mainly contracted for before it became apparent that the slackening of general business would postpone the time when the companies would require increased facilities to handle their business. This expenditure has been made, however, and although the additional facilities thus afforded have not been needed in 1908, they are available to take care of the increases in business which the companies are once more experiencing.

"Attention was called a year ago to the unsatisfactory power house results in Birmingham. We are pleased to be able to report that the changes made have proved entirely satisfactory and the results in the way of efficient and economical operation of the power house, are extremely gratifying.

"In Memphis, also, the power house operation has been materially improved, though it cannot be expected to be entirely satisfactory until the completion of the new power house, of which only one section is now finished and in operation."

Attention is called by Mr. Newman to a statement showing that from 1903 to 1908 the following changes took place in the five properties: Gross earnings, increase, 81.5 per cent; operating expenses and taxes, increase, 95.7 per cent; net earnings, increase, 63.6 per cent; interest, increase, 75.3 per cent; surplus, increase, 50.3 per cent; surplus after sinking funds, increase, 46.2 per cent. Mr. Newman continues:

"The temporary halt in the upward movement produced by the past year of depression promises to prove merely a breathing spell in which to get all construction matters caught up before starting upon another period of steady increases.

"The physical condition of your properties is excellent. During the past year the Birmingham company has completed the installation of automatic stokers and the most up-to-date ash-handling apparatus in its power plant. These have materially reduced the power cost.

"The capacity of the Little Rock and Houston power plants has been increased by the installation of a new 1500-kw turbine in each.

"In all the properties there have been nearly the normal amount of electric lighting extensions, while a few minor railway extensions have also been made. New cars have been added to the equipment in Birmingham and Little Rock.

"The power-plant capacity and car equipment now provided are adequate to take care of an increase of nearly 25 per cent in business if uniformly distributed. This makes it unnecessary for these companies to spend any very large amount for construction this year.

"The lessened construction requirements of the last 15 months, due to slackening of business, have given your companies an excellent opportunity to fund their previous construction indebtedness. The Birmingham company has sold $250,000 of 6 per cent refunding and extension mortgage bonds in addition to completing the delivery of the $1,000,000 sold in 1907. This leaves the company with no current indebtedness for construction except a loan of $150,000 from your own compay.

"The Little Rock Railway & Electric Company executed during the year a mortgage to secure an authorized issue of $5,000,000 refunding and extension mortgage bonds. Of these, $2,000,000 will be reserved to refund the outstanding first mortgage bonds; $500,000, bearing 6 per cent interest, are issuable at the discretion of the company, while the remaining $2,500,000, to bear such interest not exceeding 6 per cent as the directors shall determine, will be issuable from time to time for 80 per cent of the cost of additions, and subject to very carefully drawn restrictions. This is mentioned as it indicates the comprehensive plan now being generally followed for the future development of these properties. The proceeds of the $365,000 of these bonds which the company has sold are more than sufficient to pay off all of the company's current indebtedness for construction.

"The Memphis Street Railway has recently sold $300,000 consolidated mortgage 5 per cent bonds, which has permitted it to pay up its entire current construction indebtedness.

"The Knoxville Railway & Light Company during the past year sold $200,000 of its consolidated bonds, thus funding the balance of its construction indebtedness and providing for its few pressing construction requirements.

"The Houston company now has no current indebtedness for construction except $50,000 loaned by your company.

"The net result of this financing, therefore, has been to leave all the local companies entirely free from floating indebtedness (except the loans from this company) and with cash balances aggregating more than $400,000."

Union Railway, Gas & Electric Company

E. W. Clark & Company, Philadelphia, and Hodenpyl, Walbridge & Company, New York, have drafted a plan for the organization of the Union Railway, Gas & Electric Company to take over the Springfield Railway & Light Company, Springfield, Ill.; Peoria (Ill.) Light Company,

Evansville (Ind.) Light Company and the Rockford & Interurban Railway, Rockford, Ill.

The bonds, preferred stock and common stock of the Union Railway, Gas & Electric Company will be issued in exchange for the preferred and common stocks of the four companies named and for $500,000 cash, in the following proportions: For the stock of the Springfield Railway & Light Company there will be issued 100 per cent in new 5 per cent bonds of 6 per cent preferred stock (at option of holder) and 50 per cent of new common stock; for the preferred stock of the Peoria Light Company 100 per cent in new bonds or preferred stock and 20 per cent of new common stock; for the common stock of the Peoria Light Company, 70 per cent of new bonds or preferred stock and 30 per cent of new common; for the preferred stock of the Evansville Light Company, 100 per cent of new bonds or preferred stock and for the common stock of the Evansville Light Company 100 per cent of new common stock. For all common stock and redemption of the preferred stock of the Rockford & Interurban Railway and for $500,000 cash, $1,500,000 in new bonds or preferred stock and $2,050,000 of new common stock will be issued.

The present capitalization of the four companies, exclusive of underlying bonds, and the distribution of the new securities to be given in exchange follow:

	Present capitalization.		Exchange value.	
	Preferred stock.	Common stock.	New bonds or preferred stock.	New common stock.
Springfield Railway & Light Company	.....	$3,000,000	$3,000,000	$1,500,000
Peoria Light Company	$1,000,000	2,500,000	2,750,000	950,000
Evansville Light Company	1,000,000	1,500,000	1,000,000	1,500,000
Rockford & Interurban Railway	50,000	1,000,000	1,500,000	2,050,000
Total	$2,050,000	$8,000,000	$8,250,000	$6,000,000

The total underlying bonds of the various companies are as follows: Springfield Railway & Light Company, $3,500,000; Peoria Light Company, $3,500,000; Evansville Light Company, $1,250,000; Rockford & Interurban Railway, $2,714,000; total, $10,964,000. The combined earnings of the four companies for the year ended April 30, 1909, show gross receipts of $2,674,219 and net earnings of $1,314,440. Of these net earnings, $627,252 was taken up by taxes and bond interest of subsidiary companies, leaving net profits of $687,188, which would have been applicable to the securities of the proposed holding company.

Deposits of stocks of the merging companies must be made on or before June 21, 1909. Unless the plan shall have been declared operative on or before July 15, 1909, the deposited stocks will be returned.

Present Status of Chicago Elevated Railway Consolidation

The committee composed of Ira M. Cobe, E. K. Boisot and Samuel Insull which proposed a plan for leasing the Northwestern Elevated Railroad, the Chicago & Oak Park Elevated Railroad, the South Side Elevated Railroad and the Metropolitan West Side Elevated Railway through the Central Terminal Company, has announced that negotiations will be suspended for the present at least. The statement of the committee follows:

"The matter being one of public interest, the members of the committee have thought it desirable to give out a statement showing the status of the proposed leasing of the several elevated railways in Chicago. For some time past progress has been so far made with the Northwestern Elevated Railroad and the Chicago & Oak Park Elevated Railroad as to justify us in the belief that no practical difficulty would arise in concluding arrangements with these lines.

"In the negotiation with the Metropolitan West Side Elevated Railway substantial progress has been made, but not to an extent sufficient to justify us in stating whether or not an agreement would have been reached.

"The negotiation with the South Side Elevated Railroad has terminated. We have not been able to meet the requirements of the directors of that company as to the amount of rentals, and negotiations with that company have, therefore, been terminated. Inasmuch as we do not think it advisable to effect unification of the elevated lines except upon the basis of operating all of the properties, we do not think it advisable to proceed further with negotiations, at any rate for the present."

The terms proposed for leasing the companies were published on page 924 of the Electric Railway Journal of May 15, 1909, and page 1002 of the Electric Railway Journal of May 29, 1909.

Angelo Power & Traction Company, San Angelo, Tex.—The property of the Angelo Power & Traction Company has been sold at receiver's sale to Samuel Crowther, San Angelo, for $38,000.

Babylon (N. Y.) Railroad.—The Public Service Commission of the Second District of New York has authorized the Babylon Railroad to increase its capital stock from $25,000 to $75,000 and to issue a first mortgage for $300,000 covering all its property.

Chattanooga (Tenn.) Railways Company.—E. W. Clark & Company, Philadelphia, Graham & Company, Philadelphia, and Hodenpyl, Walbridge & Company, New York, announce that the agreement to consolidate the Chattanooga Electric Company and the Chattanooga Railways Company has been declared operative, holders of more than 90 per cent of the preferred and the common stock of the Railways Company having assented to the plan.

Columbus Railway & Light Company, Columbus, Ohio.—The Columbus Railway & Light Company has arranged to sell $490,000 of Columbus Street Railway first mortgage, 5 per cent gold bonds, due July 1, 1932. This is a portion of an authorized issue of $3,000,000 of which $2,509,000 are now outstanding. The money realized from the sale of these bonds will be used to take up first mortgage 5 per cent bonds of the Columbus Consolidated Street Railway, due July 1, 1909.

Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.—An initial quarterly dividend of 1½ per cent on the $500,000 of 6 per cent preferred stock of the Fonda, Johnstown & Gloversville Railroad was paid on June 15 to holders of stock of the company of record on June 10.

Metropolitan Street Railway, New York, N. Y.—The Central Trust Company, New York, and William A. Read & Company, New York, have purchased $3,500,000 of Metropolitan Street Railway receivers' certificates dated June 15, 1909, to run one year at 4½ per cent, issued to retire $3,500,000 of 5 per cent certificates maturing on June 15, 1909. The certificates are offered for subscription at 100¼.

New York State Railways, Rochester, N. Y.—The New York State Railways has applied to the Public Service Commission of the Second District of New York for permission to increase its capital stock from $23,140,200 to $23,860,200, for permission to purchase the stocks of various street railways and to execute a first consolidated and refunding mortgage to secure $35,000,000 bonds, and to issue at present $6,500,000 bonds under this mortgage. The increase of stock of $720,000 is to consist of common stock. With $674,700 of its new stock it is proposed to purchase from the New York Central & Hudson River Railroad and the Central Railway Syndicate their holdings of stock of the Rochester & Suburban Railway, Rochester Electric Railway and Ontario Light & Traction Company, giving an equal amount of the new common stock at par in exchange. The company also desires to acquire, from time to time, the remaining outstanding stock of the Rochester & Suburban Railway, and the Rochester Electric Railway, amounting to $45,300. The $6.500,000 bonds to be issued are to refund the outstanding bonds of the Rochester & Eastern Rapid Railway, to acquire the bonds of the Rome City Railway, Rochester & Suburban Railway and notes of the Syracuse Rapid Transit Railway, Utica & Mohawk Valley Railway, Ontario Light & Railway Company, Oneida Railway, Rochester Railway, and Rochester & Eastern Rapid Railway. In addition, provision is made for $1,693,366 in bonds, to provide funds for the acquisition of property, construction and extension.

Tarrytown, White Plains & Mamaroneck Railway, White Plains, N. Y.—The suit of the Knickerbocker Trust Company, New York, against the Tarrytown, White Plains & Mamaroneck Railway to foreclose the mortgage held by the Knickerbocker Trust Company against the railway has been heard before Supreme Court Justice Keogh, at White Plains. It is expected that the final decree ordering the sale of the road will be entered this month.

Virginia Railway & Power Company, Richmond, Va.—The Virginia Railway & Power Company will be incorporated under the laws of Virginia to take over the properties of the Virginia Passenger & Power Company, the Richmond Passenger & Power Company and the Richmond Traction Company from the receivers on June 30, in accordance with the plan of the bondholders for reorganizing the companies. The capital stock of the Virginia Railway & Power Company will be $12,500,000, of which $7,500,000 will be common stock and $5,000,000 non-cumulative preferred stock, entitled to dividends of not more than 5 per cent up to Jan. 1, 1914, and not more than 6 per cent thereafter. The authorized bond issue will be $15,000,000 all 5 per cent, 25-year, first and refunding bonds, of which $9.600.000 will be issued at once or reserved under the plan of reorganization to retire outstanding issues of subsidiary companies. The amount to be used for retiring underlying bonds is $1,800,000; about $7,800,000 will be sold.

Traffic and Transportation

Arbitration of Wages at Scranton

The board of arbitration selected to consider the question of the readjustment of the wages and terms of service of the employees of the Scranton (Pa.) Railway, in accordance with the agreement between the men and the company, began the taking of testimony on June 7, and concluded the hearings on June 10.

As stated in the ELECTRIC RAILWAY JOURNAL of June 5, 1909, page 1060, the board consisted of five members, H. E. Paine and D. B. Atherton for the company, and William Corless and P. E. Kilcullen for the men, with Judge George Gray, of the United States Circuit Court of Appeals, as chairman. The men desired a flat rate of 25 cents an hour for motormen and conductors, as compared with the rate of 20, 21 and 22 cents an hour, respectively, for the first, second and third year of service now in force, and an increase of 20 per cent for men employed in various capacities in the shops and barns. The company was represented by H. B. Gill, Philadelphia, chief counsel; C. P. O'Malley, of Willard, Warren & Knapp, local counsel for the company; C. L. S. Tingley, vice-president of the American Railways Company; Frank Caum, general manager, and P. T. Reilly, superintendent.

Judge Gray suggested that the men's side be heard first. A clerk in the employ of the railroad department of the Bureau of Internal Affairs of Pennsylvania was accordingly called to testify to the reports of the company as filed with the State. Extracts from the reports of the company for 1906, 1907 and 1908 were presented in an effort to show that the earnings were sufficient to warrant the increases which have been requested. P. J. Shea, for the men, testified regarding the rates of wages paid to employees for similar service in other cities, and said that in Pittsburgh, Albany, Troy, Rochester, Wilkes-Barre, and other cities the wages were higher than in Scranton. Cross-examined by Mr. O'Malley, Mr. Shea admitted that the method of assigning runs in Scranton is more beneficial to the men than in the cities mentioned, and that perquisites such as 50 free rides a month to the families of employees are not given in the cities he mentioned. Several local merchants and real estate dealers who were called said that the cost of living in Scranton had increased materially within the last few years.

The company's side was heard on June 8. C. L. S. Tingley, vice-president of the American Railways Company, explained the acquisition of the Scranton Railway by the American Railways Company. He said that many improvements to the system are necessary, and outlined a program of reconstruction for the next three years which involves the following expenditures: New power house to cost $500,000, machinery for transforming alternating current to direct current, $20,000; Mulberry Street double tracking, $19,000; another $100,000 for track improvements; new car barn, $80,000, and $120,000 for the proposed viaduct across Carbon Street; viaduct at Old Forge, $16,000; bridge at Moosic, $1,000; 10 new double-truck cars, $60,000, and 10 single-truck cars, $40,000.

While Mr. Tingley was on the stand, reports compiled by the Department of Commerce and Labor at Washington were submitted to show the prices of commodities during the three years beginning with 1906. Mr. O'Malley for the company said he had data from local merchants, but that he was satisfied to accept the Government's figures. Judge Gray said that the reports of the local merchants were preferable as the matter under consideration concerns the workmen of the same community as the merchants. Mr. O'Malley's statements from the local merchants were not signed, and Mr. Powell for the men objected to their admission, contending that they should not be considered as evidence unless the papers showed that they contained listed prices coming direct from the merchants. Being instructed by Judge Gray to have the statements signed, Mr. O'Malley said this was impossible, as the merchants were afraid of a boycott. Judge Gray then gave vent to his feeling about the boycott. He said:

"I thought that cowardly practice had died out here long ago. It is seven years since there was any of it around here, and I don't believe there is any of it practised here now. That has been condemned by all Americans and justly so. It is cowardly and un-American and utterly indefensible, and no man dare stand up and say he could defend it. If this man is afraid to sign that report, he will say he is, and if he does we will proclaim it through the press to the country to the discredit and miserable shame of Scranton. I am very much in favor of labor unions, but nothing has acted so much to their discredit and disgrace as that miserable, un-American, cowardly system of boycotting. No man would submit to it. It was never submitted to by the American people and it never will. I would die in my tracks before I would submit to it."

Judge Gray refused to admit as evidence a statement showing the wages earned by employees previous to their entrance into the service of the railway company. During this hearing the company offered a scale of wages dividing the men into three classes, each class providing for a deduction of from 6 per cent to 10 per cent for lost time. The scale called for the following wages for all men who lost more than 10 per cent of their time during 1908, the new scale to be effective from April 1, 1909, to January 1, 1910: Grade A—18, 19 and 20 cents an hour for the first, second and third year and thereafter. Grade B—for all who lost from 6 per cent to 10 per cent of time, 19, 20 and 21 cents. Grade C—for all who lost less than 6 per cent, 20, 21 and 22 cents an hour.

The session on June 9 was given over largely to the taking of testimony of an oral and documentary character by the company to show that the employees are receiving wages proportionally as high as those paid to other labor, both skilled and unskilled. Judge Gray, late in the afternoon, asked counsel if they would sum up before adjournment and it was decided by both sides to sum up on June 10, on which date both sides reviewed the evidence and the matter went to the arbitrators.

The members of the board of arbitration announced their finding on June 13. They recommend an increase of 1 cent an hour for motormen, conductors and car-house men over the present scale, and that all men who have been employed six years or more receive 24 cents an hour. The question of a reduction for lost time on a 365 working-day basis for a year was eliminated, following the opinion expressed during the hearings by Judge George Gray that no workman should be expected to work 365 days in a year. The scale as fixed by the arbitrators follows: First year, 21 cents; second year, 22 cents; third, fourth and fifth years, 23 cents; sixth year and afterward, 24 cents.

New York Fender Hearings

The hearing on fenders and wheel-guards for Manhattan and Bronx boroughs was continued on June 9 before Commissioner Maltbie of the First District, New York. The first witness was Ralph Sanger, representing Wonham, Magor & Sanger, makers of the Hudson-Bowring wheel-guard. Mr. Sanger was permitted to take the stand to refute a statement that his company's wheel-guard had failed to save a life on the Third Avenue Railroad. The officials of the railroad company had not only advised him that this statement was untrue, but that, on the contrary, Hudson-Bowring wheel-guards had been instrumental in saving three lives since their installation. The wheel-guards had picked up the persons on the tray in every case without pushing them forward. Mr. Sanger added that some 26,000 H-B equipments are in service in about 200 cities. American cities outside of New York using this guard are Montreal and Quebec, but orders have also been received from several companies elsewhere. Snow and ice had not interfered with the operation of the guard. Its adaptability for severe grades was illustrated by a change made in the guards ordered for San Francisco, whereby a special pedal permits the motorman to avoid tripping when going up a hill.

The second witness was R. H. Nexsen, assistant electrical engineer of the Public Service Commission. Mr. Nexsen described how he had measured clearances on the plow-guards used on 58 cars of the Second Avenue line. The noses of 16.7 per cent of the plows were 1 in. and less above the slot rail; of 21.6 per cent, 1 in. to 2 in.; of 33.3 per cent, 2 in. to 3 in.; of 21.6 per cent, 3 in. to 4 in.; of 4.6 per cent, 4 in. to 5 in.; of 2.3 per cent, 5 in to 6 in. Examining the condition of the guards, he had found that 28.6 per cent had the rubber facing worn and 31 per cent had bent frames. The nose clearances in 50 per cent of the plows were greater than the clearances at the sides. The side clearance was the perpendicular distance between the lowest part of the fender and the top of the girder rail.

The last witness was G. F. Daggett, chief of the accident bureau of the commission. Mr. Daggett said that he had from five to seven inspectors who are assigned to report accidents. His files showed that from Aug. 5, 1907, to the date of the hearing there had been 64 accidents on the Second Avenue line in which wheel-guards were concerned. In 23 of these accidents the wheel-guards were involved directly. Of the 64 accidents, 25 resulted in death. Fifteen of these fatal accidents were due to the operation or lack of operation of the wheel-guard. Brainard Tolles, of counsel for the Second Avenue Railroad, objected to Mr. Daggett's production of a more detailed statement as the

evidence showed that the guards were not kept in good condition previous to the present receivership. H. H. Whitman, of counsel for the commission, asserted that the guards were now kept in no better condition than before. Mr. Daggett testified further that many of the fatal accidents were due to portions of clothing being caught under the fender or through the pushing of the bodies.

At the session on June 14, James Griffin, car house foreman of the Second Avenue Railroad, testified with regard to the attachment and care of pilot guards. He also had had charge of some automatic trip fenders on a crosstown line, and had found that they were difficult to maintain in operative condition. George W. Linch, receiver of the company, then gave some details in connection with a wheel guard accident about which Mr. Griffin had been examined. The hearing was then closed.

Car Gates in Birmingham

The Birmingham Railway, Light & Power Company has equipped all of its loop cars with gates, and began a full service with cars so equipped on June 12. In order to prepare the public for the change, the company carried a large advertisement in the daily papers illustrating cars with gates closed and open, with the following comment:

"Commencing to-day we will inaugurate a new system for the prevention of platform accidents. On all loop cars, commencing this morning, will be found wire gates which will be opened and closed by the motorman to allow passengers to get on and off the cars. There are gates on both the front and rear end of the cars, and the motorman closes the gates by a lever before he starts the car. This prevents any one from getting on the car after it has started. When the car is stopped, the motorman opens the gates with the same lever. When the gates are closed no one can get off the car.

"We have studied this system as applied elsewhere and find that it secures excellent results in preventing platform accidents. We are installing it on all our cars as fast as they can be sent to the shops. There is a double reason for trying to reduce accidents; the greatest being our desire to prevent suffering in all forms as caused by street car accidents, and in this effort the public should join us heartily, and the other reason is to reduce our annual expense caused by damage suits and claims growing out of accidents.

"Before passing judgment on the gates see how they operate, study the humanitarian question involved and bring the matter of accident home to your own family. If the use of gates prevents accidents we are mutually benefited and should be satisfied."

Bion J. Arnold on the Width of Chicago's Devil Strip

Bion J. Arnold, of the Board of Supervising Engineers, of Chicago, in a recent letter to the Council committee on local transportation said:

"Were I commissioner of public works, I would issue no further permits for track construction unless the distance between track centers was 10 ft. 2 in.

"It is practicable to secure a greater distance between track centers than 9 ft. 8½ in., the present standard, and it should be done on all future tracks. My original position in this matter was that we should increase the track centers to 10 ft. 2 in. and narrow the cars to 8 ft. 6 in., thus giving a distance of 20 in. between the cars and leaving the space between the sides of the cars and the curbstone the same as it now is. Had this position been sustained by the board, in my judgment we would have a system which would have been much safer than it is with the present clearance of 8½ in. between some of the cars.

"With a space of 20 in. no one is going deliberately to attempt to stand between the cars with the idea that he will be safe in the position, but in case a person is caught between the cars this space will give sufficient room to prevent the person being crushed, and I contend that every additional inch of room that we can get between the cars over the present space of 8½ in. should be secured.

"It is my opinion that if the local transportation committee of the City Council would take a firm stand and pass an ordinance to the effect that the distance between track centers on all tracks that are laid from this day forward in the city shall be 10 ft. 2 in., and that no cars hereafter shall be built which are more than 8 ft. 6 in. over all in width, that it would be done promptly. As time went on the present width cars could be eliminated, and ultimately we would have a reasonably safe traction system, so far as the danger of persons being crushed is concerned."

The committee has agreed to take up the subject in conference with the supervising board at a later meeting.

Advertising Campaign in Savannah.—The Savannah (Ga.) Electric Company has commenced an extended advertising campaign in the local newspapers at Savannah, with the prevention of accidents as the end in view. The illustrations are well-devised examples of "what might happen," and they appear in each paper twice a week.

Agreement Between Employees and the Michigan United Railways.—The terms of a contract between the Michigan United Railways, Jackson, Mich., and its employees to govern terms of service have been agreed upon, but the contract has not yet been formally executed. The company has agreed to recognize the men as the employees' benefit society, the men to be free to join or not to join the employees' association.

Baseball and Limited Train Schedule.—The Cleveland, Painesville & Eastern Railroad, Willoughby, Ohio, has issued a 4-page, vest-pocket baseball and limited train schedule. The Cleveland Club of the American League plays at Willoughby-beach Park, which has become popular for picnics, outings, reunions and conventions and the company has even gone so far as to arrange to sell tickets over its line from Ashtabula, Geneva, Unionville, Madison and Perry which include a 50-cent admission to the ball grounds. A complete schedule of the Cleveland Club at home and abroad is a feature of the publication.

New Flier Between Muncie and Indianapolis.—The Indiana Union Traction Company, Anderson, Ind., has issued a folder describing the new high-speed service between Muncie and Indianapolis. The train making the run is known as the "Muncie Meteor." The folder presents halftone engravings of the parlor cars used for the run and views of the Indianapolis and the Muncie terminal stations. The "Muncie Meteor" leaves Muncie at 8 o'clock each morning and returning leaves Indianapolis at 6 p. m., making the run of 57 miles in 1 hr. 45 min., stopping only at Anderson. Six other fast trains are included in the daily schedule.

Decision Regarding the Height of Steps in Toronto.—The Ontario Railway & Municipal Board has ordered that the floors of the cars operated in Toronto shall not be less than 40 in. above the rail level. In all new cars the standards for steps are to be as follows: Open double-truck cars are to have the bottom step from 14 in. to 16 in. above the ground, and the two upper steps 14 in. to 12 in. higher again. In open single-truck cars the heights are to be, for the bottom steps, 12 in. to 15 in., and for those above, 12 in. to 9 in. The first step of closed double-truck cars is to be 14 in. to 16 in. from the ground. In closed single-truck cars the height is to be 12 in. to 15 in.

"How to See Duluth and Superior."—The Duluth Street Railway, operating in Duluth and Superior, has issued a de luxe folder describing these cities and telling how the points of interest in them can be reached by the company's lines. Particularly interesting features of the publication are two panoramic views of the Duluth-Superior harbor with its heavy lighter and steamship traffic. There is also a map of the cities on which are shown the principal street railway lines and many steamship routes. This map is printed in colors and is somewhat unique in map making. The cover is in colors and has for its subject the picturesque aerial bridge spanning the ship canal. This bridge is 34 ft. wide, 393 ft. long and spans the harbor at a height of 135 ft.

Traffic Folder Issued by the East St. Louis & Suburban Railway.—The East St. Louis & Suburban Railway, East St. Louis, Ill., has issued an attractive traffic circular printed in colors descriptive of its lines. There is a complete list of places that can be reached from East St. Louis and St. Louis with the fare between points. In addition specific instructions are appended for reaching Alton, Belleville, Collinsville, Edwardsville and other places to which the company's lines extend. Alton, Edwardsville, Lebanon, Belleville and other places are described and illustrated. There is also a map of the system. The publication is concluded with a time card of the suburban lines, including the Alton division and connecting lines and the owl cars on the city lines.

Special Newspaper Advertising of the Detroit United Railway.—For several years the Detroit (Mich.) United Railway has operated a high-speed service between Port Huron and Detroit, Mich., over its Rapid Railway division in competition with the Grand Trunk Railroad at a through fare slightly lower than the regular fare of the steam road. A substantial portion of the traffic between Port Huron and Detroit originates in the section of Michigan known as "The Thumb," lying between Lake Huron and Saginaw Bay, and served by a branch of the Pere Marquette Railroad, which terminates at Port Huron. With a view to

inducing the Detroit-bound passengers from "The Thumb" to ride from Port Huron to Detroit over the electric railway, the advertising department of the Detroit United Railway is running advertisements in about 30 local newspapers located along the steam railroad in the territory north and west of Port Huron and mails folders to about 100 hotels located in "The Thumb" district, with the result that people are learning that when they change cars at Port Huron they can reach Detroit by the electric railway as quickly as by steam at a fare slightly less than charged by the steam roads.

Circular Regarding Accident Reports in Indiana.—The Railroad Commission of Indiana has mailed Circular No. 41 to the steam and electric railways in Indiana for the purpose of aiding in the organization of the service necessary in reporting, tabulating and preserving the information to be reported concerning accidents on steam and electric railways. The circular is divided into six divisions, as follows: Who Reports, Preliminary and Final Reports, What Report Shall Contain, What Not to be Reported, Forms for Reports and Mailing Reports. Subdivisions 5, 6 and 7 of Section III, entitled "What Report Shall Contain," follow: All accidents other than those occurring in shops, road houses, power houses, on boats or at wharves, are to be reported whether the persons killed or injured be employees, passengers or other persons when the accident occurred in connection with train movement at depots or depot grounds, in the yards, at terminals or anywhere along the line. If the accident was occasioned on account of defective safety appliances, such as air-brakes, automatic couplers, standard drawbars and handholds, the report must give the numbers and initial of the defective car, point of origin and destination of the freight, if loaded. Where accidents are occasioned by defective or broken rail, give weight and make of rail and date laid.

Fast Through Express Trains.—A fast freight and express train has recently been put in service between Indianapolis and Garrett, Ind., operating over the lines of the Indiana Union Traction Company, the Fort Wayne & Wabash Valley Traction Company and the Toledo & Chicago Interurban Railway. This train is primarily for the use of the United States Express Company, which loads a car at Garrett each day at the connection between the Baltimore & Ohio Railroad and the Toledo & Chicago Interurban Railway to be run through to Indianapolis as a trailer. From Fort Wayne to Indianapolis the express train comprises the trailer, loaded by the United States Express Company, and a freight motor car operated by the Fort Wayne & Wabash Valley Traction Company and the Indiana Union Traction Company. The run from Fort Wayne to Indianapolis, 124 miles, is made each way in four hours. F. D. Norviel, general passenger and freight agent of the Indiana Union Traction Company, states that, although this service has just been started, the through car for the United States Express Company carries a full load both ways each day, in addition to the regular freight and express business of the three interurban systems over which it is operated. By means of this special through service the United States Express Company is enabled to make Indianapolis a distribution point for express matter collected between Chicago and the Atlantic Coast along the line of the Baltimore & Ohio Railroad.

Uniform Wage Scale Adopted by the Public Service Railway.—The Public Service Railway, Newark, N. J., has voluntarily increased the wages of conductors and motormen on its Southern division, with headquarters at Camden. When the property at Camden was taken over by the Public Service Corporation several years ago, the men were receiving a maximum of 17 cents an hour. The company increased this to 19 cents an hour and promised two years ago to put into effect the same scale of wages which prevails on the other divisions of the company's property as soon as the earnings of the Southern division warranted it. In the judgment of the executive officers of the company that time has arrived. The announcement was made to the men during a smoker held at the Camden car barn on June 7. It came as a surprise to the men, as no demand for an increase had been made by them and they were not aware that an increase had been contemplated at this time. The company's action is really an equalization of the wages paid to its trainmen, as the scale which will go into effect July 1 on the Southern division is identical with that which has prevailed for some time on the Northern and Central divisions of the company's property. All the men will now be paid 20 cents an hour for the first year; 21 cents from the second year to the fifth year; 22 cents from the fifth year to the tenth year, and 23 cents after the tenth year. The announcement was made verbally by John Burleigh, vice-president of the company, and N. W. Bolen, superintendent of transportation.

Personal Mention

Mr. George E. Tener has been elected a director of the Philadelphia Company, Pittsburgh, Pa., to succeed Joshua Rhodes, deceased.

Mr. J. H. Reed, Jr., has been elected general controller and purchasing agent of the Philadelphia Company, Pittsburgh, Pa., to succeed Mr. Matthew Bigger.

Mr. Charles H. Hubbell and **Mr. C. F. Handshy** have been appointed joint successors to Mr. A. C. Murray, supervisor of expenditures of the Illinois Traction System, Champaign, Ill., resigned.

Mr. George H. Earle, Jr., was elected at a joint meeting of the Councils of Philadelphia on June 10 to succeed Mr. Clarence Wolf as one of the representatives of the city of Philadelphia on the board of directors of the Philadelphia Rapid Transit Company.

Mr. E. D. Grimes, a director of the City Railway, Dayton, Ohio, and secretary of that company, has been elected president of the company to succeed Mr. D. B. Corwin, whose resignation is announced elsewhere in this column. Mr. Grimes has been connected with the Tower Varnish & Drier Company, Dayton, for 20 years, and is a director of the Dayton National Bank.

Mr. Martin J. Insull, general manager of the Louisville & Northern Railway & Lighting Company, New Albany, Ind., has been appointed operating manager of the Indianapolis & Louisville Traction Company, with headquarters in New Albany. Mr. Insull succeeds Mr. W. S. Kuhn and Mr. J. S. Kuhn, Pittsburgh, who have been acting as operating managers of the Indianapolis & Louisville Railway since the resignation of Mr. A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction Company, Columbus, Ind., about a year ago. Mr. Insull will continue as general manager of the Louisville & Northern Railway & Lighting Company.

Mr. A. E. Reynolds, whose appointment as general manager of the Hudson Valley Railway, Glens Falls, N. Y., was announced in the ELECTRIC RAILWAY JOURNAL of June 5, 1909, was formerly treasurer and general manager of the Plattsburgh (N. Y.) Traction Company. Mr. Reynolds entered the employ of the Plattsburgh Light, Heat & Power Company 18 years ago, and since that time he has been prominently identified with nearly all the movements which have had for their object the betterment of Plattsburgh. He has been associated with the Plattsburgh Traction Company from its formation, becoming treasurer upon the death of D. F. Dobie. He has been general manager of the company since 1903. Mr. Reynolds has for several years been secretary of the Macdonough Club, of Plattsburgh. He was one of the organizers of the industrial branch of the club and has always taken an active part in the work assigned to that branch of the organization.

Mr. L. H. Rodenbaugh has been appointed traffic manager of the Central California Traction Company, Stockton, Cal. Mr. Rodenbaugh was born at Plymouth Meeting, Pa., April 1, 1874. He began his railroad work in 1890 with the Philadelphia & Reading Railroad, with which he served as a telegraph operator. Since then he has held positions with different steam railroads as block signal operator, telegrapher, freight cashier, agent, train dispatcher, ticket agent and traveling passenger agent, serving in these different capacities with the Pennsylvania Railroad, New York, Chicago & St. Louis Railroad, Missouri Pacific Railway, Old Colony Railroad, New York, New Haven & Hartford Railroad and the Southern Pacific Railroad. Mr. Rodenbaugh entered the employ of the Southern Pacific Railroad in April, 1903, as assistant agent. In January, 1905, he was appointed general passenger agent and held that position until quite recently when he resigned to become connected with the Central California Traction Company.

Mr. D. B. Corwin has resigned as president of the City Railway, Dayton, Ohio. Mr. Corwin has been a prominent factor in business and political life in Dayton for about 50 years. He was associated with the Republican State and County executive committees for many years and at one time was chairman of these committees. In 1873, Mr. Corwin was elected State Senator. He was elected State Solicitor in 1867 and was re-elected to that office in 1869. Up to 1880, Mr. Corwin gave his attention almost exclusively to the practice of law. In that year, however, he and Mr. A. A. Thomas organized the Fifth Street Railway, and in 1881 the line was constructed. In 1892 several of the local city lines at Dayton, including the Fifth Street Railway, were consolidated as the Dayton City Railway largely through the influence of Mr. Corwin, who was elected president of the company and has served in that

capacity since that time. Mr. Corwin will continue as a director of the City Railway.

Mr. B. R. Stephens has resigned as general traffic manager of the Illinois Traction System, Champaign, Ill., effective on July 1, to become connected with an Eastern railroad syndicate, the name of which will be announced by Mr. Stephens later. Mr. Stephens has been connected with the Illinois Traction System for eight years. For the last four years he has been general traffic manager of the company, with headquarters in Springfield, and previous to that was connected with the Indiana interests of the company for two years and served for two years at Champaign, Ill. In the capacity of general traffic manager of the Illinois Traction System Mr. Stephens has given his attention largely to freight business, and the rapid growth of this department is attributed largely to his efforts. He also succeeded in bringing about the interchange of freight business between the Illinois Traction System and intersecting railroads. Mr. Stephens has had 20 years' experience with railroads. From the position of trainman he has risen to that of traffic manager of the second largest electric railway system in the world. Mr. Stephens has at various times been connected with the Toledo, St. Louis & Western Railroad, Ohio Southern Railroad, Cleveland, Akron & Columbus Railroad, New York, Chicago & St. Louis Railroad and Chicago & Eastern Illinois Railroad. He will assume the duties of his new position on Aug. 1.

Mr. Arthur N. Dutton has resigned as superintendent of transportation of the Brooklyn (N. Y.) Rapid Transit Company to become vice-president and general manager of the Peerless Motor Car Company, New York. Mr. Dutton was born in Milwaukee in 1873, and until he became connected with the Brooklyn Rapid Transit Company in 1903, had served for many years in railroad work in the West. His business career, however, was begun with the First National Bank, Milwaukee. Mr. Dutton's father, Mr. C. F. Dutton, was general manager of the Milwaukee & Northern Railroad, and Mr. Dutton is said to have been influenced toward a railway career by the record made by his father. Mr. Dutton's first work with the Brooklyn Rapid Transit Company was on the elevated lines. Three months after entering the employ of the company he was made assistant superintendent of the elevated system, and when Mr. George R. Folds resigned as assistant general manager of the company Mr. Dutton was appointed assistant to Mr. J. F. Calderwood, vice-president and general manager, and subsequently was given the title of assistant to the general manager. Later Mr. Dutton's authority was extended and he was appointed superintendent of transportation, in which position he had supervision of the operation of the entire system. It is announced that the duties of the superintendent of transportation of the company will hereafter be cared for from the office of the vice-president, under the direct supervision of Mr. W. S. Menden, assistant general manager and chief engineer.

Mr. William L. Derr, formerly general superintendent of the New York City Railway, has been appointed inspector of the transportation division of the Public Service Commission of the Second District of New York. Mr. Derr succeeds Mr. Edmund F. Van Hoesen, resigned, who has accepted a position under the New York State Engineer. Mr. Derr was educated at the Polytechnic College of the State of Pennsylvania, Philadelphia, and entered railway service in 1876. From 1876 to 1878 he was assistant engineer of the Susquehanna Bridge, Philadelphia, Wilmington & Baltimore Railroad, and from 1878 to 1880 he was connected with the maintenance of way department of the Pittsburgh, Cincinnati & St. Louis Railway. From 1880 to 1883 Mr. Derr was assistant engineer of maintenance of way of the New York & New England Railroad in charge of the relocation of the line between Boston and Newburgh. He next became connected with the Woonsocket & Valley Falls division of the New York & New England Railroad. In 1886 he entered the employ of the New York, Lake Erie & Western Railroad as roadmaster of its Buffalo division and subsequently served as roadmaster of the Delaware division and as assistant superintendent of the Susquehanna division of the company. In 1889 he became connected with the Erie Railroad and served with that company as superintendent of the Jefferson division, superintendent of the Delaware division, superintendent of the Susquehanna division, superintendent of the New York division, and chief engineer, resigning in March, 1905, to become superintendent of the Hartford division of the New York, New Haven & Hartford Railroad. On Feb. 15, 1907, Mr. Derr was appointed superintendent of the Chicago & Alton Railroad, Bloomington, Ill., but resigned from that company on June 30, 1907, to accept the position of general superintendent of the New York City Railway.

Construction News

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

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

RECENT INCORPORATIONS

***Kansas City, Lawrence & Topeka Electric Railway, Rosedale, Kan.**—Incorporated to build an electric or steam railway between Topeka and Kansas City, 67 miles. Headquarters, 408 Gumbel Building, Kansas City Mo. Capital stock, $1,000,000. Incorporators: R. W. Hocker, F. P. Dickson, J. A. Stewart, F. B. Glover, Kansas City, Mo.; D. B. Johnson and R. O. Larson; George Holsinger, Rosedale. It is stated that this company is to take over the Kansas City-Olathe Railway, now in operation.

***Ohio Central Electric Railway, Uhrichsville, Ohio.**—Incorporated in Delaware to build electric railways in Ohio. Capital stock, $500,000. Incorporators: Harry S. Thompson, Uhrichsville; Charles C. Conkle, Pittsburgh, Pa.; Wylie Y. Taylor, Wellsville, W. Va.; Martin E. Smith, Wilmington, Del.

Finleyville Southern Street Railway, Harrisburg, Pa.—Chartered to build a 14-mile railway from Finleyville to Venetia and Bentleyville, crossing the Baltimore & Ohio Railroad by an overhead bridge. Capital stock, $84,000. Incorporators: H. B. Hayden, president; A. E. Hayden, T. M. Hayden, J. E. Hayden, S. C. Wilson, A. H. Anderson, Geo. Englert and Jos. R. Hayden. [E. R. J., April 24, '09.] '09.]

Philadelphia Suburban Traction Company, Harrisburg, Pa.—Chartered to build an electric railway from Southampton, through Davisville and Johnsville, to Hatboro, 3½ miles. Capital stock, $25,000. Incorporators: W. E. Watts, Dubois, president; John L. Grogan, H. C. Case and J. A. Bonnell, Philadelphia; W. A. Merrick, Newton. [E. R. J., April 17, '09.]

***Connell Northern Railway, Tacoma, Wash.**—Incorporated to build an electric railway from Connell to Adrian, with a branch to Ritzville and Tokio. Headquarters, Tacoma. Capital stock, $50,000. Incorporators: H. C. Nutt, F. S. Jarvis and J. L. Taggard, Tacoma.

FRANCHISES

Ensley, Ala.—J. M. Dewberry, president of the Tidewater Development Company, has applied to the City Council for an extension of its franchise to build an electric railway in Ensley.

Phoenix, Ariz.—An electric railway franchise has been granted to Dr. A. J. Chandler, president of the Consolidated Canal Company, by the City Council. [E. R. J., May 29, '09.]

Los Angeles, Cal.—Application has been made by the Pacific Electric Railway to the Board of Supervisors for a franchise to build an electric railway from the city limits of Long Beach on East Seventh Street to Redondo Avenue. The franchise was ordered advertised for sale.

Oakland, Cal.—A. W. Maltby and Joseph Napthaly, of the Oakland & Antioch Railway, have been granted a permit by the Board of Supervisors to use the tunnel, which connects Alameda County with Contra Costa County for building the proposed railway. The recent decision of the Superior Court permitted the issuance of a permit instead of a franchise. [E. R. J., April 24, '09.]

San José, Cal.—Jerry T. Burke has purchased for $11,000 a 50-year franchise for an electric railway on First Street.

Atlanta, Ga.—The City Council has granted to the Georgia Railway & Electric Company a franchise to build a street railway on West Peachtree Avenue and Ponce De Leon Avenue.

Moline, Ill.—Application has been made by the Tri-City & Northeastern Interurban Railway to the village boards of Watertown, Rapids City, Hampton, Port Bryon, Cordova and Albany for 20-year franchises. The franchises provide that the railway shall be in operation within three years after they have been granted by each individual board. The route of the electric railway will be from Watertown to Albany, Ill. [E. R. J., June 5, '09.]

Mound City, Ill.—The City Council has granted to the Cairo & St. Louis Railway a 50-year franchise to build a street railway through Mound City. This proposed electric railway will extend from Cairo to Mounds, via Mound City. [E. R. J., April 10, '09.]

Gladstone, Mich.—At a special meeting held recently in Gladstone a franchise was granted to the Escanaba Electric Street Railway for 30 years. [E. R. J., May 8, '09.]

*Ranier, Minn.—A franchise has been granted to the American Suburbs Company, Minneapolis, to build an electric railway from Ranier to International Falls.

New York, N. Y.—The Board of Estimate and Apportionment has laid over the petition of the Tri-Borough Railroad for a franchise to operate a double-track street railway over the Manhattan Bridge and along the Flatbush Avenue extension, pending a report of the select committee to which it has been referred. [E. R. J., May 8, '09.]

New York, N. Y.—The Third Avenue Railroad has applied to the Board of Estimate and Apportionment for a franchise to construct a double-track street railway from the intersection of Third Avenue and Fifty-seventh Street, Manhattan, upon and along Fifty-seventh street to Second Avenue, to Sixtieth Street, and across the Queensboro Bridge to Jackson Avenue, Long Island City.

*Salisbury, N. C.—A franchise has been granted to N. B. McCanless, J. K. Link, C. L. Welch and J. B. Norwood for the construction of an electric railway from Salisbury to Faith via Granite Quarry, 5 miles south of Salisbury.

*Wahpeton, N. D.—F. L. Strum has applied to the City Council for a franchise to build a street railway in Wahpeton which is to be extended to Breckinridge. Application has also been made to the Breckinridge Council for a franchise.

*Marshfield, Ore.—Application has been made to the City Council by J. M. Blake, who is said to represent Eastern capitalists, for an electric railway franchise.

*Scranton, Pa.—W. S. Connell and J. J. Brown, promoters of the proposed electric railway between Scranton and Lake Ariel, have petitioned the City Council of Dunmore for a franchise to build an electric railway over certain streets of the borough so that it can be connected with the Scranton Railway.

Richmond, Va.—The City Council has granted to the Richmond & Henrico Railway an extension of one year to its franchise from June 30, 1909, to build its proposed railway and viaduct.

*Fayetteville, W. Va.—R. H. Dickinson has applied to the City Council for a franchise to build a street railway and electric light line from Fayetteville to Stuart, connecting with the White Oak Railway.

Walla Walla, Wash.—Application has been made to the City Council, by the Oregon-Washington Traction Company, for an extension of its franchise for the construction of its proposed electric railway to January 1, 1910. [E. R. J., Sept. 26, '09.]

TRACK AND ROADWAY

Edmonton (Alta.) Radial Railway (Municipal).—This company has placed an order for 600 tons of 60-lb. rails and 200 tons of 80-lb. rails for this year's extensions, consisting of about 5½ miles. The contract for this work has been let to Lubbock & Matheson, Edmonton, and it is expected that work will be completed toward the latter part of July. Charles E. Taylor, general manager.

Glendale & Eagle Rock Railway, Glendale, Cal.—E. G. Goode, president, writes that this company has completed and placed in operation a 2½-mile narrow-gage street railway between Glendale and Eagle Rock. At the latter place connection is made with the lines of the Los Angeles Railway, running from Eagle Rock to Los Angeles. The company is negotiating with the Pacific Electric Railway for the purchase of its franchise over the distance between its Glendale line and the terminus of the new line. The company proposes to construct this connecting link within 90 days providing the franchise can be secured. The company is an independent one and at present is only operating one car. Power is rented from the Pacific Light & Power Company, Los Angeles. Capital stock, $25,000. Headquarters, 329 Cedar Street, Glendale. Officers: E. D. Goode, president and treasurer; Geoge Benson, vice-president; R. E. Goode, secretary. [E. R. J., May 1, '09.]

Pasadena Rapid Transit Company, Pasadena, Cal.—This company, which proposes to build an elevated electric railway between Los Angeles and Pasadena, will abandon the old cycleway entrance into Pasadena between Raymond and Fair Oaks Avenue, and will select another route from several which are now under consideration. [E. R. J., Jan. 16, '09.]

Denver-Greeley Electric Railway, Greeley, Col.—The City Council has accepted the $25,000 bond put up by this company which proposes to build an electric railway in Greeley. The company will commence work within a few days, starting on Seventh and Twelfth Avenues and Nineteenth Street, encircling the south part of the city. The railway will be extended to Denver.

Connecticut Company, Hartford, Conn.—It is stated that this company, which recently placed in operation a new line between Hartford and Middletown, is now planning to extend it from Middletown to Durham, a distance of about 4 miles.

Shore Line Electric Railway, New Haven, Conn.—The House has passed a resolution amending the charter of this company and providing for an important extension of its lines. The company proposes to build a connection from Guilford to meet the Connecticut company's lines at Stoney Creek and it will then run a line along the highway from Essex through the Meadows Woods Road, Deep River, Chester and through Boston Street in Guilford, through North Branford, Totoket and Foxon and into New Haven.

Baltimore & Washington Transit Company, Washington, D. C.—The District Commissioners have issued a permit to this company to construct the extension of its lines within the District. The Baltimore & Washington Transit Company has a State charter to construct a railway not only to Baltimore, but also to Gettysburg. The present construction work is with a view to obtaining a Washington terminal for the line. The contract for the extension has been awarded to Allen & Kefauver, Washington. William A. Mellen, vice-president and general manager.

City & Suburban Railway, Brunswick, Ga.—This company has awarded a contract to John F. Glenn, Atlanta, for furnishing the rails to be used in the construction of this proposed railway. This line is to extend 3 miles east and west and 3 miles north and south. Work on its construction will be undertaken at once. [E. R. J., March 20, '09.]

Vincennes, Centralia & St. Louis Transit Company, Centralia, Ill.—This company has filed for record at Lawrenceville a mortgage to the Illinois Trust Company, East St. Louis, for $2,500,000. The company proposes to build an electric railway from St. Louis, Mo., to Vincennes, Ind. Burns & Company, Isabella Building, Chicago, are said to be interested in this project. [E. R. J., June 27, '08.]

Illinois Traction System, Champaign, Ill.—It is stated that this company is preparing to begin work on its terminals in St. Louis, Mo., which it will enter by means of a new bridge that the company is erecting over the Mississippi River from Salisbury Street, in St. Louis, to Venice, Ill. It is expected to complete and put in use this structure by Jan. 1 next. The company has about 250 acres of land in St. Louis, and will build freight yards. These improvements at St. Louis are estimated to cost $5,000,000. The bridge will cost half of that, and it is designed to accommodate highway traffic and pedestrians, as well as the trains of the interurban railway. The power-house for the company will be on the Illinois shore. Steel has been received for the track in St. Louis and for the upper work of the bridge.

Charleston, Westfield, Marshall & Terre Haute Electric Railway, Charleston, Ill.—Announcement is made that this company will soon begin the construction of its proposed 12-mile electric railway. Practically all of the right-of-way between Charleston and Westfield has been donated by land owners. Three surveys leading out of Charleston have been made. It will be necessary to construct a concrete bridge. N. S. Cook, engineer. [E. R. J., Feb. 20, '09.]

Columbus, Greenburg & Richmond Traction Company, Indianapolis, Ind.—This company, which proposes the construction of an electric railway, 90 miles in length, from Columbus to Richmond, is said to be ready to discuss a contract with contractors who might be willing to accept part or all of the contract price in first mortgage bonds of the company for construction, etc. The company is also considering the advisability of installing gasoline motor cars. Officers: Aug. M. Kuhn, Indianapolis, president; R. E. Moore, 116 South Audubon Road, Indianapolis, secretary; Walter E. Moore, Richmond, treasurer. [E. R. J., March 27, '09.]

Indianapolis Union Railway, Indianapolis, Ind.—Contracts for the grading, concrete work and steel to be used in the East Washington Street track elevation have been let by the Indianapolis Union Railway Company with the approval of the city. The contracts amount to about $150,000. The contract for the steel was let to the McClintic-Marshall Company, Pittsburgh, who will also get the contract for erecting the steel. The American Construction Company, Indianapolis, received the contract for the grading and concrete work. The elevation across Washington Street will include five concrete arches with five passageways for pedestrians, vehicles and cars.

Covington & Southwestern Railway, Kingman, Ind.—This company is reported to have begun work at Kingman on its proposed electric railway which is to extend from Kingman to Crawfordsville and Covington. Coal Creek, Wallace, Alama and Yountsville will also be connected. The principal business will be the carrying of coal, but a pas-

senger service will also be maintained. Capital stock, $750,000. Officers: William C. Ruhl, president; B. E. Jones, secretary; Harmon W. Campbell, treasurer. [E. R. J., April 10, '09.]

Davenport & Manchester Interurban Railway, Davenport, Ia.—At an adjourned meeting of the board of directors of this company the following officers were elected: L. M. Matthews, president; J. A. Voorhees, Monticello, vice-president; F. W. Rank, Moline, secretary; R. F. Hilligan, Davenport, treasurer. The right of way was surveyed several months ago and the services of J. F. Cross, Chicago, Ill., were secured to head the building of the railway. [E. R. J., June 20, '08.]

***Baltimore, Md.**—Henry J. C. Hoffman and others are said to be organizing a company to build an electric railway between Brooklyn, a suburb, and Glenburnie, Md., about 5 miles. It will be called the Brooklyn, Cedar Hill & Furnace Creek Electric Railway.

Boston, Lowell & Lawrence Electric Railroad, Boston, Mass.—This company has petitioned the Railroad Commissioners for a certificate authorizing it to construct an interurban electric railroad between Lowell and Lawrence and connecting both cities with Boston. The plan is to provide an electric railroad operating over private right-of-way, with no grade crossings. If the approval of the Railroad Commissioners is obtained, the railway expects to furnish popular service with a running time of 35 minutes from Lowell to Sullivan Square, 40 minutes from Lawrence, 20 and 25 minutes between Lowell and Lawrence. Directors: Paul Butler, Spencer Borden, Jr., Butler Ames, Oakes Ames and John Burnett.

Missouri, Inland & Southern Railway, Licking, Mo.—E. C. Young writes that construction work will probably be started by Oct. 1 on this new railway which is to extend from Rolla to Lecoma, Anutt, Lenox and Licking, a distance of about 40 miles. The railway will serve directly 200,000 acres of farming land and about 100,000 acres of heavy pine timber which at present is, at least, 25 miles from a railroad. It is the intention to operate gasoline electric cars. Repair shops will be erected at Licking. Capital stock, authorized, $400,000; issued, $40,000. Officers: E. E. Young, president and general manager; A. H. Bradford, vice-president; E. C. Halbert, secretary; D. M. Meadows, treasurer. Hugh G. Palmer, Box 305, Aurora, Ill. [E. R. J., June 5, '09.]

St. Louis, Montesano & Southern Railway, St. Louis, Mo.—This company has executed a deed of trust to the St. Louis Union Trust Company, trustee for bondholders, covering all its properties for $2,500,000, for three years at 5 per cent. The document is in the nature of an amendment to the deed of trust for the same amount executed some time ago and is the first step in a plan to revive the project to construct an electric railroad from St. Louis to Flat River, a distance of 63 miles. The first deed required that the bonds of the company be sold for cash, while the new document makes them available for construction purposes, it was explained by an official of the company. At present about 8 miles of the railway extending from St. Louis as far as the company's power house is nearly completed. The plan of the company is to complete the line as far as the power house and begin the operation of cars over that distance. The balance of the line will be constructed after that is in operation.

Morris County Traction Company, Morristown, N. J.—Announcement is made that this company will place in operation on June 19 its line between Summit and Elizabeth. By an arrangement with the Public Service Railway the company's cars will be run over the Public Service line from the connecting point of the two lines in Morris Avenue, Elizabeth, to the railroad station in that city.

Champlain & Sanford Railroad, Albany, N. Y.—The Public Service Commission of the Second District has granted the application of this company for a change of motive power so that its proposed railway may be operated by electricity or by oil-burning locomotives. Under the terms of the original order the railway was to be operated by electricity. [E. R. J., Aug. 22, '08.]

South Flatbush Railroad, Brooklyn, N. Y.—This company has applied to the Public Service Commission for permission to issue $30,000 of stock and for a certificate of public convenience and necessity. The company, of which John C. Langan is president, was incorporated in January to build an electric street railroad line 3 miles long in the Flatbush section of Brooklyn. [E. R. J., April 17, '09.]

Rochester & Eastern Rapid Railway, Geneva, N. Y.—It is reported that this company will build an extension from Geneva to Penn Yan.

Metropolitan Street Railway, New York, N. Y.—The receivers of this company have placed an order with the Pennsylvania Steel Company for the following rails: 400 tons 9-in. girder rail in 59-ft. 11⅞-in. lengths; 50 tons 7-in. girder rail in 59-ft. 11⅞-in. lengths; 325 tons 7-in. girder rail in 53-ft. 11⅞-in. lengths. The receivers have also placed an order for 598 tons of channel rails for the electric conduit with the Lorain Steel Company.

Rochester Railway & Light Company, Rochester, N. Y.—Permission has been granted by the Public Service Commission of the Second District to the Rochester Railway & Light Company and the Buffalo, Lockport & Rochester Railway, to cross the Lyell Avenue grading of the New York Central & Hudson River Railroad. The Buffalo, Lockport & Rochester Railway can now run its cars into Rochester.

Rockland Railroad, Suffern, N. Y.—The Public Service Commission of the Second District has authorized the Rockland Railroad to construct and operate its line in Rockland County, and to exercise franchises in the villages of Piermont, Grand-View-on-Hudson, Nyack, South Nyack, Haverstraw, West Haverstraw, Spring Valley and Suffern, and in the towns of Clarkstown, Stony Point, Orangetown, and Ramapo. A franchise has also been received from the county Board of Supervisors. The permission given will enable the company to construct electric railway lines throughout the greater part of Rockland County.

***Salisbury, N. C.**—It is stated that N. B. McCanless, J. K. Link, C. L. Welch and J. B. Norwood, Salisbury, are interested in a plan to build an electric railway from Salisbury to Faith via Granite Quarry. The enterprise is said to be awaiting termination of negotiations with the Southern Power Company, after which active work is to begin immediately.

Shawnee Electric Railways, Shawnee, Okla.—This company advises that it will probably be ready within 60 days to take up the construction of its proposed railway which is to connect Shawnee, Dale, McLoud, Harrah, Choctaw City and Oklahoma City, a distance of 38.58 miles. Catenary construction will be installed. Twelve cars will be purchased. It is also proposed to furnish power for lighting. Officers: C. T. Edwards, president; A. Hardgrave, vice-president and general manager; R. E. Pugh, secretary and treasurer. [E. R. J., June 5, '09.]

***Baker City, Ore.**—According to press reports Anthony Mohr, who represents Portland capitalists, is making preparations to begin the surveys for the proposed electric railway in Baker City and an interurban line from Baker City to North Powder.

***Woodlawn Electric Railway, Beaver, Pa.**—This company is reported to have begun the construction of an electric railway between Woodlawn and Sheffield. Officers: J. A. Newell, Newell, W. Va., president; J. F. Reed, Beaver, secretary; M. J. Allison, Beaver, treasurer.

***Freedom, Pa.**—It is stated that Barker, Barker & Owens, civil engineers, Beaver, Pa., have completed the survey for E. B. Shilton, Freedom, and Pittsburgh capitalists, of a proposed 8-mile street railway from Freedom to Crider's Corners, at the intersection of the Pittsburgh, Harmony, Butler & New Castle Railway. A part of the right-of-way has already been secured. The new line will be equipped with electric locomotives for handling freight traffic.

Central Pennsylvania Traction Company, Harrisburg, Pa.—The shareholders of this company have authorized a bond issue of $300,000 for the purpose of building certain extensions and making other improvements. This new work will include the construction of the line from Lucknow to Dauphin, extension of the Second, Third and Fourth Street lines to Division Street, and the erection of a large addition to the car house on North Cameron Street.

Chambersburg, Greencastle & Waynesboro Street Railway, Waynesboro, Pa.—It is stated that this company has decided to build its proposed railway from Chambersburg to Red Bridge.

Waynesburg & Monogahela Electric Railway, Waynesburg, Pa.—This company has awarded to John R. Bennett, Fairmont, W. Va., the contract for grading 34 miles of roadbed from Waynesburg to Millsboro, with a branch to Carmichaels and Rice's Landing. [E. R. J., May 29, '09.]

Red Springs Street Railway, Mount Pleasant, Tex.—This street railway is now being built from Mount Pleasant to Red Springs, a distance of 1⅛ miles. About one-half of the track has already been laid and will be completed within a few days. Gasoline motor cars will be operated. Track is being laid with 35-lb. steel rails. [E. R. J., Feb. 13, '09.]

Norfolk City & Suburban Railway, Norfolk, Va.—It is stated that this company will shortly extend its railway from Oaklett to Kempsville. The line now extends from Campostella Heights to Indian River Park and connects

at Campostella with the Norfolk-Berkley division of the Norfolk & Portsmouth Traction Company.

Hinton Street Car & Transportation Company, Hinton, W. Va.—This company advises that it plans to build 3 miles of track which will be operated with Stover motor cars. In the future a change to electricity may be considered. [E. R. J., June 5, '09.]

SHOPS AND BUILDINGS

San Diego (Cal.) Electric Railway.—This company has purchased property on Fifteenth Street, from K to M, to be used as the site for its car house. The total frontage on Fifteenth Street is 600 ft., and each block extends back 200 ft. Plans are now being drawn for a building to cover almost the entire area. It will be built of brick, concrete and steel.

Washington, Alexandria & Mount Vernon Railway, Washington, D. C.—This company proposes to rebuild its passenger station at Fairfax, Va.

Illinois Traction System, Champaign, Ill.—It is announced that this company will erect in St. Louis a small passenger station at Broadway and Salisbury Street and another at Ninth Street and Branch Street, where land has been bought to straighten the line. A depot for handling merchandise freight will be constructed near the heart of town. A decision is not yet reached concerning the main passenger station, which will cost $250,000 or more. No plans will be made until a satisfactory downtown site is obtained.

Indianapolis Traction & Terminal Company, Indianapolis, Ind.—The West Washington Street car house and paint shop of this company burned on June 9, entailing a loss of $50,000, fully covered by insurance. Two interurban and four city cars being repaired and repainted were destroyed. A fire wall prevented the further destruction of the shops and power house.

Vincennes Traction & Light Company, Vincennes, Ind.—This company has awarded to J. A. Keller the contract for the construction of a new car house in Vincennes. The plans, which were prepared by John W. Gaddis, call for a brick and steel structure covering the whole of the grounds where the present buildings are located on Fairground Avenue.

Wallkill Traction Company, Middletown, N. Y.—This company advises that it is at present building a new car house, which is to be over 200 ft. long.

Central Pennsylvania Traction Company, Harrisburg, Pa.—This company expects to build a concrete addition to its car house on Cameron Street on the same plan as the present structure.

Salt Lake & Ogden Railway, Salt Lake City, Utah.—Sidney Bamberger, vice-president of this company, announces that contracts will be let during the next few months for the erection of a large car house, repair shop, etc. The company is now engaged in electrifying its railway from Salt Lake City to Ogden.

Walla Walla Valley Traction Company, Walla Walla, Wash.—It is stated that this company in connection with the Northwestern Gas & Electric Company is considering the erection of a structure at the corner of Sixth Street and Rose Street, to be used as local offices of both these companies, as well as a freight depot for the city and interurban railways.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis.—This company has commenced grading work on its 30-acre tract of land, located on McKinley Boulevard, from Thirty-eighth Street to Fortieth Street, preparatory to the building of its new repair shops.

POWER HOUSES AND SUBSTATIONS

Washington, Baltimore & Annapolis Railway, Washington, D. C.—This company has engaged the Cleveland Construction Company, Cleveland, Ohio, to engineer and superintend the reconstruction of its power facilities from 6600-volt a. c. to 1200-volt d. c. The new work includes the erection of new substations and the re-equipment of the present transformer stations, also the erection of high-tension and feeder wires.

Rochester Railway & Light Company, Rochester, N. Y.—This company has closed a contract with the Rochester, Charlotte & Manitou Railway to supply it with power for the future operation of its railway. [E. R. J., June 5, '09.]

Salt Lake & Ogden Railway, Salt Lake City, Utah.—This company advises that it expects to place contracts during the next 20 weeks for the construction of a 2500-kw power station. The company also expects to purchase equipment for the same.

Manufactures & Supplies

ROLLING STOCK

Louisville (Ky.) Railway is in the market for 35 cars, it is rumored.

United Railways Company, St. Louis, Mo., it is reported, will construct one car a week in its shops.

United Railways Company, Portland, Ore., has purchased two double-truck cars from the American Car Company.

Western New York & Pennsylvania Traction Company, Olean, N. Y., has purchased two more cars from The J. G. Brill Company.

Pittsburgh (Pa.) Railways will purchase 100 city cars and 30 interurbans. No contract has been closed, as previously mentioned.

Northern Texas Traction Company, Fort Worth, Tex., will have specifications drawn soon for four interurban car bodies for service on the Fort Worth-Dallas line.

Tacoma Railway & Power Company, Tacoma, Wash., will soon buy four large combination city cars. Stone & Webster, general managers, will draw up the specifications.

South Dakota Central Railway, Sioux Falls, S. D., has had a gasoline motor car especially built for service on 67 miles of its road. The car has a 30-hp four-cylinder auto engine.

Chicago (Ill.) Railways is reported to contemplate the purchase of 300 cars. This rolling stock is in addition to the 350 pay-as-you-enter cars recently ordered from the Pullman Company.

Grand Forks (N. D.) Street Railway has purchased one 18-ft. closed motor car equipped with Brill 21-E trucks and two GE-800 motors from the Dorner Railway Equipment Company, Chicago.

Utica & Mohawk Railway, Utica, N. Y., has purchased a sprinkler car with a capacity of 3000 gal. from the American Car Sprinkler Company, Worcester, Mass. This car was recently placed in service.

Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind., lost one large combination interurban car in a fire which destroyed the Indianapolis Traction & Terminal Company's car barns.

Nashville (Tenn.) Interurban Railway is in the market for the following second-hand material: One double-truck motor work car, one 40-ton electric locomotive, motor and trailer ballast cars, all for 500-volt d. c. operation.

San Jose & Santa Clara County Railroad Company, San Jose, Cal., has purchased five second-hand open side-seat cars from the United Railroad Company, of San Francisco. The cars seat 48, weigh 14 tons and are 40 ft. long over vestibules.

Central California Traction Company, San Francisco, Cal., is in the market for seven interurban cars. While the plans for these cars have not yet been drawn, it has been announced by the company that each car is to have a total weight of from 37 to 40 tons.

Puget Sound Electric Railway, Tacoma, Wash., as reported in the ELECTRIC RAILWAY JOURNAL of May 22, 1909, will buy one 55-ft. motor car and one 55-ft. trailer parlor car similar to those now being operated. Stone & Webster, Boston, Mass., general managers.

Indianapolis Traction & Terminal Company, Indianapolis, Ind., suffered a loss by fire of one interurban freight trailer, one large double-truck closed car, three single-truck closed cars and 10 single-truck open cars, when the company's West Washington car barns were destroyed by fire on June 9.

Dallas (Tex.) Consolidated Electric Street Railway has bought through Stone & Webster two cars from the Cincinnati Car Company, to be mounted on Brill 27 GE-1 trucks equipped with four GE-81 motors, K-28 J controllers and air brakes. Report of this contemplated purchase was made in the ELECTRIC RAILWAY JOURNAL of June 5, 1909.

Ohio Electric Railway, Cincinnati, Ohio, is having a number of its cars lengthened to accommodate express matter, under a new contract the company has closed with the United States Express Company. The work is being done in both the company's shops and those of the Cincinnati Car Company. The railway company is also constructing a number of new cars in its own shops.

Northern Texas Traction Company, Fort Worth, Tex., has purchased through Stone & Webster 12 28-ft. and one 21-ft. closed car bodies from the Cincinnati Car Company. The larger cars will have Standard Motor Truck Company's O-50 trucks, with four GE-81 motors, K-28 J controllers, with contactors and air brakes. Mention of the contem-

plated purchase of these cars was made in the Electric Railway Journal of May 8, 1909.

Houston (Tex.) Electric Company, mentioned in the Electric Railway Journal of May 1, 1909, as being in the market for cars, has ordered five double-end and 15 single-end cars from the Cincinnati Car Company through Stone & Webster. The double-end cars will be mounted on Standard single trucks and the single-end cars on Brill 21-E trucks. All the cars will be equipped with two GE-80 motors each and K-11 H controllers with contactors.

Helena Railway, Light & Power Company, Helena, Mont., has drawn the following specifications for the two single-truck closed cars ordered from the Cincinnati Car Company, as reported in the Electric Railway Journal of Feb. 13, 1909:

Seating capacity..32 persons	Heaters ..... Consolidated
Length of body...21 ft. 8 in.	Headlights ..... Dayton
Length over vest..31 ft. 8 in.	Journal boxes .....Peckham
Width over posts..8 ft. 3 in.	Motors 2 GE-80
Sill to roof.....8 ft. 10½ in.	Registers ..... International
H'ght rail to sills.2 ft. 4⅞ in.	Roofs ..... Monitor
Body ..... wood	Sanders .....C. C. Co.
Interior trim .....cherry	Seats .....Hale & Kilburn
Underframe ..... Composite	Seating material .....rattan
Bumpers .....steel angle	Step treads....Carborundum
Couplers.....C. Car Co. type	Trolley base.....U. S. No. 6
Curtain fix....Curtain S. Co.	Trucks ..... Peckham
Curtain material...Pantasote	Special....Wallace door fix.
Hand brakes..... Peacock	

TRADE NOTES

U. S. Wood Preserving Company, New York, N. Y., has moved its New York offices to 165 Broadway.

General Electric Company, Schenectady, N. Y., advises that its Montana office was moved to a new location in the Phoenix Building, Butte, on June 1.

E. F. Quirke, of the New York office of H. W. Johns-Manville Company, New York, N. Y., has resigned. Mr. Quirke represented this company in the South.

Standard Underground Cable Company, Pittsburgh, Pa., announces that it will remove its San Francisco office from the Shreve Building to the First National Bank Building, on June 15.

Lord Electric Company, 213 West Fortieth Street, New York, N. Y., advises that the large order recently announced is for all the electrical work and railway construction on the Manhattan Bridge from New York to Brooklyn.

Harrisburg Foundry & Machine Works, Harrisburg, Pa., announce that F. W. Jackson, for a number of years in the company's engineering and sales departments, has been appointed district manager of the Baltimore district, with headquarters at 1415 Continental Trust Building.

McKeen Motor Car Company, Omaha, Neb., announces that F. J. Jumper, formerly assistant mechanical engineer for the Union Pacific Railroad Company at Omaha, has resigned to accept the position of mechanical engineer of the McKeen Motor Car Company, at Omaha, Neb.

U. S. Metal & Manufacturing Company, New York, N. Y., announces that it has secured the services of Arthur Masters as salesman in the railroad department. Mr. Masters was formerly assistant superintendent of the Crescent Shipyard and for the past few years consulting engineer for the Panama Railroad Company and Isthmian Canal Commission. He succeeds Charles R. Day, resigned.

Barney & Smith Car Company, Dayton, Ohio, held its annual meeting on June 1. The directors were all re-elected with the exception of Col. John D. Platt, who retired in favor of his son, Frank Platt. The directors elected the following officers: A. M. Kittredge, president; H. M. Estabrook, vice-president and general manager; J. F. Kiefaber, secretary and treasurer; E. A. Oblinger, assistant secretary and treasurer.

Westinghouse Electric & Manufacturing Company, Boston, Mass., officers and employees, and officers and employees of the Westinghouse Machine Company; Westinghouse, Church, Kerr & Company; the Westinghouse Air Brake Company; the Cooper Hewitt Electric Company and the Nernst Lamp Company to the number of 65 enjoyed an outing at Salem Willows, Mass., on June 7. The party was headed by George C. Ewing, and transportation was furnished free of charge by the Boston & Northern Street Railway.

Crocker & Ketchum, Denver, Col., is the title of a new engineering firm formed by Herbert S. Crocker and Milo S. Ketchum, with offices at Suite 438, 811 Seventeenth Street, Denver, Col. The firm offers its services in connection with the following: Steel and reinforced concrete bridges; steel and reinforced concrete building construction; mill and mine buildings and structures; irrigation structures; grain elevators; bins; retaining walls; dams; foundations; examinations; valuations and reports. They are also representatives of the American Bureau of Inspection & Tests.

ADVERTISING LITERATURE

Pathé Frères, New York, N. Y., have added Sardou's famous tragedy "La Tosca" to their moving picture films.

Borne, Scrymser & Company, New York, N. Y., are mailing price lists of their "Colonial" brands of motor oil, grease and gear case compound.

H. W. Johns-Manville Company, New York, N. Y., is issuing folders on "Keystone" hair insulator for heat insulation of houses, and on "Regal" roofing.

Pettingell-Andrews Company, Boston, Mass., prints in the June number of *Juice* a number of interesting notes on "Victor" insulators, tungsten street lamp fixtures and other electrical subjects.

Dearborn Drug & Chemical Works, Chicago, Ill., has prepared a valuable booklet entitled "Lubrication versus Friction." This publication contains considerable data on the properties and testing of lubricants.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is sending out folder No. 4132, which presents brief illustrated descriptions of Westinghouse motor applications in the office, store, shop and home.

Buda Foundry & Manufacturing Company, Chicago, Ill., has published a booklet illustrating its numerous types of motor cars and velocipedes for track inspection service. This publication also describes the Buda pressed-steel wheels made from 14 in. to 24 in. diameter.

American Blower Company, Detroit, Mich., is mailing to its friends a pretty colored card showing a baby blowing out a candle, and appropriately named "A Little Blower." The other side of the card bears an invitation to visit the company's exhibit at Atlantic City, N. J., June 16 to June 23.

National Tube Company, Frick Building, Pittsburgh, Pa., has recently issued an attractive two-color folder describing the advantages of Shelby seamless steel trolley poles, especially of the Standard "A" trolley poles, and showing the results of tests to which these poles have been subjected.

National Electric Lamp Association, Cleveland, Ohio, has prepared an extensive bulletin on tungsten sign lamps with light and power cost curves, wiring, spacing, etc. It has also published a pocketbook giving important data on carbon, gem and tungsten incandescent lamps of different candle-powers and shapes.

General Electric Company, Schenectady, N. Y., announces the following bulletins: No. 4661, on aluminum lightning arresters for a.c. circuits; No. 4662, Thomson recording wattmeters for switchboard service; No. 4663, multigap lightning arresters for alternating currents; No. 4669, Curtis steam turbines for low pressure and mixed pressure.

Western Electric Company, New York, N. Y., has printed a unique booklet entitled "An International Achievement," telling how it supplied a 10,000-subscriber line switchboard to replace one destroyed by fire in Paris, France. The board was built at the Hawthorne, Ill., works, 5000 miles from Paris, and was in service on Nov. 30, 1908—less than 60 days after a definite order had been given.

Industrial Instrument Company, Foxboro, Mass., has had binders made for its 8-in. x 11-in. engineering bulletins, and will send these binders on the application of its engineering friends. The company supplies data on its instruments in the form of engineering bulletins, each being devoted to a certain line or class of meters, or to those instruments of different classes that group themselves conveniently for a certain industry. The various bulletins published by this company are 8 in. x 11 in. in size and are punched for binding together in the new covers.

Graphite Lubricating Company, Bound Brook, N. J., has issued a pamphlet which has for its subject the company's graphite bushings. The company tells about the development of these bushings and how they have met the requirements of naval constructors, steam turbine and gas engine builders and users, woodworking machinery makers and users, and how the bushings have complied with the exacting demands of railway service in trolley wheels. The company concludes the booklet with a list of users of its product which includes many of the largest railroads and manufacturers of machinery in the United States.