Street Railway Journal

Vol. XXV. NEW YORK, SATURDAY, JANUARY 14, 1905. No. 2.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of issue. New advertisements will be accepted up to noon of Tuesday for the paper dated the following Saturday.

TERMS OF SUBSCRIPTION

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

Street Railway Journal (52 issues).............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

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

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid...................... $6.00
25 shillings. 25 marks 31 francs.

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1905, to date, 18,000 copies—an average of 9000 copies per week.

Through Service on Interurban Lines

We hear much in these days of the completion of through interurban electric railway routes between important cities, such routes being frequently made up of a long chain of interurban roads owned and operated by different companies. The completion of such routes is frequently heralded as an important event, as it often is, but it is doubtful whether either the public or electric railway men in general have analyzed the matter sufficiently to know just what bearing the fact that these through routes exist may have on the transportation business. It is frequently forgotten that the most important thing about a long continuous interurban route is not so much the facilities it offers for travel from one end of the route to the other as the possibilities for local business between various links of the chain. For example, there are now interurban lines by which one can travel from Indianapolis, the capital of Indiana, to Columbus, the capital of Ohio. Now, to our minds, the thing of most present importance in such a chain of interurban roads as this is that there is a chance for local travel by means of the interurban road between various points intermediate between Indianapolis and Columbus. On account of the length of the journey and the great amount of time consumed in traveling the whole distance from Columbus to Indianapolis by interurban cars, it is hardly safe to assume that any great amount of day traffic will be diverted from the steam railroads, but it is of importance to every interurban road in that chain that at its terminals are interurban lines connecting with the country beyond. It virtually adds a certain amount to the tributary population of each road. For distances of 60 miles to 80 miles, and possibly a little more, the limited service that is being inaugurated on many interurban lines is such a strong competitor of the steam railroad for local business that one might almost consider the steam railroad to be out of the race. For through passenger traffic between points over 80 miles apart, the interurban is considerably at a disadvantage, and from the nature of its service always will be unless something can be worked out in the way of sleeping car service which will enable traveling men to make a comfortable night's ride between towns 100 miles to 200 miles apart. As we have said before, we believe there is an opportunity for some such service, as it would fill a need of the transportation business that is not now supplied by steam railroads.

The Technical Graduate in the Repair Shop

A number of students in electrical engineering, after graduation from a university, find their way into street railway repair shops. A better place to get a general understanding of apparatus, a knowledge of men and a familiarity with handling current, could hardly be selected. If the young man enters into the work with the proper spirit, he will soon acquire such an understanding and knowledge of the electrical equipment of cars in particular and of electrical apparatus in general as can be gained in no other way. There is hardly a car shop where the work is limited simply to cleaning the cars and replacing worn parts. Trouble of some sort with the electrical apparatus is always present, and trouble is what the recent graduate is after. Its occurrence not only shows him the weak points of the apparatus, but it makes him do some hard thinking—first, to discover the trouble; second, to eliminate it, and lastly, to avoid its repetition. The weak points of the apparatus are brought forcibly before him, and if he has any ingenuity he will naturally attempt to improve the faulty apparatus.

The ability to handle current, too, is an acquisition of considerable value. The voltage carried by street railways, while not high enough to be regarded as fatal, is, nevertheless, sufficiently great to require caution in handling it. After a careless workman has gotten one or two good "jars" he will become cautious without any further instruction. After familiarizing himself with current at 600 volts, it is safe to say that the student will exercise the proper amount of care when handling higher voltages.

The opportunity to study the characteristic traits of workmen in a car shop is not to be overlooked. Street railway workmen seem to fraternize closer than men in other vocations, and this close relation, from which the student will not be debarred if he conducts himself properly, will give him chance to learn men in a manner that hardly any other position would admit. This fellowship feeling also aids the student in another manner. The workmen with years of experience are ever willing to give him any information they may possess. This information, of course, does not involve calculus, but it is that kind which can only be gotten by actual contact with apparatus, and is equal in value to the purely technical.

It may be hard for the technical graduate to find a dirtier job than that in the repair shop, but it is a question whether he can find anywhere else a place where he can learn so much in a practical way in so short a time.

The Multiple-Unit System for Suburban Service

A communication from one of our readers recently published in these columns inclined rather strongly to the use of electric locomotives instead of the multiple-unit system for the electrical equipment of the suburban service of steam railroads. The multiple-unit system has practically conquered the entire field of elevated railway service in the United States, and its fitness for this class of service is therefore hardly open to question at this time, when the change to the multiple-unit system is being made by the only elevated railway companies which have not heretofore employed it. The essential question then is, Are conditions of suburban service on steam railroads so essentially different from those on elevated railways as to call for a different plan of operation? Steam railroad suburban service, it is true, is different from elevated railway service in some particulars, but it appears to us that these differences are such that they constitute even stronger arguments in favor of the multiple-unit system as against individual locomotives in suburban service than can be advanced on elevated railways.

We are, of course, here considering suburban service pure and simple, without any relation to the hauling of through trains in and out of city terminals. Any tenable argument in favor of electric locomotives instead of the multiple-unit system for the ordinary run of steam suburban service in and out of large cities must be based on the assumption that the present service from steam locomotives is entirely satisfactory as regards speed and reliability. This assumption, however, is not by any means a safe one to make. It may be perfectly true that the present schedules of most suburban lines of steam railroads, as shown by the time-tables, are satisfactory, and there is no need of going to great expense to improve upon them, but that tells only a part of the story. The trouble is not with the schedules or the time-tables, but with the ability of the suburban trains to maintain these schedules during the rush-hour traffic.

During the past ten years the writer has had occasion to patronize regularly for daily transportation at various times some eight different steam railroad companies operating suburban service out of four of the largest American cities and one elevated railway operating steam locomotives. These daily experiences with suburban steam service demonstrate conclusively the fact that steam suburban service cannot maintain the same schedule speed during the rush hours as during the middle of the day, although the time-table almost invariably gives the same running time. What is supposed to take place and what actually does take place are two very different things. In steam railroad suburban service during the middle of the day, a few heavy locomotives are kept operating over the line with very light trains, and the maintenance of schedules is extremely easy; so easy, in fact, that the engineer almost loiters along the road. During the rush hour there is an enormous and sudden increase in traffic, greater if anything than is experienced by either elevated or street railways, because the steam suburban business is essentially commuter business and consists of taking people to their work in the morning and back at night. Owing to the infrequency of trains during the middle of the day, traffic seeks other means of transportation if it is available. This might be changed with the adoption of electric traction, but as conditions are at present, the morning and evening traffic peaks are enormously high compared with that during the day. Thus we see on a steam railroad operating three-car suburban trains at one-hour intervals during the day, that the evening traffic between 5:15 and 6:15 will take six, seven and eight-car trains on five or ten minutes' headway. Just at the time when the locomotive should be able to accelerate its trains the most rapidly and make the best time between stops in order to compensate for the long station stops during the rush hours, it is loaded down with a heavy train, which tends to make the case worse instead of better. The amount of motive power should, if anything, be increased during the rush hours rather than decreased. Even at best, there are enough chances for delay, if trains are being operated on very short headway, without adding to these chances by clinging to a system of motive power which gives slower schedules during the rush hours than at any other time.

The ultimate aim of any system of transportation is service rather than economy in motor repairs, and there are plenty who will even question the economy of electric locomotives as compared to smaller motors scattered through the train. The constant tendency in the rapid transit service is to increase the number of driving wheels, as is well shown by the present popularity of four-motor equipments as against two-motor equipments on double-truck cars a few years ago. Some master mechanics held up their hands in horror at the thought of four-motor equipments when they were first proposed, on the ground that double the number of motors under a car would greatly increase the maintenance expense. Experience, however, seems to have shown that the better ventilation of four small motors as against two large ones tends to keep repairs approximately the same, and, if anything, in favor of the four-motor equipment, while the service possible from four motors in the way of better acceleration and less delays on slippery tracks is such as to leave two-motor equipments out of the reckoning altogether in many cities. The same principles apply in a general way to heavier service where cars are operated in trains.

It is quite likely to be the case in steam road suburban service that the number of trains which can be operated out of a terminal during the rush hours in the evening cannot be greatly increased. This is due to a number of various local conditions, but it is the exception rather than the rule around our largest cities to find suburban service where there are not very great obstacles to overcome if the number of trains between 5 and 6 in the evening is to be increased. The number of passengers desiring to ride, however, is growing steadily, and is sure to continue to increase as long as comfortable transportation can be offered. Now, the only way to increase the carrying capacity if the number of trains is fixed is to increase the length of trains. This can be done indefinitely with the multiple-unit system. We admit there is opportunity for considerable argument on some of the fine points of locomotive vs. multiple-unit system; for instance, as regards comparative investment and cost of operation. But of more importance than these are the broad questions of service which we have just discussed and which appear to be altogether in favor of the multiple-unit system.

Concerning Stops

The question of car stops has been so frequently discussed in our columns that there would be little reason to refer to it again at this time were it not for the fact that there is still room for a vast amount of improvement in the matter on the part of various operating companies. Recent trips upon electric railways in widely separated parts of the country tend to confirm the impression that the inordinate number of stops occurring upon certain urban and suburban trolley systems constitutes the most adverse element of the many conditions which are interfering with rapid transit service.

There is little doubt that the bad effect of a large number of stops per mile upon fast schedules is appreciated by the great majority of street railway men, but in some quarters it seems next to impossible to improve the situation. The attitude of the public is the stumbling block in the way of the manager who desires to stretch the distance between stopping points, rather than any failure to grasp the relations existing between stops and schedule time. It is the old question of express vs. local service over again.

It is a simple fact, however, that real rapid transit cannot be given to a community which requires the stopping of cars at every point along the route where passengers may wish to enter or leave them. Nor can it be given when cars are obliged to stop at each street corner, unless the streets are further apart than is common in most cities. When motormen are required to come to a full stop at intersecting streets, even where no passengers desire to get off or on, the last hope of making a schedule much quicker than the horse car time-tables of the early eighties vanishes. From the standpoint of the passenger, it is difficult to name a more aggravating cause of delay than this. Certainly it is trying to travel 30 miles in ninety minutes on a high-speed interurban line and then spend three-quarters of an hour over the remaining 6 miles of the journey, which has to be taken in the cars of another company through purely suburban territory.

There is probably no specific limit as to the number of stops per mile above which a schedule will fall into disrepute from the viewpoint of good practice. In the business districts of cities it is the usual custom to stop at every corner, although we believe the foreign practice of stopping only at every second or third corner perfectly practicable here. Be this as it may, there can be no question as regards suburban regions or the residential portions of a community. Here it is safe to say that eight or ten stops per mile are about as many as the service can accommodate and maintain a reasonably fast schedule. Except in cities laid out upon the checkerboard plan, equidistant stops are, of course, seldom attained. At best they express a sort of average which gives a basis of comparison.

The function of a street railway is to carry passengers at a profit, and not the running of a certain schedule with specific energy consumption per ton-mile. It is easy to see that if stops are made so far apart as to be seriously inconvenient, the volume of traffic will be the first thing to suffer. For this reason it has paid street railway companies to spend large sums of money for motive power capable of producing acceleration far beyond that in effect upon steam railways, and for air-brake equipment of sufficient capacity to stop their cars more quickly than was ever possible with the older types of hand brakes. But the street railway motor cycle from stop to stop has been developed on the basis of such short runs that the full benefits of this expensive equipment are often lost with the heavy cars now found in suburban service. It is often asked, "What is the use of making a fast schedule if we carry the people anyway?" The answer is this: Good service attracts business which otherwise may be lost, and it is scarcely open to doubt that a reasonably fast schedule is absolutely necessary if the maximum number of people are to be regularly carried in the face of steam railway competition. A slow, funereal schedule means a large number of cars in service, with a corresponding increase in the expense of conducting transportation; it means that the motors must be constantly operated with the heavy currents demanded by the straight line portion of the acceleration curve; that traffic congestion is more likely to occur because of the larger number of cars operating under short headway, and, finally, it results in the loss of considerable good will on the part of the traveling public. Of course, there are extremes of speed to which even suburban and interurban cars may not profitably go, but the thing which is really needed in suburban schedules, and in residence district schedules for that matter, is a good average speed. There is a vast difference between slowing down to 6 m.p.h. at an important intersecting street and making a dead stop. Cases have occurred in which cars were stopped regularly on both sides of a street in the business district of a medium-sized city, but it is a satisfaction to state that this practice is exceptional.

The greatest good of the greatest number is a fundamental principle of transportation no less than of republican government. It is doubtless true that considerable opposition can easily be aroused on the part of the general public by suddenly putting into effect sweeping changes in regard to the spacing of stops. What is needed is a sort of educational campaign. A few succinct and clearly expressed placards placed in the cars ought to go a long way toward explaining how the entire service of a line can be improved by the elimination of certain stops. It is important to point out that even where designated stopping points are 800 ft. apart, the maximum distance that any passenger has to walk to get a car is 400 ft. Then, too, the public does not always realize that its willingness to walk even half a mile to the nearest station is a contributory factor of great importance in the fast schedules possible upon suburban steam railways. There is no doubt that the public wants real rapid transit, but the fact remains that it does not always know how to help secure it. In the elevated railway and subway lines of the largest cities an unconsiderable proportion of the passengers appear to realize that by entering and leaving the trains quickly they are actually assisting the companies to give quick service. Certainly the public of residential and suburban districts ought to be brought to appreciate the value of fewer stops in enabling the great majority of passengers to be transported more speedily. Given a favorable public sentiment, the way is at least partly cleared for improvement in the service, and this without resorting to higher maximum speeds than the laws permit.

CAR-TEST RECORDER OF THE BOSTON ELEVATED RAILWAY COMPANY

BY J. M. AYER AND H. S. KNOWLTON

The study of problems connected with train movement has occupied the attention of the management of the Boston Elevated Railway Company from the earliest days of the elevated division's design down to the present time. Long before the division was opened to handle traffic, and even before experimental trains began to operate, careful consideration was given to the questions of speed, running time, acceleration, coasting, braking and power consumption, which were unique in the history of Boston transportation. In fact, the problems encountered presented features of peculiar difficulty, thanks to the complications which the geography of the city imposed upon the alignment and grade available.

Useful and important as this study was in determining preliminary train schedules and movements, the results obtained were necessarily theoretical, being based on data largely speculative, until the time came where train tests were made in the subway in connection with the selection of equipment for the road. These tests gave the company information of great value in regard to the possibilities of the proposed equipment, but they required the services of a large number of observers, and were correspondingly expensive and complex. In order to take the two-second readings which were essential to the obtaining of good results, it was necessary to arrange a clock circuit and gong to give the requisite signals—a proceeding which at times involved no little confusion, possibility of error in the records, and difficulty in the ranks of the instrument observers and recorders. Then, too, a long time was used up in calculating the results and plotting the curves derived from the tests. Realizing these difficulties, Paul Winsor, assistant to the vice-president of the company, who then had charge of the elevated division, turned his attention to the problem of securing automatic test records with a minimum of manual supervision, and designed the apparatus which to-day represents the company's most advanced practice in the analysis of actual operating conditions. J. M. Ayer, assistant to Mr. Winsor, had general oversight of the construction of the test recorder and its operation. It is this apparatus which forms the basis of this article.

The train test recorder consists, in the main, of a double table of hard pine, to one end of which is attached a lower frame. Upon the table are mounted the indicating and recording mechanisms which produce the test diagrams desired. The lower frame carries a galvanized iron tank used in determining acceleration values. The instrument occupies approximately half the inside length of an elevated car. Its length over all is 15 ft. 1 in.; its width over all, 2 ft. 2 ins., and the height (see Fig. 1) from the floor of the car to the top of the table is 2 ft. 8 ins. Mounted on the top of the table is an instrument shelf 3 ft. 4 ins. above the floor, which is a convenient height for observation and manipulation. At the head of the table, and at the same level as the instrument shelf, is a platform upon which is mounted the recording apparatus. The general method of recording the values of the physical quantities observed consists in transmitting the instrument indications to pens bearing upon a moving sheet of paper, the transmission being accomplished by a system of steel piano wires connecting the pens with manually operated discs placed directly over the instruments. One of these discs is shown in Fig. 2.

Each disc is of cherry, 4½ ins. in diameter. A groove in the circumference receives the piano wire, which is fastened to a thumb screw at the end of its travel. Each instrument is mounted upon a wooden base, which is secured to the shelf shown in Fig. 1. A small brass upright post with a projecting arm carries the cherry disc directly over the center of the circle described by the instrument pointer, and the disc is pivoted and secured to this arm by an adjustable screw. A third thumb screw, movable in the curved slot shown in the disc, enables a brass pointer to be fastened tightly to the disc in the additional adjustment, which is made in bringing the recording pen and the pointer to zero. The indications of the instrument are followed by the observer, who turns the disc by the brass handle, in close accord with the fluctuations of the instrument needle. The ease with which even erratic variations in current, voltage, etc., can be followed is immeasurably greater than that of the old method of straining one's eyes to obtain a long series of two-second readings—a method which entirely failed to record the variations of the quantity observed during the interval between successive readings. Between each disc and its pen is a brass lever, giving an additional adjustment of the connecting wires. These levers are provided with small holes .1 in. apart, so that it is an easy matter to alter the ratio of wire movement by hooking into different holes. In operation, the systems of levers and wires are so adjusted that a pen deflection of 3 ins. from the zero line corresponds to the maximum scale reading of the attached instrument, which is chiefly determined by the diameter of the disc. Small pulleys are provided to change the direction of the steel wires when necessary.

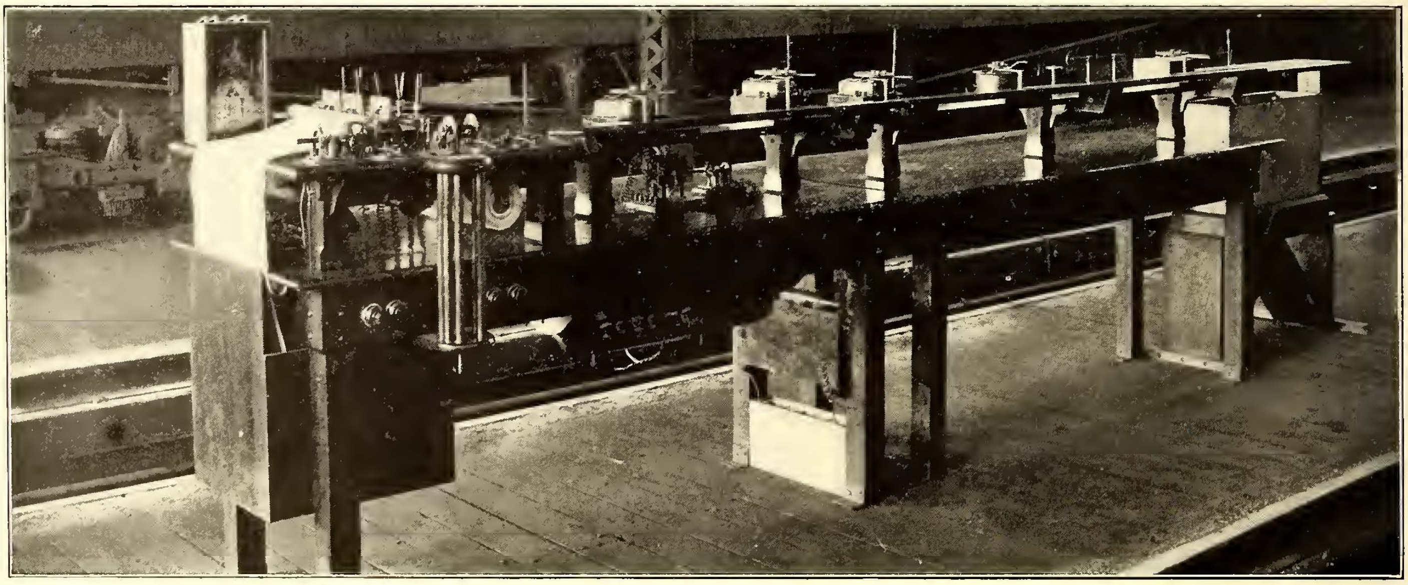


FIG. 1.—GENERAL VIEW OF RECORDER

Fig. 3 illustrates the arrangement of the record sheet as the curves of voltage, current, speed, air-brake pressures, etc., are drawn upon it as it is fed forward. The curves are drawn in ink by stylographic pens, the base lines being traced by the row of pencils shown in front of the pens. The pens are automatically returned to zero by small lead weights which move up and down in the brass tubes shown in the front of Fig. 4. The instrument shelf is equipped with positions for five observers, with an additional position for an acceleration operator above the tank.

Fig. 1 shows the roll of paper mounted on brackets beneath the table and the manner of its passing upward through the slot in the table. It is drawn over two brass writing tablets, one of which is used by the pens and the other by the base line pencils. Then the paper passes through the driving rolls and out, as shown in Fig. 3. Each end of the operating head of the recorder is mounted on solid brass brackets which are screwed to the table (see Fig. 1). These brackets carry the two driving cylinders and train of gears connecting them with the escapement; also a locking lever for throwing them in or out on the pinion of the lower cylinder. The writing tablets are fastened to these brackets, as are also three brass rods mounted above the tablets themselves. The forward rod carries the leads, which are set in three adjustable batteries of seven leads each, which mark the base lines ½ in. apart. Considerable experimenting was required to get leads of proper hardness to make distinct lines. These leads are weighted as shown in the accompanying cuts.

It will thus be seen that the diagram is transversely made up

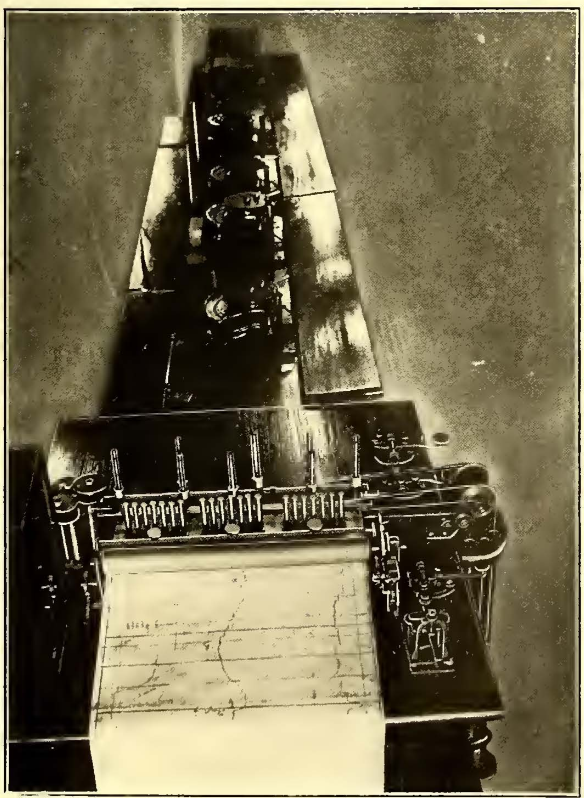


FIG. 3.—TOP VIEW OF RECORDER, SHOWING DIAGRAM AS IT COMES FROM THE APPARATUS

of three sections, each 3½ ins. wide. Outside of these are the station and distance records, which are made by pens mounted on the armatures of electromagnets, independently of the recorder head.

The other two rods carry the fountain pens which describe the curves of the diagram. These rods are fitted with adjustable stops which hold the pens at the base lines as they are drawn to zero by the wires and weights. Each rod carries three pens, making a total of six, or two pens to each of the three transverse sections of the diagram. These pens move freely upon the rods in responding to the pull of the wires given by the observers as they follow the deflections of the instrument needles. The rods carrying the pens are 2 ins. apart, and the pen holders consequently are set at an angle from the vertical, so that one pen can pass the other in the same section. This angle is such that the points of two adjacent pens on the paper are ⅛ in. apart. As the time scale of the diagram is 1 in. = 16 seconds, the two adjacent curves are two seconds apart, hori-

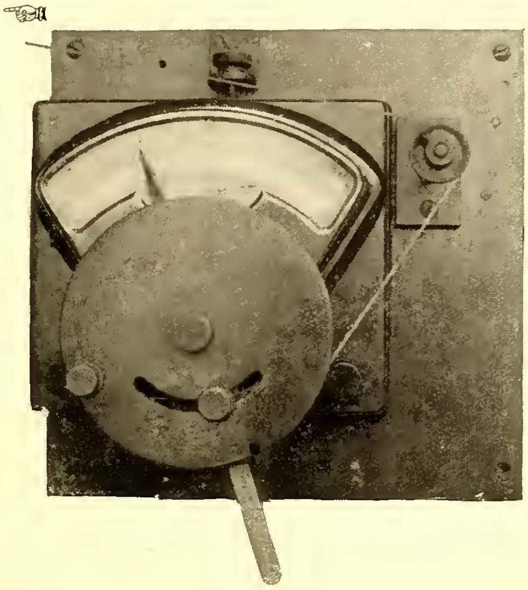


FIG. 2.—OPERATORS' DISC

zontally. The pens not standing vertically, had to be weighted to keep them in constant touch with the paper.

The wiring diagram of the apparatus is shown in Fig. 5. The moving strip of paper is driven by a powerful clock located beneath the table, through the medium of two solid brass cylinders, one of which is geared to the clock mechanism. The movement is controlled by a time clock operating through an electromagnetic escapement. Power for operating the various electromagnets, with the exception of those mounted in the time clock, is drawn from the third rail through suitable resistances. It was necessary to connect with the relay board on the car to secure continuous operation, regardless of whether a train is moving or standing still. In the diagram of Fig. 5 the connection of the car wiring with the third-rail shoe is shown through the main switch, main fuse, wattmeter terminals and reverser of the multiple-unit control system. From the main switch a tap leads to the voltmeter, the ground connection being made at point No. 13 on the bottom of the diagram. The wattmeter connections are shown in Fig. 6. These instruments are inserted when desired, as a check on the results calculated from the curves on the diagrams, and to determine the energy consumed by the motors which drive the air compressors throughout the train. The diagram in Fig. 6 represents the motors for driving the compressors of a four-car train. Returning to Fig. 5, the ammeter current is taken from a shunt in the main motor circuit between the reverser and the pilot-motor operated controller. The speed of the train is taken from a voltmeter operated by current generated by a magneto belted to a 6-in. wooden drum mounted on one of the axles of the trailer truck. The magneto is supported on a board with a felt cushion to take up the jar of the truck. Records of air pressure in the brake system are taken from a gage piped to the brake cylinder, or to the auxiliary reservoir, as may be desired.

On the same trailer axle is also mounted an interrupting device consisting of an 18-in. drum circumscribed by a brass contact ring. This ring is broken at two points, making an insulated section, covering about one-third the periphery. The other two-thirds section is grounded to the axle. At every revolution of the axle, therefore, the contact on the drum closes a circuit through an electromagnet, whose armature releases a wheel in a "speed clock" mounted on the table underneath the instrument shelf (see Fig. 1). This wheel advances one tooth for each movement of the armature, and is connected by a train of gears in the clock with a toothed contact wheel. Each revolution of this contact wheel corresponds to 132 revolutions of the trailer truck-axle, and therefore, with a 31-in. trailer wheel, represents a train movement of 1071.7 ft. When an 11-toothed contact wheel is used in the clock, the advance of one tooth corresponds to a distance of 97.3 ft. Each tooth of the contact wheel closes a circuit through an electromagnet at the bottom of the moving strip of paper, and the armature of the magnet moves a stylographic pen that makes a notch in the otherwise straight line which it describes upon the paper. The distance between each notch therefore represents 97.3 ft. travel of the train. The pen is held in a clamp at the end of a brass bar, which is in turn attached to the armature of the electromagnet. because it gives the speed of the train in miles per hour directly when the running time in seconds is divided into 1000. This is readily shown by substituting 1466⅔ for D in the familiar equation

$$v = \frac{D}{t \times 1.466\tfrac{2}{3}} \qquad (1)$$

Where v = speed in miles per hour, D = distance covered in feet, t = time in seconds. The equation becomes

$$v = \frac{1000}{t} \qquad (2)$$

The straight and level track is chosen for this test as the speed of the elevated trains is practically constant throughout this particular distance on the structure.

When accurate checking is desired, the observer with the stop watch also holds a small push-button in his hand and presses it at the instant of passing each marker. The pen attached to the electromagnet A (Fig. 5), at the top of the moving paper, then records a corresponding notch in the otherwise straight line which it draws, at each pressing of the button. The record may then be taken into the office if desired, and perpendiculars dropped from the notches upon the base line so as to cut the speed curve drawn by the voltmeter pen, and enclose an area which represents the distance traveled, on the speed-time diagram. By checking up this area with a planimeter, the accuracy of the speed curve in terms of the speed scale selected is immediately made evident. This scale is always taken as 1 in. to 20 miles per hour. In case the observed speed deduced from the stop-watch measurement does not check with the average speed between the markers, as exhibited on the diagram, the ratio of the lever arms which regulate the movement of the steel wires connecting the voltmeter disc with the recording pen is altered in close proportion to the ratio of the two speeds. Thus, if the stop watch gave a speed of 40 miles per hour and the average shown on the paper was 45 miles per hour, and the wire from the voltmeter disc was hooked above the wire to the pen on the lever, the distance of the wires from the fulcrum of the lever being 3.5 ins. and 3 ins., respectively, the resulting ratio is $\frac{3.5}{3} = 1.17$. This ratio must be increased

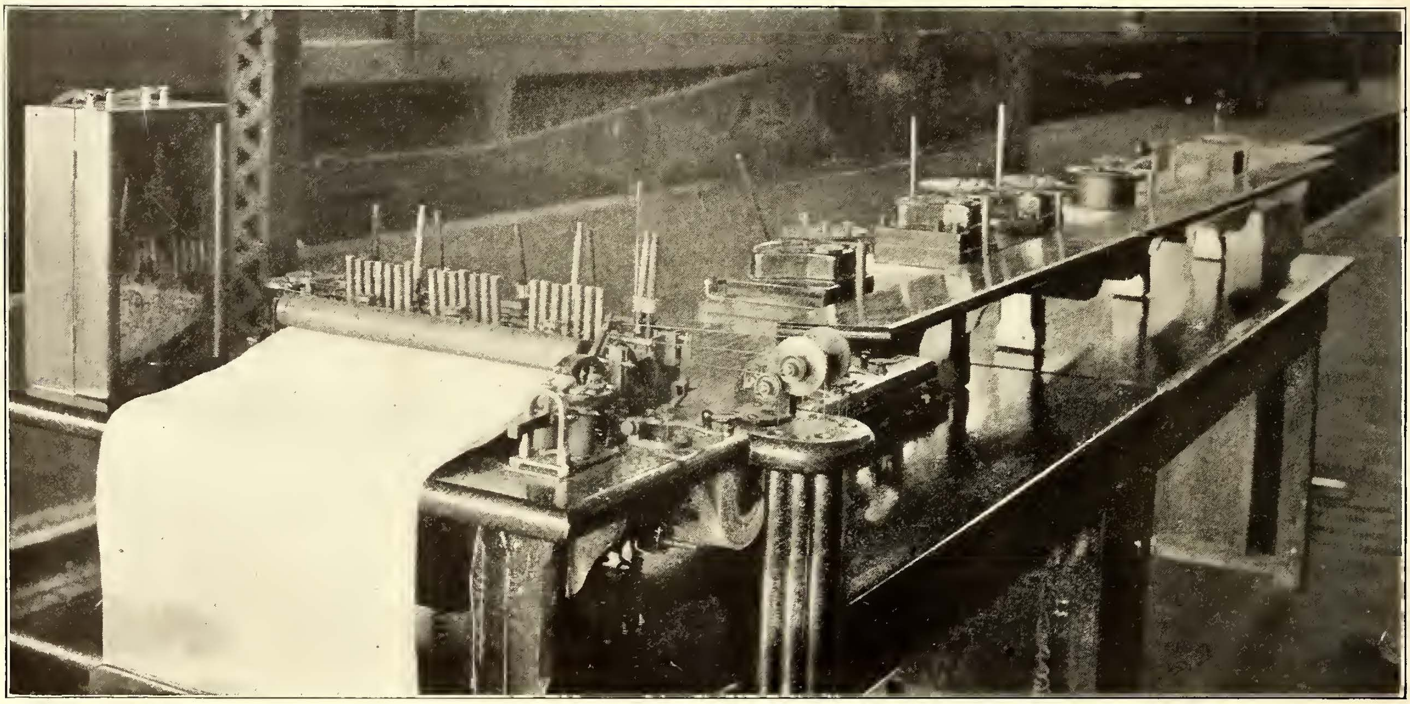


FIG. 4.—RECORDER, SHOWING DETAILS OF OPERATING HEAD

The resistances illustrated in Fig. 5 are mounted beneath the table. A single-pole knift switch cuts off the current when desired, and the resistances and wiring are protected by a 10-amp. Noark fuse. The potential required on the electromagnet circuits is derived from the drop in voltage existing across the smaller resistances shown in the right-hand portion of the diagram. A resistance of 600 ohms total is placed between the smaller resistances and the line connection, and a ½-cp pilot lamp is placed in series with the circuit to show quickly when the current is on. This pilot lamp is also mounted beneath the table.

For the determination of speed, the magneto-generator is calibrated with a speed indicator which is plugged into its shaft, the magneto being driven by a small 110-volt motor. A curve that is practically a straight line is then plotted to give the relation between the speed of the magneto and the voltmeter readings. The indication of the voltmeter is transmitted to the speed pen and recorded in a curve on the moving paper. It is checked by timing with a stop watch, the seconds required to cover a distance of 1466⅔ ft., set off on the elevated structure between the Sullivan Square terminal and the Thompson Square station. This distance is marked by horizontal white markers at its beginning and its end, and is included in a piece of track which is practically straight and level on each side of the markers, and also between them. This distance was chosen in order to give a smaller pen deflection with the same voltmeter deflection, and the effect of the increase is represented by

$$\frac{1.17 \times 45}{40} = 1.32.$$

Leaving the voltmeter wire in the same position (3.5 ins. above the fulcrum), the position at which the pen wire must be attached comes to 2.68 ins. above the fulcrum, the ratio between 3.5 and 2.68 being 1.32, approximately.

The horizontal scale of the test recorder is sixteen seconds per inch. This is obtained in the following manner: The moving sheet of paper is fed forward by the clock mechanism underneath the table, which is geared to a solid brass cylinder having milled raised bands parallel to the circumference. On top of this cylinder rests a second milled cylinder of brass, about 1¼ ins. in diameter, which serves as a weight to hold the paper in place as it is passed between the two after the manner of a clothes wringer. The top cylinder simply operates as an idler, and is not connected with any other mechanism by gearing. The circumference of the lower cylinder is 4 ins., and it is mounted upon a shaft which is geared to the driving clock and to an electromagnetic escapement in such a manner (gear ratio 4 to 1) that each time the escapement releases a 16-pin wheel, seen in Fig. 1, the cylinder rotates one-quarter as fast as the latter. The escapement releases one pin every second, and hence the cylinder requires sixty-four seconds to make a revolution. The armature of the electromagnet (Fig. 5, left-hand corner of cylinder) terminates in an open jaw, which allows the escapement pins on the pin wheel to pass through, one at a time; see also Fig. 1.

The armature of the escapement electromagnet is operated through a relay, which in turn is operated by a second relay in the time clock which stands upon the test table. The relay in the time clock is operated by a delicate sliding verge contact and local battery connection inside the clock, which completes the circuit once every second. The second relay is used simply to take all the strain possible off the time clock mechanism, which might become deranged if a powerful spring contact were connected with it mechanically. A key, shown at 1, Fig. 5, is connected in the circuit so that the paper may be fed forward by hand in case it is desired, either for adjustment or in case the clock fails during test operations.

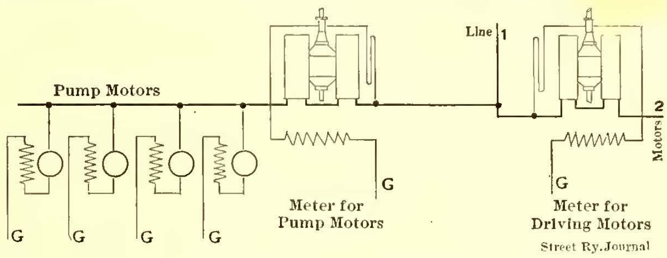


FIG. 6.—WATTMETER CONNECTIONS FOR POWER TEST OF CARS

In order to prevent sparking at the relay contact inside the clock, a non-inductive resistance coil is installed and connected across the magnet circuit. The magnet coils have a combined resistance of 125 ohms. The non-inductive resistance is composed of 54 ft. of No. 36 Climax wire, having a resistance of 21 ohms per foot, and furnished by the Driver-Harris Wire Company, of Harrison, N. J. The diameter of the wire is .005 in. The time clock was furnished by Blodgett Brothers, of Boston.

The accelerometer is one of the most interesting parts of the test recorder. It is designed to draw a curve of the rate of change in train speed as it increases or decreases during any run. It consists in the main of a galvanized iron tank, partly filled with water, carrying a wooden float to which is attached a vertical brass pointer. The tank is 18¼ ins. high, 8⅜ ins. wide and 26½ ins. long, in outside dimensions. The float is 25½ ins. long x 7 ins. wide x 3 ins. thick, and is secured to the tank by a rod about which it is free to revolve as an axis.

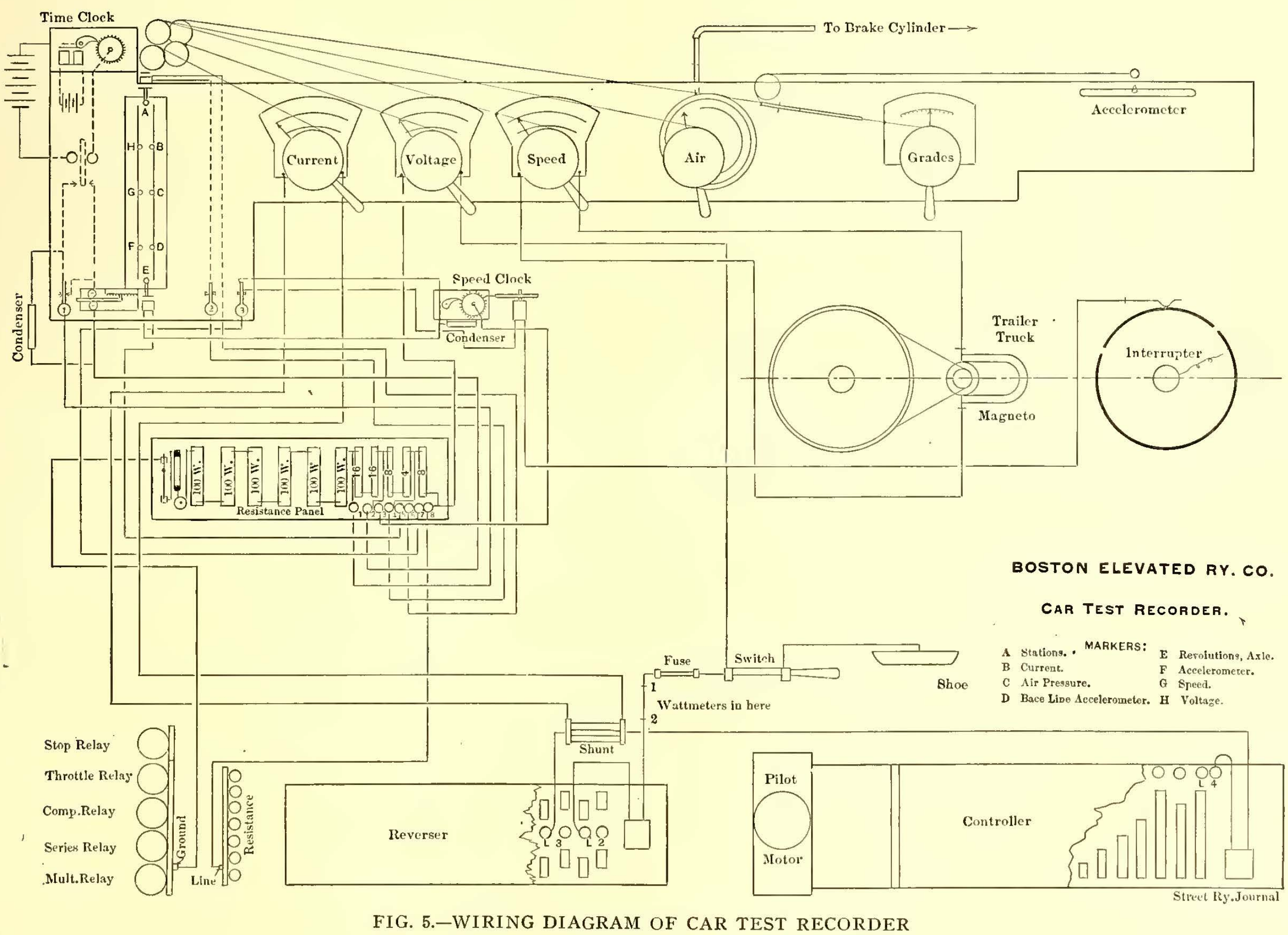


FIG. 5.—WIRING DIAGRAM OF CAR TEST RECORDER

Longitudinal motion is prevented by the suspension of this rod and its attachment to the sides of the tank. The acceleration of the car, positive or negative, piles up the water in the tank at one end or the other, according to the direction of motion, tilting the float forward or backward, as the case may be. The tank has a rigid connection with the car, as may be seen by Fig. 7. The pointer attached to the float moves to and fro from a zero position as the float swings up or down around the axis rod, and the motion of the pointer is followed by an observer with a pivoted pointer in much the same way that the indications of the other instruments are watched. Fig. 8 shows the general arrangement of the accelerometer and its connections as a car is standing upon a grade. A is the float, T the tank, B the brass pointer attached to the float, C the movable pointer,

FIG. 7.—RECORDER SET UP IN CAR

D a movable disc and pointer, and E a scale, which is used in connection with D to compensate for the effect of grades. F, G and S are pulleys, H an adjusting lever, and P the recording pen at the head of the table. The accelerometer pen is connected by a steel wire to the adjustable pointer C through the adjusting lever and pulleys. Pulley F is pivoted to a sliding arm which is wired to the compensating disc.

It is manifestly impossible to obtain correct indications of the acceleration values unless the effect of grades is overcome, on account of the tilting of the tank itself, which occurs at every change in grade. In operation, therefore, the apparatus is so adjusted that as each grade is reached, the operator handling the disc D corrects for the grade by simply moving the pointer to the scale E, in accordance with the exact value of the grade encountered while the observer follows the pointer of the float with the movable pointer. The pen then draws a correct curve of the accelerations and retardations of the train to a scale which is determined by the adjustment, the base line or zero of the scale coming in the center of the diagram.

The adjustment of the accelerometer is a matter of interest. The car containing the test recorder is first brought to a standstill upon level track. The water in the tank is level, and the float pointer stands in a vertical position at the zero point of its scale. The pen is placed at zero (on the base line), the pointer C being held at zero, and the slack in the wire is now all taken up, the compensating disc D being held with its pointer at zero on the scale E. The apparatus is now in shape to give acceleration readings on level track, but the scale of the pen diagram is unknown, the adjusting lever being set at some arbitrary ratio at this stage of the proceedings. The car therefore proceeds to the —8 per cent grade on the southbound track just beyond the Boylston Street subway station. Fig. 9 represents the position of the tank, float and pointer as the car stands upon this grade. The disc D is now fastened or held at zero; the pointer B has taken up a position due to the —8 per cent grade. The observer at the accelerometer tank then turns the movable pointer C to coincide with the position of B, which allows the pen P to move by means of the weight attached to it through a certain deflection on the diagrams. This deflection represents the effect of the —8 per cent grade, which effect corresponds to an acceleration of 1.76 miles per hour per second. This is derived from the well-known relation

$$\text{m.p.h.} = \frac{Tt}{91.2}$$

where m.p.h. = speed gained or lost in time t seconds with a tractive effort in pounds per ton of T. In this case, $T = 160$ lbs. per ton, the accelerating effort due to a —8 per cent grade, and $t = 1$ second. In other words, the effect of a —1 per cent grade is equivalent to an acceleration of .22 miles per hour per second. Now, in the test recorder of the Boston Elevated, a vertical scale of .5 ins. is taken, equal to 1 mile per hour per second of acceleration, positive or negative, on each side of the base line. When the pen deflection on the —8 per cent grade is measured on the diagram, therefore, if the resulting displacement from the base line is not .88 ins., the adjustment of the lever ratio must be altered until the correct deflection is obtained when the car comes to a standstill upon this grade. This ratio is 1.43, the pen wire hook being nearer the fulcrum.

It now remains to calibrate the scale E of grade corrections to be used in actual operation. This is done while standing upon the —8 per cent grade. The pointer C is held at the position it occupied before, when the scale determination was made, coinciding with the position of the pointer B in Fig. 9. The disc D is then turned so as to bring the pen P back to the base line. The indication of D's pointer on the scale E therefore gives the location of the compensating point for the —8 per cent grade. An equal arc is set off on the other side of the zero of scale E to give the + 8 per cent grade correction. Although in regular operation there is no movement of trains up an 8 per cent grade on the Boston Elevated system, the scale is completed for the purposes of symmetry. Intermediate points are now marked off in regular spacing and the apparatus is adjusted. Briefly stated, the object of the compensating disc D is to tighten up or loosen the pen wire just enough to offset the deflections which the grades themselves produce. In making tests with the accelerometer, one observer is required to manipulate the pointer C to coincide with pointer B, and another the pointer at D, on the scale E. The observer at D therefore has a table of grades before him, and he refers to these as the train passes over the line, setting his pointer on the grade of the scale corresponding to the track grade upon which he happens to be. In some parts of the subway the grades change rapidly, and considerable agility is necessary to follow the grades on the track, but the practice obtained in successive tests enables the work to be done with comparative ease.

The reader will note two arrows in the diagram (Fig. 8) which indicate the directions in which the train may be moving with reference to the accelerometer tank. These arrows are marked on the compensating scale. The + and — signs show which side of the grade scale is to be chosen, as the pointer is moved to follow any specific grade encountered on the line.

For example, let the train be considered as moving from left to right down the 8 per cent grade beyond Boylston Street station. The upper arrow indicates this motion, and the signs show that the left-hand side of the compensating scale is to be used for positive grades and the right-hand side for negative grades. Therefore, the observer at the compensating disc moves his pointer over the scale *E* to the right, until he reaches 8 per cent. This slacks up just enough on the movable arm attached to the pulley *F* to compensate for the effect of the grade upon the float, and consequently upon the pulleys, wires and, finally, the pen. On the diagram drawn by the pen, positive acceleration is shown above the base line, and negative acceleration or retardation below; which depends upon the direction of car movement.

Three keys are provided at the side of the table near the escapement which drives the recording sheet of paper. These are shown at 1, 2 and 3 in Fig. 5. Key 1 enables the paper to be manually fed forward in case the time-clock circuit is interrupted or special adjustment is wanted. Key 2 is used to mark the passing of stations, interlocking towers or other special points of interest on the line. This closes a circuit through the electromagnet *A*, which has a pen attached to its armature, so that every time the key is depressed a notch is marked in a line that is drawn continuously on the moving sheet of paper. Key 2 is pressed twice for stations and three times for interlocking towers. Key 3 is connected with the electromagnetic pen *E* at the bottom of the paper, and is used for special marks as may be required from time to time in testing. It is also connected so as to cut in the interrupter by means of a switch mounted on the key base. The batteries shown in the left-hand corner of the diagram are "Mesco" dry cells mounted in a box beneath the table. A condenser is placed across the

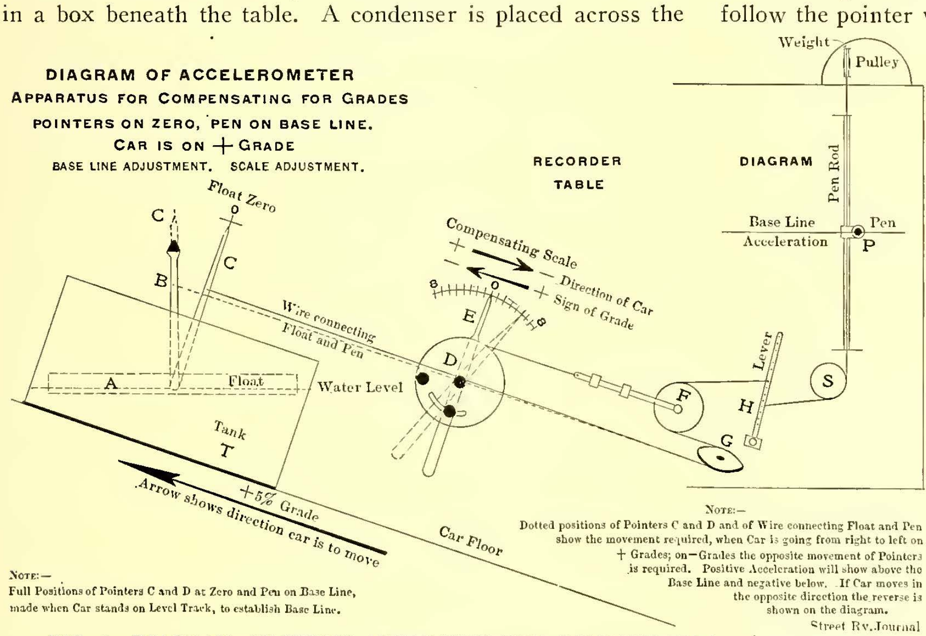


FIG. 8.—DIAGRAM, SHOWING APPARATUS FOR COMPENSATING FOR GRADES

relay contacts in the escapement circuit, and another in the speed-clock relay circuit to suppress sparking.

It will be observed in Fig. 5 that the brake cylinder is ordinarily piped to the pressure gage mounted on the test recorder. When it is desired, however, to obtain simultaneous records of the brake cylinder pressure and the auxiliary reservoir pressure, the former is obtained by a special automatic indicator which is mounted upon the table and connected to one of the pens. The latter is obtained by the usual method of following the gage readings with a disc and pointer.

Ordinarily the test recorder is kept in the shops of the Boston Elevated Railway Company in a place free from disturbance. Considerable care is, of course, necessary in order that the apparatus shall be properly set up in perfect working condition whenever a test is planned. The success of the tests is, to a noteworthy extent, thus dependent upon the oversight of the general foreman of elevated shops, John Lindall, and his assistant, Clark Doty.

The organization of tests on the elevated division requires the service of nine men, and frequently an extra man to check the diagrams by taking stop watch readings of the running

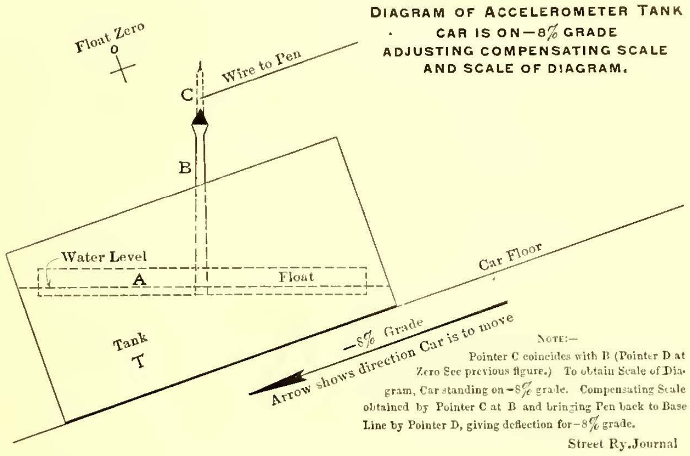


FIG. 9.—DIAGRAM OF ACCELEROMETER

times, stops, etc., between and at stations, towers, etc. These observers comprise the engineer in charge, John W. Corning; a key operator, diagram man, to write the names of stations, etc., on the chart; ammeter observer, voltmeter observer, speed observer and air-brake pressure observer. One man is also required to operate the compensator for grades, and another to follow the pointer which is attached to the accelerometer float.

The four quick-break snap switches, shown at the side of the table in Fig. 1, are for the purpose of connecting the dry batteries with the clock contacts and relays. Two of these are duplicates, so that an extra battery may be thrown into circuit in case anything goes wrong with those already in use. The roll of paper used with the apparatus is about 600 ft. long and 14 ins. wide. The running time of trains for the round trip from Sullivan Square to Dudley Street being forty-four minutes and the speed of the paper 1 in. in sixteen seconds, it follows that about 14 ft. of paper are used up in making a complete test over the route. About forty tests of this character can thus be made without replacing the roll of paper. As the paper is used up, it is fed forward over the end of the table into a wooden box, which keeps it clean and prevents its falling upon the floor. When a test is about to be started, the main switch located in the hood of the car is thrown in. This makes all the circuits alive down to the small knife switch, which is mounted on the resistance panel beneath the table. This switch is then thrown in, and all the apparatus except the battery circuits becomes alive. The time clock has previously been started and the driving clock beneath the table wound, but the paper does not begin to be fed forward until the two battery switches have been closed, which is the last operation before starting a test.

Summing up the foregoing and assuming that a test is now under way, we find the record showing the following, as the paper is fed forward: Stations, current, air, accelerometer, axle revolutions, speed and voltage. The scales on the diagrams drawn in the test are:

1 Space = 97 ft. (distance scale.)
1 in. = 200 amps.
1 in. = 200 volts.
1 in. = 20 m.p.h.
1 in. = 30 lbs. per square inch brake-cylinder pressure.
1 in. = 16 seconds time, on paper, horizontally.
1 in. = 2 m.p.h. per second acceleration and retardation.

The various scales are obtained by the adjustment of the wires at the levers.

Fig. 3 shows plainly a record coming from the machine as it looks during an actual test. Fig. 10 illustrates a record of a run from Beach Street station to Northampton Street station practically as it was taken from the paper roll on the recorder. Fig. 11 is the same record, properly labeled and marked with the scales used. This run was made in the current year with car No. 090 of the elevated division, equipped with two Westinghouse 50-C motors, gear ratio 50:21 = 2.38, 34-in. wheels and Christensen air-brake system. The weight of the car loaded was approximately 30 tons. In this test but one car was run in the train. Fig. 12 shows the alignment and grade of the track covered in the run, with a map of this section of the line.

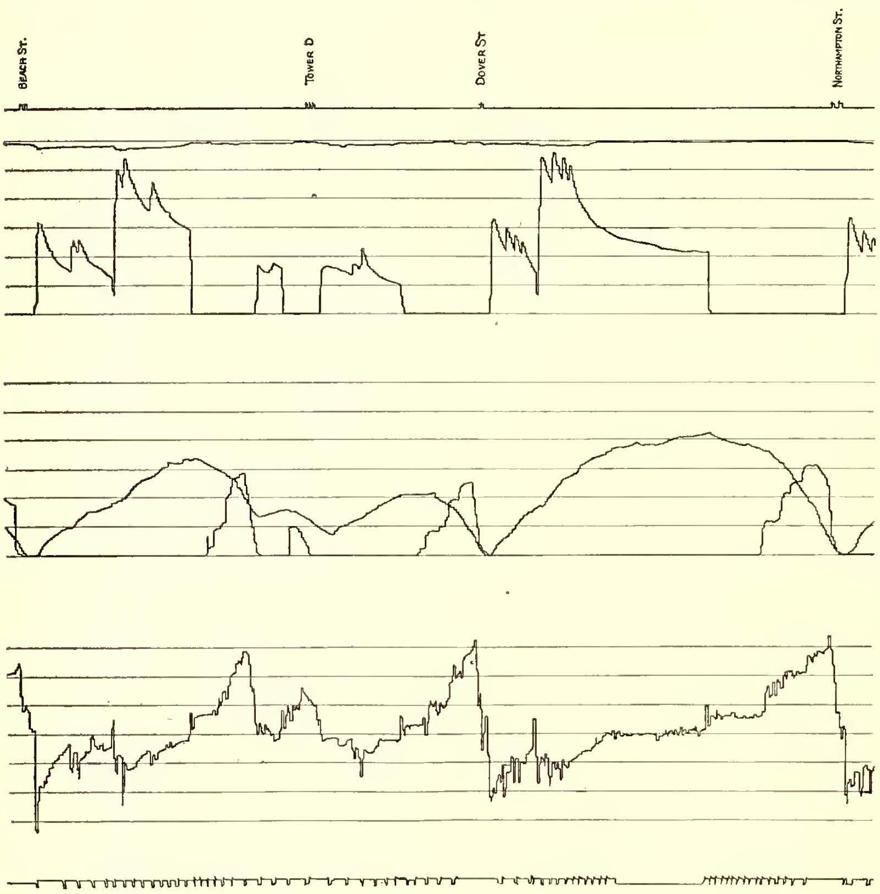


FIG. 10.—DIAGRAM JUST AS IT COMES FROM THE RECORDER

All the curves are drawn upon the same horizontal time axis. Turning to Fig. 11, the "Location Record" is seen at the top of the diagram, two notches having been made as the train reached Beach Street station, and three as it passed Tower D at the Motte Street Y. Below this is the voltage curve, and then the current curve. The speed-time curve follows, then we have the diagram of brake cylinder pressure, followed by the acceleration curve and distance record. The slight fall in voltage as the current increases is plainly evident, and the "notching-up" of the control as the series and parallel resistance points are passed is also apparent. The train started from rest at Beach Street; accelerated to a maximum speed of about 33 miles per hour along Harrison Avenue; braked to a speed of 13 miles per hour at the Motte Street curve to the right (radius 144 ft.); accelerated to 16 miles on Motte Street; braked to 7.5 miles in rounding the 90-ft. radius curve at Tower D on Washington Street; accelerated to 21 miles approaching Dover Street station, and braked to a standstill, coming to rest at the station. After a two-second stop at Dover Street, the train accelerated on level track free from any curves of note to a maximum speed of about 42 miles per hour. Current was cut off about fourteen seconds before the brakes were applied in approaching Northampton Street station; the car coasted for about 700 ft., and then was braked to a stop. The record shows the longer time of remaining in series on leaving Beach Street as compared with the quicker getting away from Dover Street, this being due to the 105-ft. radius curve at the former station. The maximum current during the run was about 550 amps. The brake cylinder diagram shows that four applications were made in slowing down at the Motte Street curve, and three at Northampton Street. The effect of the heavier applications upon the speed-time and acceleration-time curves is noteworthy, as is the effect of the single application made in slowing down at Tower D.

Looking at the acceleration and speed-time curves upon leaving Beach Street, in conjunction with the current curve, an interesting point is observed. The falling off in current is clear, after the resistance is cut out and the counter electromotive force of the motors in series rises. The drop in current causes a corresponding fall in tractive effort, the speed does not increase as rapidly and the acceleration curve sags toward the zero line. Every change in the accelertion is instantly reflected in the curve. It is, of course, necessary to use average values in judging the variation of the acceleration. In the diagram shown in Fig. 11, positive acceleration is shown below the zero line and negative above.

In the run from Dover to Northampton Street, the gradual decrease in acceleration as the current falls off in the motor curve is well shown. The flattening of the speed-time curve in this run as the speed approaches a fairly constant value is also most evident in its effect upon the acceleration, which drops practically to zero at the points of high speed.

An interesting place in the acceleration diagram between Dover and Northampton Streets occurs where the car begins to coast before the brakes are applied for the Northampton Street stop. An examination of the speed-time diagram at this point shows that the speed curve slants downward at a practically uniform rate during this part of the run. The acceleration curve is, of course, negative here, and the constant rate of retardation appears plainly on the diagram between the time of shutting off current and the time of applying brakes. The value of train resistance under these conditions may easily be reduced from the speed-time curve, which drops from 42 to 36 miles per hour in about seventeen seconds. The application of the equation

$$t = \frac{\text{m.p.h.} \times 91.2}{T}, \text{ where } t = \text{seconds}, T = \text{pounds per ton},$$

previously mentioned, gives a value of approximately 32 lbs. per ton for the friction and air resistance encountered by the single car used in the test. In making the Northampton Street stop, the motorman released the brakes slightly before the end of the run, so that the rate of braking was largely determined by the train resistance. The retardation therefore decreased very rapidly, as may be seen on examination of the acceleration diagram, which gave an easier stop than was made at Dover Street.

Considering the distance record, it will be noted that the space between notches grows shorter as the speed of the car increases, and that a corresponding elongation of the gaps between the indentations occurs as the speed slows down. Thus, about one and one-half seconds are required to cover the distance of 97 ft. indicated by the marks, at the maximum speed between Dover and Northampton Streets, while some ten seconds are required to cover the same distance in accelerating through the first part of the run after a speed of about 5 m.p.h. has been reached. This checks closely with the speed-time curve.

In the upper portion of the diagrams (Fig. 11) are two tabulated statements, which give the data bearing upon the energy consumption for the two runs. These are determined by integrating the current curve with a planimeter, obtaining the average amperes for the car by dividing the time of the run in inches, including the stop into the area (5.45 sq. ins. in this case, Dover-Northampton); this gives the average amperes per car derived from the mean height of the current curve in inches, multiplied by the scale. The average volts are obtained by measuring a considerable number of voltage ordinates and taking the mean of these. The product of the two gives the average power in watts, and this multiplied into the length of the run in hours gives the energy consumption in kw-hours, provided the factor .001 is properly used to convert watts into kilowatts. The distance in miles is either known from the engineer's tables or measured on the diagram in feet and converted. The division of this distance in miles into the energy consumption obtained in kw-hours gives the quotient of energy consumption in kw-hours per car-mile.

This comes to 4.405 in the case of the Beach Street to Dover Street run, and to 3.778 in the run from the latter station to Northampton Street. An interesting phase of this determination arises from its illustration in the present case of the point that a high-speed run with few stops can frequently be made at a less expenditure of energy than a low-speed run, where the stops and slow-downs are more frequent, necessitating repeated accelerations. In the two runs of Fig. 11, the watt-hours per ton-mile figure 147 for the Beach-Dover Street run, and 126 for the Dover-Northampton Street run.

Fig. 13 shows a round-trip run in a recent test in which the apparatus was set up to give the curves of brake cylinder and auxiliary reservoir pressures in addition to the regular curves.

The run was made with a four-car train between 2 and 3 a. m. on Nov. 13, and is identical with a regular service run with the exception of the length of station stops. Each car in the train was equipped with two GE 68-C motors, rated at 170 hp each, gear ratio 3.28. The driving wheels were 33 ins. in diameter, and the train was equipped with the Westinghouse automatic air brake and the Sprague-General Electric system of multiple-unit control. The recorder was mounted in the first car of the train, No. 0171, and the round trip was made from Sullivan Square terminal to Dudley Street terminal and return, via the subway.

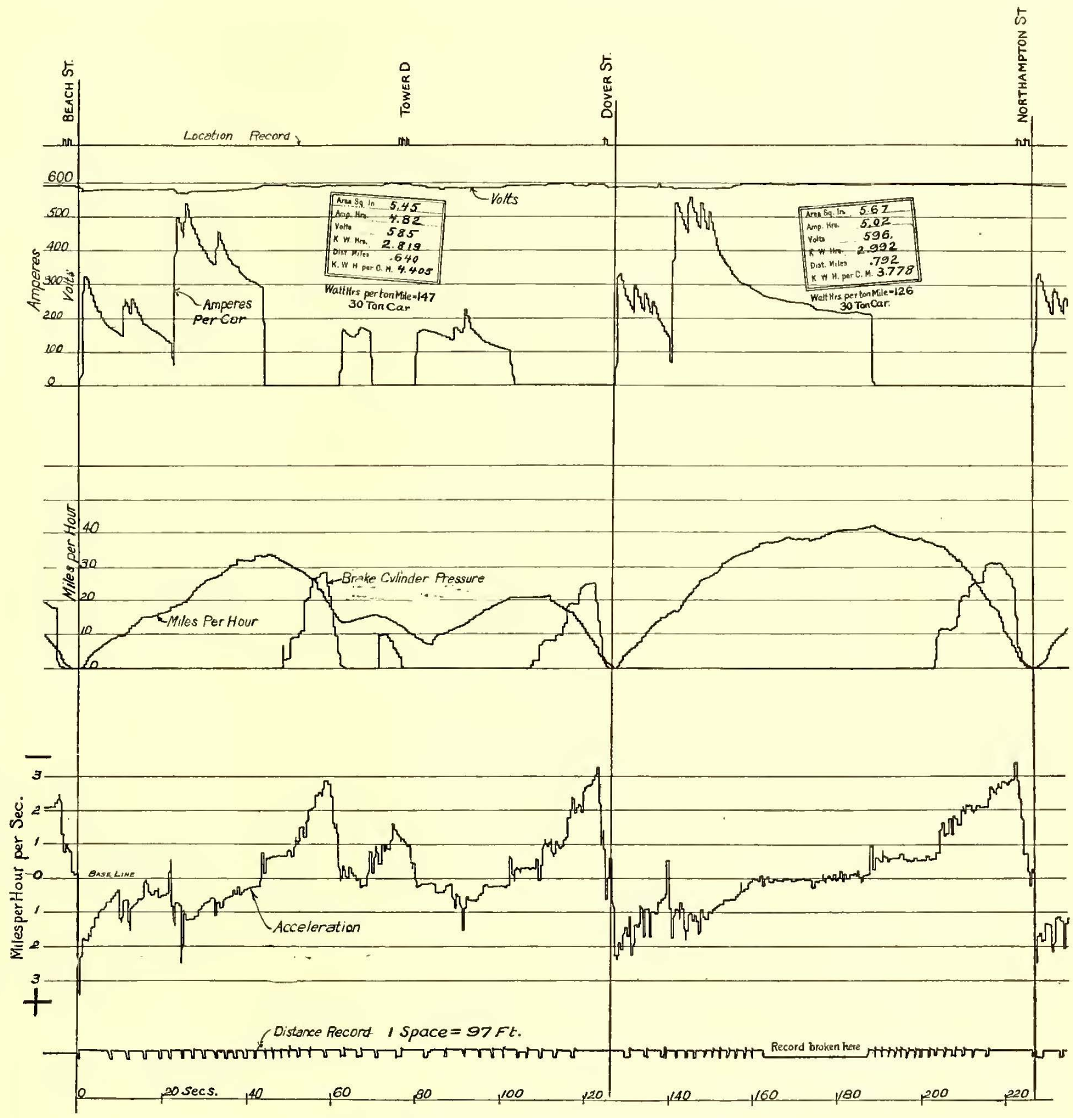


FIG. 11.—DIAGRAM WITH NOTATION ADDED

Starting from Sullivan Square, the train accelerated with the motors in series until about sixty seconds had elasped, when the controller was thrown into multiple upon taking the so-called Bunker Hill Street curve. The gradual decrease in current per car on the "series-motor curve" is clearly shown, the maximum series current being approximately 240 amps., and the minimum, 50 amps., at a speed of 20 m.p.h. The low rate of acceleration when running in series through the Sullivan Square yard is also apparent, as is the instantaneous increase in the rate of acceleration upon going into multiple and taking 344 amps.

Full multiple running brought the train to a maximum speed of 40 m.p.h., the acceleration curve showing the gradual decrease in the rate of gaining speed as the motors took less and less current. At the point of maximum speed the current was 125 amps. During this acceleration the calibration points on the structure were passed, and the average speed determined by stop watch figured 36.6 m.p.h. This checks closely with the average speed determined from the speed-time curve between the two points shown. The train coasted for about eighteen seconds with the current off, of course, after reaching maximum speed. It then braked to a full stop at Thompson Square at an average rate of retardation of 1.6 m.p.h. per sec-Square at an average rate of retardation of 1.6 m.p.h. per second.

This is well shown by the average of the acceleration curve below the base line, about two minutes eighteen seconds from the point of starting from Sullivan Square. The advantages of coasting are apparent from a glance at the current curve, which encloses an area that is a proportional factor in the energy consumption of the run. It will be noted that the auxiliary reservoir pressure was maintained at about 70 lbs. during the major part of the run, until the braking point was reached, when it fell to about 66 lbs. The brake cylinder diagram shows that three applications of the brakes were made before release in stopping at Thompson Square, followed by a single light application. These applications produced brake-cylinder pressures of 30 lbs., 42 lbs., 46 lbs. and 12 lbs. per square inch, respectively. From the station record line at the top of the diagram it will be seen that the run from Sullivan

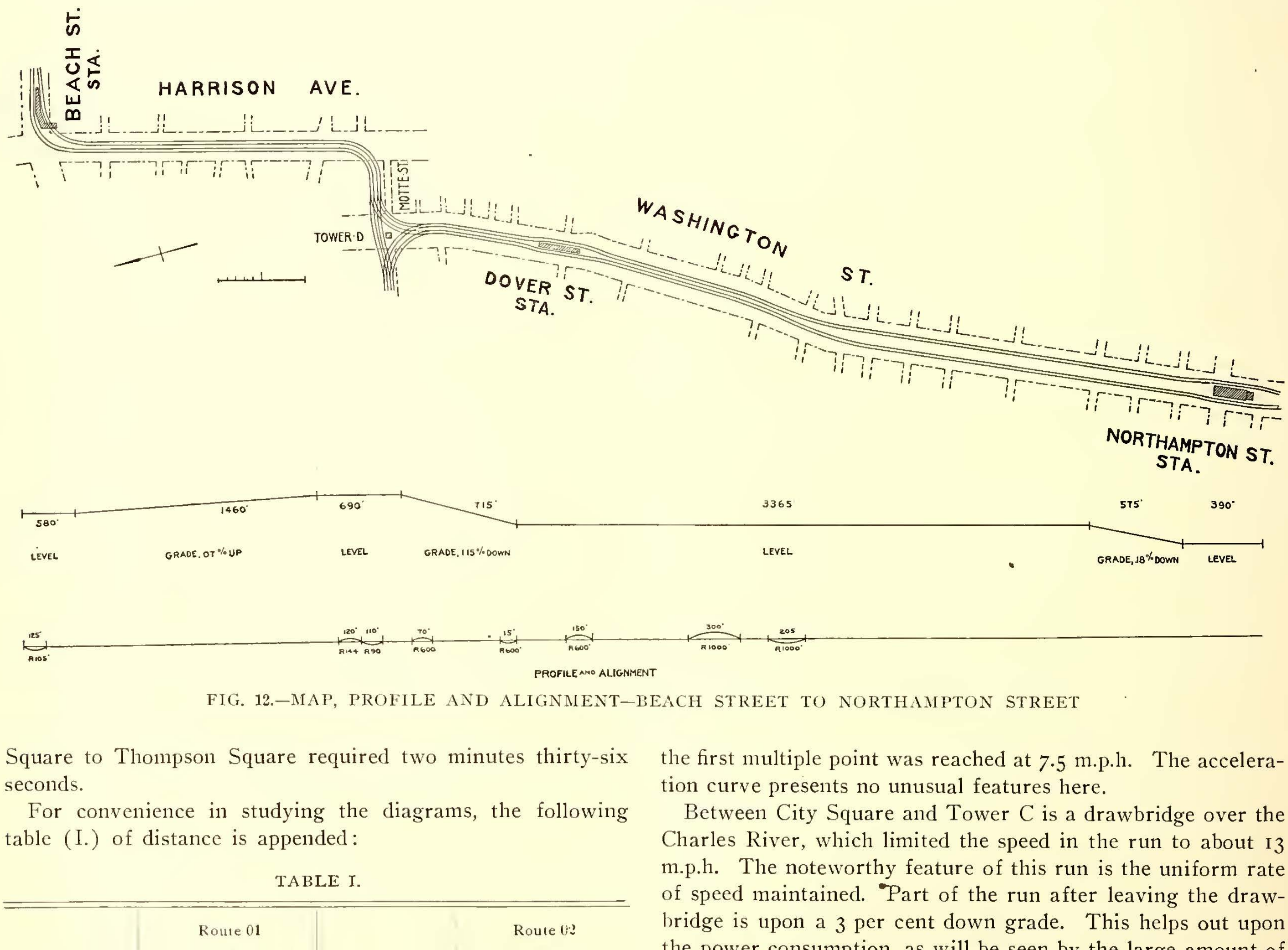


FIG. 12.—MAP, PROFILE AND ALIGNMENT—BEACH STREET TO NORTHAMPTON STREET

Square to Thompson Square required two minutes thirty-six seconds.

For convenience in studying the diagrams, the following table (I.) of distance is appended:

TABLE I.

Route 01			Route 02		
	Feet	Miles		Feet	Miles
Sull. Sq			Dudley St..		
Thomp. Sq ..	5,605	1.062	North. "	3,091	.585
City " ...	1,391	.263	Dover " ..	4,189	.793
No. Sta	2,911	.551	Pls. " ..	2,517	.477
Haykt Sq	1,029	.195	Byl. " ..	1,419	.269
Scy. " ...	1,5(0	.284	Park " .	1,335	.253
Park St......	1,580	.299	Scy. Sq..	1,440	.273
Byl. "	1,080	.204	Adams " ..	770	.146
Pls. "	1,730	.328	Haykt " ..	990	.188
Dover St.....	2,507	.475	No. Sta	1,072	.203
Nor. "	4,182	.792	City Sq..	2,887	.547
Dud. "	3,937	.746	Thomp." ..	1,390	.263
			Sull. " ..	4,654	.881

The voltage curve between Sullivan and Thompson Squares shows the drop in pressure at each moment of unusual current demand, and the rise as the current is thrown off. During the run the average voltage was about 570. The alignment and grade was favorable to high-speed operation.

The foregoing analysis indicates the sort of information that the curves give, and similar studies can easily be made of the other runs in the round trip. It remains to touch upon the salient features of the record.

From Thompson to City Square the short run presents no special points of interest except the regular notching-up of the control as the train speed increased; the maximum current demand of about 450 amps., maximum speed of 26.3 m.p.h., maximum rate of acceleration of about 2 m.p.h. per second, and lower demand upon the brakes. An interesting point is shown in connection with the maximum current demand in the first two runs.

The current reaches a higher value between Thompson and City Squares, because the speed is lower when the control goes into multiple, and there is less counter electromotive force in the motor armatures than in the Sullivan-Thompson run, where multiple was reached at a speed of 20 m.p.h. Here the first multiple point was reached at 7.5 m.p.h. The acceleration curve presents no unusual features here.

Between City Square and Tower C is a drawbridge over the Charles River, which limited the speed in the run to about 13 m.p.h. The noteworthy feature of this run is the uniform rate of speed maintained. Part of the run after leaving the drawbridge is upon a 3 per cent down grade. This helps out upon the power consumption, as will be seen by the large amount of coasting involved, the current being required for only brief impulses of short duration.

Leaving tower C, the speed was about 12½ m.p.h. as the train passed around the 125-ft. radius curve to the right, and the run to North Station was made without notable increase in speed. A single application of current was enough to carry the train around the 100-ft. radius curve at the North Station. An interesting point is noted in the voltage curve just after leaving Tower C. The train passed over a gap in the third rail at this point and the current supply of the head car was momentarily cut off, so that the voltage curve dropped to zero.

In the run from the North Station to Haymarket Square the track is carried down a 5 per cent incline into the subway. This run is consequently nearly all coasting, and only a brief application of current to the train was necessary. The control did not pass beyond the series running point. The brake cylinder diagram is of special interest here on account of the additional braking required by the down grade, to keep the train well under control at a maximum speed of 20 m.p.h. The gradual reduction in auxiliary reservoir pressure is interesting to note.

The negative acceleration appears well during the braking period. A glance at the speed-time curve shows why it was necessary to make an additional quick application of the brakes to prevent overrunning the station in coming to a full stop at Haymarket Square. The reader will note that the brakes were kept on at the North Station while the train was standing there, on a —1 per cent grade.

Between Haymarket Square and Scollay Square the effect of the alignment and grade upon the current and speed curves is especially apparent. The train barely had time to accelerate in series to 16 m.p.h. before it was necessary to brake on account of the 90-ft. radius curve, reached seven minutes after leaving Sullivan Square. After passing around this curve, the train accelerated through series to multiple up a 3 per cent and then a 5 per cent grade, until it was again necessary to cut off current, which was followed by coasting around part of the 90-ft. radius curve approaching Scollay Square. The train was still climbing a 2.7 per cent grade as it entered the station, so that a third application of the current was necessary in order to make a proper stop. It is easily apparent that this type of run is exceedingly expensive from the standpoint of power consumption. Even at Scollay Square it was necessary to keep the brakes on in order to hold the train at the platform, about 38 lbs. per square inch being required in the brake cylinder. It will be noted that the maximum series current taken by the car in the second period of acceleration is less than in the first period. This is because the speed and counter electromotive force of the motors was higher, as was explained previously in the run from Sullivan to Thompson Square. The acceleration curve is worth examining in this run.

The effect of the throttle in the control is noteworthy as one examines the current curves. It will be seen that this was set in the equipment to about 240 amps. for series running and 480 amps. in the multiple. In the Haymarket-Scollay run it was possible to run in multiple for about six seconds.

The first part of the run from Scollay Square to Park Street involves clear operation from series to multiple. A maximum speed of 23 m.p.h. was reached, followed by a brief coast. Then the train was braked to a speed of 10 m.p.h. for the 90-ft. and 82-ft. radius reversed curve entering Park Street. It was necessary to keep the current on for fourteen seconds in passing around the curve. At Park Street the train was held on a —2.8 per cent grade with the brakes on.

The effect of the sharp curves appears plainly in the run from Park to Boylston Street. Scarcely does the train leave Park Street before it has to be braked for a 90-ft. radius curve; speed is then gained until the train approaches a 90-ft. radius reversed curve on nearing Boylston Street, when the brakes are again applied; then two short applications of current are given, followed by braking to a stop. The curve of brake-cylinder pressure plainly shows the frequent demands upon the brakes in the subway, as does the recurring falling and rising of the auxiliary reservoir pressure. Coasting is relatively less frequent in the subway.

Upon leaving Boylston street the train passed down an 8 per cent grade with a single brief application of current. The maximum speed attained was 12.5 m.p.h. The rapid acceleration at first is plainly shown by the acceleration curve, which sags as the brakes are applied, although there is a slight positive acceleration all the way down. At the bottom of this grade the climax of the subway's intricacy is reached in a 90-ft. radius reversed curve, the latter part of which is on a 4.5 per cent up grade. Here current is applied for the run to Pleasant Street, which is reached without further incident.

The noteworthy features of the run from Pleasant Street to Tower D are: The heavy consumption of current and slower rate of acceleration in climbing the 5 per cent incline which leads out of the subway; the cutting off of current and ensuing series operation upon reaching the 200-ft. radius curve over the New York Central and New York, New Haven & Hartford Railroad tracks, and the maintenance of a speed of about 12 m.p.h. around the 125-ft. radius curve at the Y at Tower D. The 200-ft. radius curve over the railroad tracks is also upon a 3.85 per cent up grade.

From Tower D to Dover Street nothing unusual occurred. Sometimes a train goes into multiple for a few seconds between these points.

Between Dover and Northampton Streets the conditions are favorable for high-speed running and quick acceleration. On the run shown in Fig. 13 an emergency stop was made from a speed of 37.5 m.p.h. in eighteen seconds, the rate of retardation being 2.1 m.p.h. per second. The demand upon the brake cylinder and the auxiliary reservoir is well shown here. Thus, 60 lbs. was held in the former, and the latter dropped to about 60 lbs. also, in the emergency equalization. If this emergency stop had not been made, the energy consumption for the run would have been much less, as may be seen by the run northbound from Northampton to Dover Streets, in which no stop was made. The curves show very well that acceleration and not running at speed is what requires great power.

In the run from Northampton to Dudley Streets the effect of the curves in the line upon approaching the terminal is apparent. The shortest curve, on the loop, has a radius of 105 ft. Series running and brief applications of current characterize the latter part of this movement. Shortly before entering Dudley Street, the train passed over a gap in the third rail, and the effect on the voltage curve is shown as at Tower C. The running time from Sullivan Square was eighteen minutes eight seconds.

A stop of seventeen seconds was made at Dudley Street, after which the northbound run was begun. Some series running was required to clear the special work and curve just north of Dudley Street, after which a full-speed run without hindrance was made to Northampton Street. The approach to Northampton Street is in part a 1 per cent down grade, and the increased demand upon the brakes in coming to a stop is easily apparent.

Between Northampton and Dover Street an excellent run is possible, accelerating uniformly until the motor curve is reached, the maximum speed being 38 m.p.h. Nearly twenty seconds are used up in coasting. At the point of maximum speed the current is 125 amps. In this run the gradual decrease in acceleration as the current falls off upon the motor curve is extremely well shown, as is the gradual increase in retardation as the brakes are applied.

From Dover Street to Tower D the only notable feature is the reduction of speed to 10 m.p.h. in passing around the Y toward Pleasant Street. A short series application of current is then made, after which the train coasts down the 2.48 per cent and 3.85 per cent grades over the steam railroad tracks around the 200-ft. radius curve shown, and thence down the 5 per cent grade into Pleasant Street. In approaching the latter station, the brakes are on for about thirty-eight seconds. This run takes little energy after Tower D has been passed, as may be seen from the current curve.

At Pleasant Street the track enters the subway, northbound. From this point to Boylston Street the speed-time curve is more or less distorted by the alignment and grade. It will be seen that the current is necessarily kept on a considerable portion of the time, and that a third application of the current is needed in entering the station at Boylston Street, on account

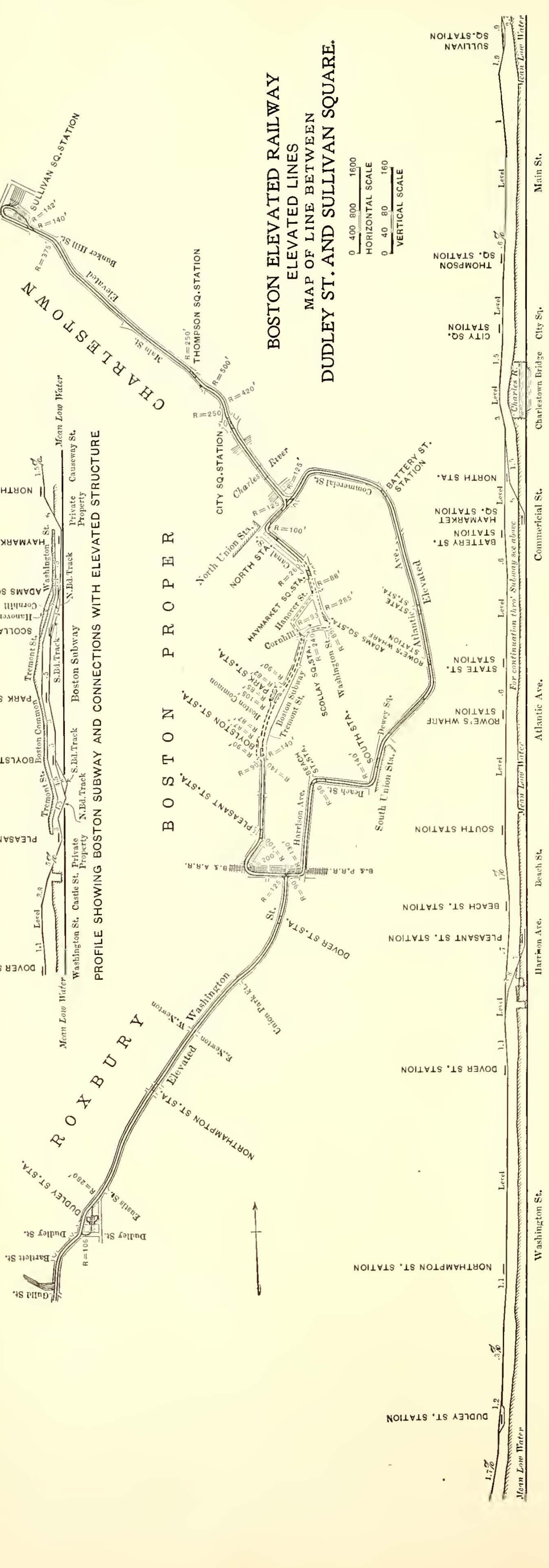


FIG. 14.—PLAN AND PROFILE, SHOWING ELEVATED STRUCTURE FROM DUDLEY STREET, ROXBURY, TO SULLIVAN SQUARE, CHARLESTOWN, VIA ATLANTIC AVENUE AND SUBWAY

of a 90-ft. radius curve and a 4.5 per cent grade encountered just south of the platform.

Between Boylston and Park Streets the acceleration curve is especially smooth and well balanced. There is no significance in obtaining equal maximum values, other than the fact that in such cases the acceleration and braking rates are equal, but the reader will note the close correspondence between the acceleration, current and speed curves here. The run between these two stations presents little difficulty from the track layout's standpoint, but it is so short that very little time is left for coasting between the moments of shutting off power and applying the brakes.

The run from Park Street to Scollay Square is still more economical of energy consumption in terms of distance. Nearly one-third of the time of run is spent in coasting, and yet the distance, 1440 ft., is covered in fifty-four seconds, which means an average speed of 18.2 m. p. h. The effect of the down grade of 3 per cent in stopping at Scollay Square is evident on the speed, brake cylinder and auxiliary reservoir curves.

The shortest run in the subway is from Scollay to Adams Square, 770 ft. Three per cent and 4 per cent down grades abound, with a 90-ft. radius curve approaching Adams Square. The conditions are favorable for a run that is largely made up of coasting, and as one would expect, the current curve is not prominent. The current is off during about 87 per cent of this run. An application of the brakes is necessary on approaching the 90-ft. radius curve, which is rounded at 10 m. p. h. to 12 m. p. h., after which the train makes its stop.

From Adams Square to Haymarket Square series running is the order of events, with a little judicious coasting. No serious curves or grades are found here. This run is a good example of the effect of holding the motors in series, then coasting and braking. The acceleration curve is seen to drop off with great rapidity as the current in the motors decreases, and the short period of straight acceleration as compared with the long motor curve is worthy of comment.

The advantages of going into multiple when possible, as far as the schedule is concerned, are plainly shown in the run up the 5 per cent incline between Haymarket and the North Station. In the preceding run thirty-eight seconds were required to accelerate to 17.5 m. p. h., while in this one but fifteen seconds are needed. This is, of course, not a perfectly fair comparison, as the alignment and grade upon leaving Adams Square is not quite similar to that at Haymarket Square, but it shows in a general way the advantages of multiple operation in saving time. In this run it will be noted that the current reaches a constant value, as does the speed (20 m. p. h.) in climbing the 5 per cent grade. This means that this is the highest speed that can be attained on this grade by the equipment, with the voltage at the point shown. The area of the current-time diagram is significant as an indication of the power consumption of such a car, weighing about 30 tons, in ascending a 5 per cent grade. The run from North Station to Tower C does not differ in general character from the corresponding southbound run. Upon passing around the 125-ft. radius curve at Tower C, however, in the run to City Square, the motors are thrown into multiple, and the train accelerates up the 3 per cent grade which marks the Charlestown drawbridge approach. Power is shut off for a few seconds, and then the train accelerates across the bridge with the motors in series; this is kept up long enough to allow a brief period of coasting and subsequent braking into City Square. The reader will note that the train is taking but 47 amps. per car in this series running at 20 m.p.h.

The short run from City Square to Thompson Square requires no special comment, other than the second application of brakes needed to avoid overrunning the station platform.

The final run from Thompson Square to Sullivan Square illustrates the regular acceleration of the train to a maximum speed of about 36.3 m.p.h. Coasting is particularly evident as the train approached the curve near Bunker Hill Street. The calibration points on the structure were passed in 28.3 seconds, giving an average speed between points of 35.3 m.p.h., which checks exactly with the speed-time curve. The train coasted for forty-five seconds; braked to a speed of 11 m.p.h. at the 105-ft. radius reversed curve at the entrance to the terminal, and came to a stop in the Sullivan Square station, having made the round trip, 10.071 miles, in thirty-four minutes six seconds. A single application of current was required to round the last reversed curve satisfactorily. The momentary drop in voltage while the train was standing at Dudley Street, and also while standing at Pleasant Street, was due to feeder tests which are made nightly at the power houses.

BOSTON ELEVATED RAILWAY COMPANY
TABLE II.

Power test made on elevated cars, made in March, 1904.

Table of test, March 20, for maximum difference of power. Cars Nos. 0108 and 090.

Equipment, 2—50E—31 ins. and 2—50C—34 ins.

	Routes 03 and 02 K. W. Hrs. p. c. m.			Routes 01 and 04 K. W. Hrs. p. c. m.	
Equip.	50E—31″	50C—34″	Equip.	50E—31″	50C—34″
Sull.			Sull.		
Thmp	2.162	3.264	Thmp	1.978	3.283
City	4.030	5.502	City	4.055	6.300
To. C.	2.806	4.082	To. C	2.860	4.338
Batt	3.404	5.370	N. S	0.757	0.911
State	2.733	4.500	Hykt	1.473	1.364
R. W	2.622	3 907	Scy	3.740	6.190
S. S	2.550	3.907	Park	3.700	4.490
B'ch	2.020	3.050	Byl	1.556	1.721
To. D.	3.330	5.270	Pls	2.348	3 610
Dov	2.513	3.468	To. D	5.395	8.302
Nor	2.204	3.632	Dov	2.238	2.406
Dud	2.912	4.400	Nor	2.198	3.640
			Dud	2.432	3.875
Av	2.774	4.200	Av	2.672	3.880
Dud.			Dud.		
Nor	1.873	2 706	Nor	1.750	2 566
Dov	2.020	3.302	Dov	1.896	3.198
To. D.	2.937	4.205	To. D	2.748	3.983
Pls	1.048	1.431	B'ch	2 220	3.370
Byl	3.456	6.615	S. S	2.162	3.280
P'k	2.476	3.220	R. W	2 505	4.038
Scy	2.143	2.853	State	2.565	3.372
Adams	1.540	1.083	Batt	2.732	4.410
Hyt	3.212	4.858	To. C	2 605	3.850
N. S	6.780	10.030	City	2.907	3.962
To. C	3 160	5.845	Thp	2.332	3 390
City	1.911	3.378	Sull	2.016	3.172
Thmp	4.210	6.440			
Sull	2.127	3.390			
Av	2.778	4.245	Av	2.370	3 549

Table II. illustrates the result of working up a test obtained by the recorder, comparing the energy consumption of two different gear ratios upon the elevated division. The 50-C motors were geared to 34-in. wheels, with a ratio of 2.38, and the 50-E motors were geared to 31-in. wheels, with a ratio of 3.18. The latter motors proved to be the most economical of energy. Some remarkable differences in energy consumption with the same equipment were brought out, over different portions of the line. Thus, under route 01 and equipment 50-E—31 ins., the long run at high speed from Sullivan Square to Thompson Square takes but 1.978 kw-hours per car-mile, against 4.055 kw-hours per car-mile in the short run between Thompson and City Square. The runs in the subway from Haymarket Square through to Park Street show plainly how much more power is used in overcoming the grades and curves, and in accelerating from the low speeds entailed, as compared with the freer runs at higher speed between Tower D and Dudley Street, for instance. The energy consumption runs up to 5.395 kw-hours per car-mile between Pleasant Street and Tower D, on account of the effect of the long climb out of the subway to the elevated structure. This latter figure rises to 8.302 kw-hours per car-mile for this run in the case of the 50-C—34-in. equipment, which accelerates more slowly to a higher maximum speed than the 50-E—31-in. The higher acceleration proves more economical in nearly every case, and this is particularly notable on up grades, as may be further seen in the extreme case of Haymarket-North Station, route 02. Here the higher speed equipment took 10.03 kw-hours per car-mile, and the lower speed and quicker acceleration equipment required but 6.78. The ratios and wheel diameters of Table II. were arranged to give the maximum difference in accelerating power and in capacity for maximum speed with the given equipments.

BOSTON ELEVATED RAILWAY COMPANY
TABLE III.

Power test on elevated cars, made in March, 1904, with car-test recorder.

Table of test, March 20, 1904. Two-car train, maximum difference in power from Dover Street to Northampton Street.

Car. Nos	090	0108	Train
Equipment	2—50C—34″ wh.	2—50E— w.31″	
Gear ratios	2.38	3.18	
Run	Dov. to Nor.	Dov. to Nor.	
Distance, miles	0.792	0.792	
Weight, tons	29.5	29.5	59
Ton miles	23.76	23.76	47.52
Time motor			
Curve reached	30 sec.	22 sec.	
Time to make run	1 min. 49.5 sec.	1 min. 49.5 sec.	
Time current on	64 per cent.	64 per cent.	
Kw hours	2.879	1.749	4.628
Kw hours per c. m.	3.632	2.204	2.918
W. hours per t. m.	121.2	73.6	97.4
Average speed m. p. h.	26.0	26.0	
Max. " "	41.8	41.8	
Accel. " "			
Per S	1.00	1.00	
Coast do	0.30	0.30	
Brake "	2.02	2.02	

The detailed analysis of a run from Dover to Northampton Streets is shown in Table III., based upon the above recorder test. In the test two cars were used, and the performance of the motors on each car noted, one current curve being shown in red and the other in black ink. One car was geared differently from the other, as stated in both tables. The running time was, of course, identical with each equipment. It will be seen that the recorder enables the most detailed comparisons to be made between the motors in the different cars of a train after the connections are properly made with the instruments.

The figures of Table III. are significant in respect to the lower consumption of energy with the gear ratio which gives the quicker acceleration, between Dover and Northampton Streets. This works out as 73.6 watt-hours per ton-mile, against 121.2 watt-hours with the slower acceleration. The motor curve was reached in twenty-two seconds, against thirty seconds in favor of the 50-E—31 equipment. The coupling of the two differently geared cars together in the same train gave a test in which the running time, speed, acceleration, coasting and braking factors were identical with each, leaving only the power consumption to vary, between the two equipments.

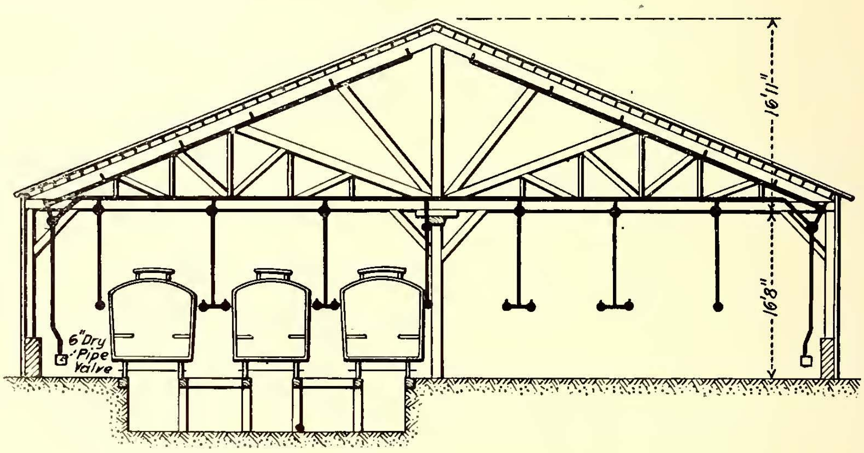
Fig. 14 shows a map and profile of the elevated division.

The importance of securing accurate information in regard to the behavior of the rolling stock and equipment is great upon any road, but it is especially so in the case of lines giving rapid transit in the congested districts of large cities. In the short runs which characterize elevated railway or subway service, the detailed analysis of acceleration, coasting, braking and energy consumption problems is well nigh absolutely necessary if a road is to be operated in a scientific manner. The interrelations of the complex factors which enter into a run with a modern high-powered train must be studied both singly and in toto if full control is to be had of the equipment's performance. In modern rapid transit, time is the vital point. Anything which will save time without undue additional expenditure of money is of momentous consequence. The seconds count in short runs as they cannot in long ones. Important as coasting is from the standpoint of energy consumption and motor heating, the acceleration and braking curves are the determining features of such runs as are found on elevated and subway routes in cities. The apparatus described in this article enables the slightest noticeable irregularity in train operation to be recorded for careful investigation; it furnishes a continuous story on the spot, of the manner in which different motormen operate the train; is adaptable to any car on the road, surface or elevated; enables both approximate and accurate information to be given to officials immediately, without recourse to long and tedious calculations; shows the economical and expensive sections of the line from the viewpoint of power consumption; indicates where it will pay to slacken up and where to increase the schedule speed; furnishes information as to the value of new appliances in multiple-unit control, air-brake systems, etc., and enables many physical quantities hitherto in doubt and more or less speculative to be determined by the engineering department of any company with sufficient accuracy for all commercial purposes.

The recorder described as in use in Boston can be used with equal facility on other electric railways, and in surface or interurban car work especially is it valuable in determining the characteristics of the track, acceleration and braking under adverse or favorable conditions of weather, the power required to operate heavy cars in snowy periods, etc. Used in connection with power-station load curves and feeder-system data, it provides information of the highest consequence in determining the actual losses between the station bus-bars and the wheels of the cars. Load curves may readily be predicted for any schedule from the characteristic runs made with the recorder, and the daily or monthly cost of operation closely estimated for both trains and the power-station equipment supplying them. In conjunction with data supplied by the manufacturers of car equipment, the copper and iron losses of the motors can be figured from the recorder diagrams at every point on the most tortuous alignment and variable profile. Thus, the data necessary for determining motor heating and capacity can be accurately obtained for any given transportation cycle. By a quick reference to a table of station distances, or the distance record on the diagram, and a moment's use of the slide rule, the engineer in charge of the test can determine for any official present the energy consumption actually being made by the train. Emergency stops can also be analyzed with despatch, and the effect of running past a danger signal fitted with an automatic stop can be studied on the spot. In short, the possibilities of investigation with the recorder appear limitless.

THE RECENT CAR-HOUSE FIRE TEST IN NEWARK, N. J.

The test conducted at Newark, Dec. 2, by the Underwriters' Electrical Bureau, of New York, to determine the practicability of protecting car houses by automatic sprinklers, has been previously mentioned in these columns, but further particulars are now available. The test was conducted at the Belleville Avenue car house of the Public Service Corporation, which generously placed this structure at the disposal of the underwriters, and also supplied a number of cars to be burned for the purpose of this test. The car house, a section of which is presented herewith, is a frame structure 80 ft. x 150 ft., with light wood, slate-covered roof, with heavy wood trusses spaced 16 ft. 8 ins. between centers, and with the lower chord of the trusses 16 ft. 8 ins. from the former. The peak of the roof is 33 ft. 7 ins. from the floor; the distance between tracks is extreme, being 6 ft. 1¾ ins. and 6 ft. 3¾ ins. With cars in position, the distance between car bodies on the first and second tracks is 41 ins., and between the second and third tracks is 44 ins. There are seven tracks in the car house, but for reasons of economy it was not considered advisable to sprinkle more than three of them.



SECTION OF CAR HOUSE, SHOWING ARRANGEMENT OF SPRINKLERS

The car house was fitted with the dry-pipe system of automatic sprinklers, with two different makes of sprinkler heads and two dry valves. Half of the sprinklers and one dry valve were furnished by the General Fire Extinguisher Company, of Providence, R. I., manufacturers of the Grinnell system, and the other half and the other dry valve by the Manufacturers' Automatic Sprinkler Company, of New York. There were altogether 192 sprinklers on the Grinnell dry valve and 193 on the Manufacturers' dry valve, making a total of 385. The sprinklers were upright and the two makes were alternated on all the lines.

In this connection it might be said that a "dry-pipe" system of sprinkler piping is one from which the water supply is held back by a "dry valve" located at some point in the supply pipe, as at the base of a riser. The sprinkler piping is filled with air under pressure. When a sprinkler opens it releases the air, which in turn releases the "dry valve." This allows the water to rush into the piping and discharge from the opened sprinkler. It can be seen that some time is taken by these operations, the interval being limited, however, by the rule that not over 200 heads shall be placed on one dry valve. The time is also dependent upon the releasing point of the particular type of dry valve and the air and water pressure which may chance to obtain at the time of the fire. Under average conditions, this period will vary from one to two minutes. The nearer the valve is located to the base of the riser, and the less the amount of piping under air pressure, the quicker will be the operation.

The sprinkler equipment of the Belleville Avenue car house was divided into two systems, with one 6-in. riser for each sys-

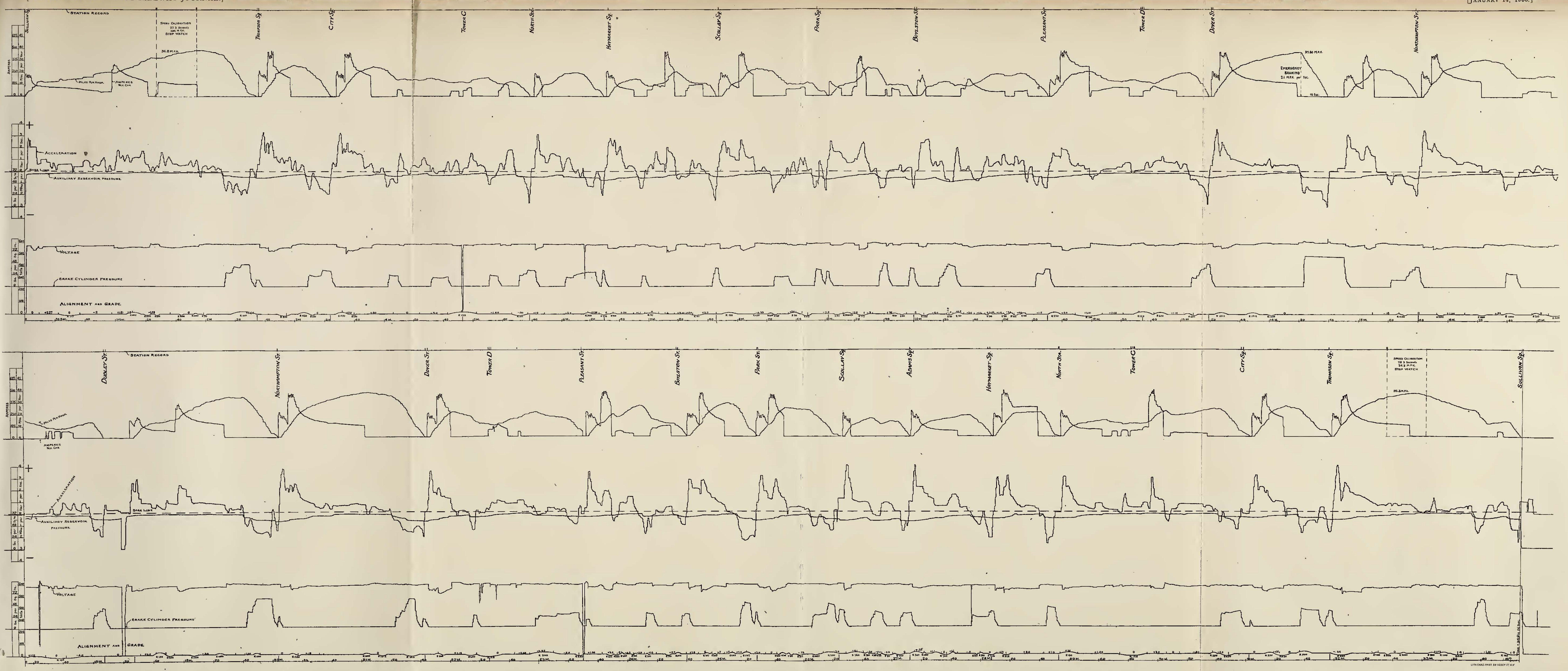
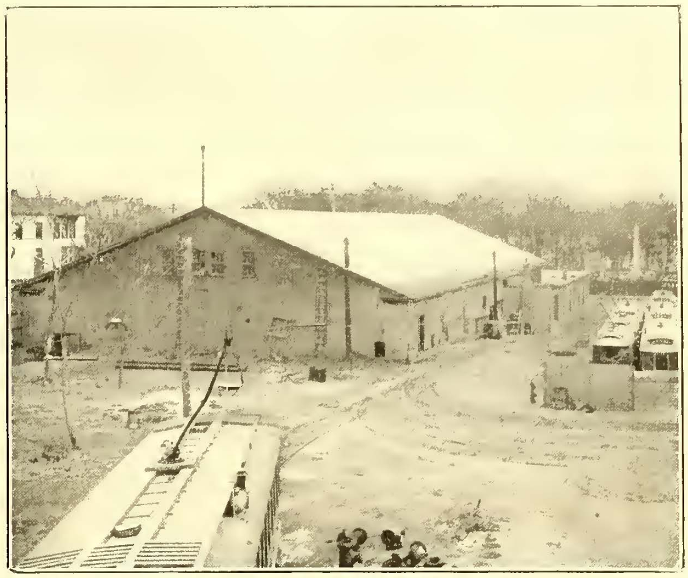


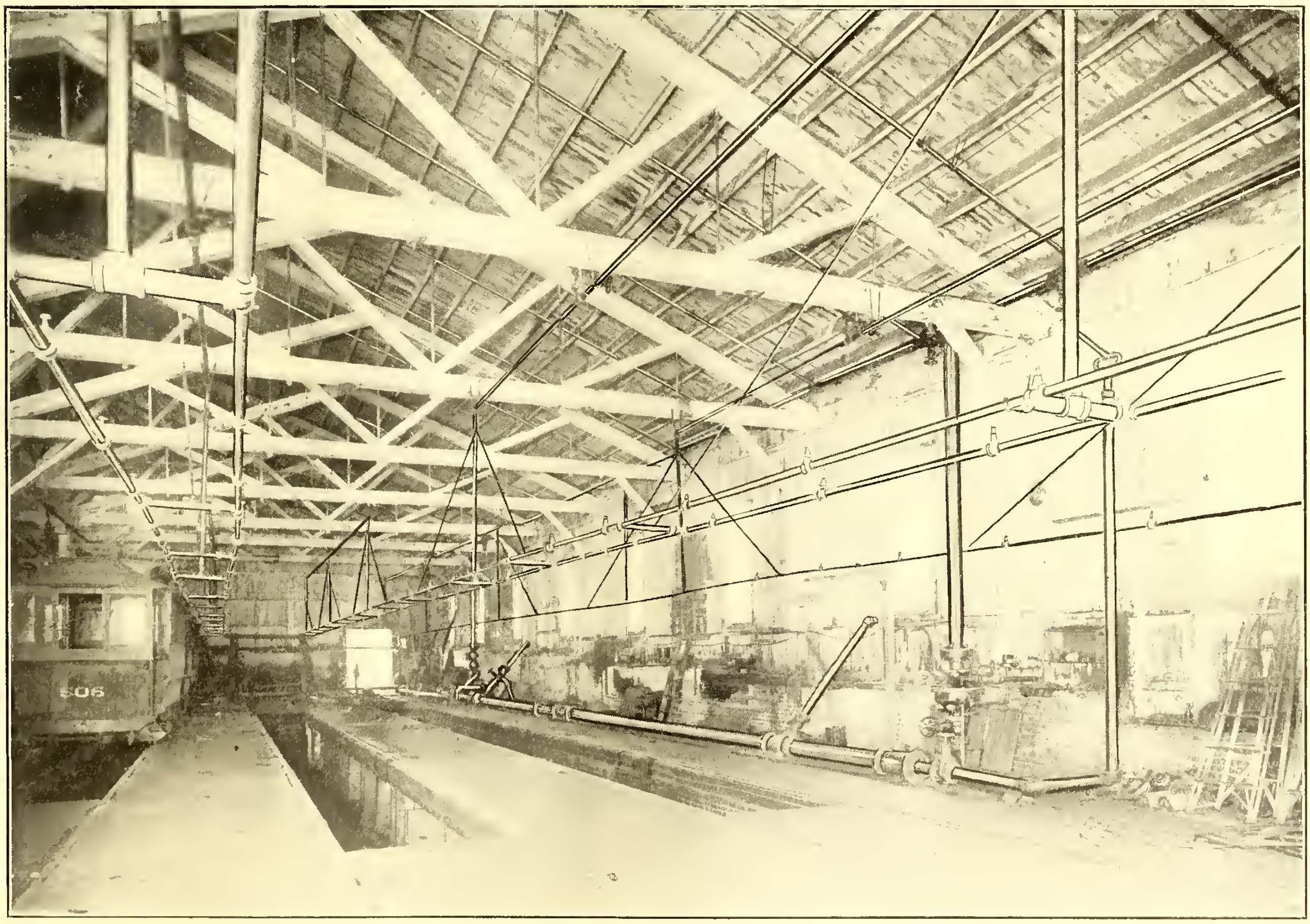
FIG. 13. DIAGRAM OF RUN FROM SULLIVAN SQ. TO DUDLEY ST. AND RETURN VIA SUBWAY, ON NOV. 13, 1904. 4 CAR TRAIN--ALL MOTOR CARS. WEIGHT PER CAR, 30 TONS. EQUIPMENT PER CAR, TWO G. E. 68 C MOTORS, 170 H. P. EACH. GEAR RATIO, 59:18=3.28. 33" DRIVING WHEELS. WESTINGHOUSE STANDARD AIR BRAKES.

tem, and both connected to a common 8-in. main. All the ceiling was sprinkled except the office, and the four aisles between the cars were protected with low-line heads, which, as shown in the section, were about even with the tops of the car windows. The highest line of ceiling sprinklers above the ground was 32 ft., and the pressure from the city supply was 20 lbs. to 30 lbs., but this pressure was capable of being increased from 40 lbs. to 64 lbs. by the fire pump to be described below. The ceiling sprinklers were spaced 7 ft. 11 ins. x 8 ft. to 9 ft. The low-line sprinklers were placed 5 ft. apart.

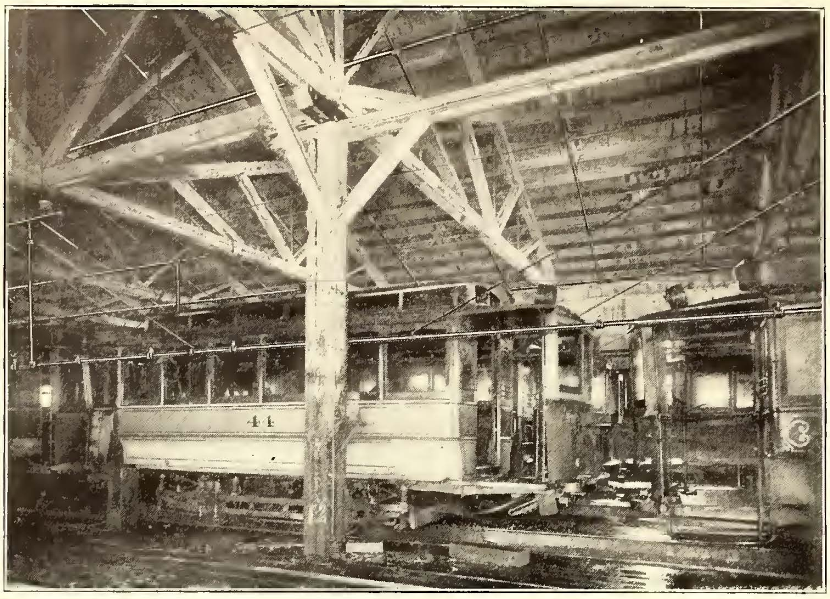
For mechanical reasons, the low line of piping was principally 1¼ ins. in diameter. There was a connection to the city main and, in addition, there was a 750-gal. Worthington two-stage centrifugal pump and a 500-gal. Gould rotary pump, each driven by a 50-hp railway motor. The air pressure for the dry-pipe system was supplied by a Christensen air-brake compressor, supplied by the National Electric Company. There were alarm connections on both dry valves, and the valves and piping were so installed that either system could be controlled independently of the other. The system was also provided with



BELLEVILLE AVENUE CAR HOUSE—FRONT AND REAR VIEWS



BELLEVILLE AVENUE CAR HOUSE—FRONT AND REAR VIEWS



CAR IN TEST NO. 3—BEFORE THE FIRE

a Glazier nozzle attached to a standpipe 12 ft. above the ground, so arranged that it could be supplied with water from either or both pumps.

In the first test, a car in the center row in the front of the car house was fired, with all windows closed, doors open and just enough paper under the seats to start the car blazing. This was a severe test, because the fire naturally gained a great deal of headway before the glass in the windows broke and, hence, before the sprinklers could be operated by the heat. The car was set on fire at both ends, and the first sprinkler, which was one on the low line opposite the windows, opened four minutes after the fire was started. Altogether during the test, ten sprinklers opened and the fire was extinguished in eighteen minutes after the opening of the first sprinkler. Throughout the test the fire was confined to the car in which it originated. In this test the city water pressure, which was from 32 lbs. to 34 lbs., was used.

The second test was conducted with a car in the center row in the rear of the car house, and the car was set on fire, with the windows and doors open, and with just enough paper and excelsior to start the car blazing. In this test the Worthington centrifugal pump was used, in which the water pressure was raised to from 75 lbs. to 80 lbs. The first sprinkler, which was one on the low line, opened just one minute and a half after the fire was started, and the fire was practically extinguished in two and a half minutes after the first sprinkler opened, or in four minutes after the fire was started. Eleven sprinklers opened.

The third test, which was the most severe of all, was conducted on a car in the center of the last row. In previous tests, as stated, only enough paper and excelsior had been used to start the fire; in this test the entire interior of the car was saturated with kerosene oil. In addition, the windows were closed, while the doors were kept open. The automatic pump was connected to the water system as in the second test. In this case the first sprinkler opened in forty-five seconds after the fire was started, and the fire was practically out in four and a quarter minutes after the fire was started, ten sprinklers having opened. One noticeable feature of this test was that, although it was the hottest of any, it proved to be the easiest to extinguish.

CAR IN TEST NO. 3—DURING THE FIRE

CAR IN TEST NO. 3—AFTER THE FIRE

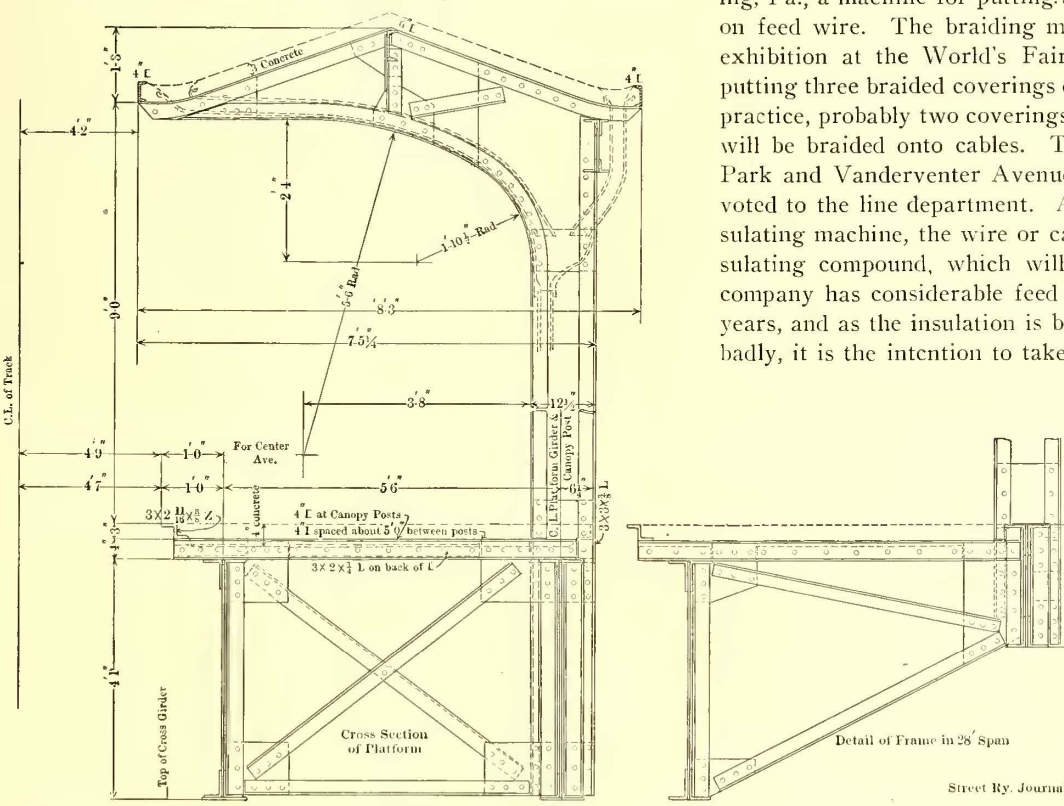
The three tests described were conducted for the fire underwriters under the direction of Bruce E. Loomis, chief of the Underwriters' Electrical Bureau, of New York. According to Mr. Loomis, a number of important points were demonstrated which amply justify the insurance companies going to the great expense and trouble to which they were put in conducting these tests. One of these was that a centrifugal or rotary pump, as used in these tests, is of considerable value, and that it is desirable to gear the motors so that the pump should run higher than its normal speed, in order to provide against fluctuations in voltage. The test also showed that two lines of the low sprinklers, where cars are far apart, are much more satisfactory than one line, although this is not a question of very great importance, because in most car houses the distance between tracks is considerably less than at the Belleville Avenue car house. The system of sprinkler pipes did not interfere with the operation of the car house, and trolleys can be turned easily. To guard against trouble in grounding from any accidental contact, an insulated joint was introduced into the sprinkler system by Mr. Loomis. A satisfactory insulated coupling of this kind can be made by the use of three boxwood discs, boiled in paraffine, coated with P. & B. compound, and held between the pipe flanges by bolts passing through insulating bushings. The fact that, although the adjoining tracks contained cars, the damage was confined entirely to the cars in which the fire was ignited, indicated absolutely to the underwriters that automatic sprinklers can be very successfully applied to car house properties.

In view of the successful result of these tests, it is believed that the stock fire insurance companies are prepared to make material reductions in car house premiums where the railway companies are prepared to install approved sprinkler systems.

CONCRETE ELEVATED PLATFORMS AND CANOPIES IN CHICAGO

The Metropolitan West Side Elevated Railway Company has recently been replacing some of its wooden station platforms with concrete. The result has been a platform which is apparently much more durable and is certainly much neater in appearance than the wooden platforms. The wooden platforms on certain stations which had been down ten years were worn out.

The concrete construction is shown both by the accompanying photograph (which is of the Center Avenue station) and by the drawing. The concrete of the floor is 4 ins. thick with expanded metal reinforcement. The concrete is spread between a z bar at the outer edge of the platform and an angle bar at the inner edge. The real support of the concrete slabs consists of 4-in. I-beams placed about 5 ft. between centers.



CONSTRUCTION DETAILS OF STEEL WORK FOR REINFORCED CONCRETE PLATFORM AND ROOF

The concrete being 4 ins. thick, extends about 1 in. over the top of each I-beam, so as to give a firm hold on the I-beam. The concrete used was a mixture of one part Lehigh cement, three of sand and five of crushed limestone.

Besides the station floors, the roof and stairs are also of reinforced concrete. The concrete of the roof is 3 ins. thick, as shown by the drawing. On top of the concrete of the roof is a layer of asphalt cement on which was placed a layer of roof felt, which is covered with asphalt, after which the whole is entirely covered with gravel.

CONCRETE STATION PLATFORM AND ROOF, METROPOLITAN ELEVATED RAILWAY, CHICAGO

This work is under the charge of C. S. Menden, chief engineer of the Metropolitan West Side Elevated Railway Company.

PLANS FOR RE-INSULATING FEED WIRE AT ST. LOUIS

The United Railways Company, of St. Louis, at the close of the Exposition purchased of the Textile Machine Works, Reading, Pa., a machine for putting a waterproof braided insulation on feed wire. The braiding machine was one which was on exhibition at the World's Fair. The machine is capable of putting three braided coverings on a wire or cable. In ordinary practice, probably two coverings, one of jute and one of cotton, will be braided onto cables. The machine is being set up at Park and Vanderventer Avenues, in portion of a building devoted to the line department. After being run through the insulating machine, the wire or cable is to be passed through insulating compound, which will saturate the insulation. The company has considerable feed wire which has been up many years, and as the insulation is becoming frayed so that it looks badly, it is the intention to take this wire down and put a new braided covering on it. There is also a lot of lead-covered underground cable, the insulation of which was ruined in the big conduit burn-out last June, which was fully described in these columns. It has been found that the lead covering can be stripped off of these cables and a braided insulation put on top of the paper insulation of the cable so as to make very good overhead feed wire. The amount realized from the sale of the scrap lead in this case will be sufficient to pay for reinsulating the cable for overhead use.

Power from the Kern River plant, in California, is now being used to operate the Los Angeles, Pacific Electric and Redondo Railways, in Los Angeles, which is more than 125 miles from the source of generation. Power is transmitted into the city over two-pole lines of three wires each. The difference of potential is 65,000 volts. The plant was three years building.

"SPECIAL TRACK WORK" AT THE NEW ENGLAND STREET RAILWAY CLUB

A largely attended meeting of the New England Street Railway Club was held in Pierce Hall, Copley Square, Boston, on the evening of Dec. 29, President Neal being in the chair. A number of members of the New England Railway Club were also present. It was announced that the date of the annual banquet would be Jan. 26, 1905, the place selected being the Hotel Brunswick, Boston. The speaker of the evening was Victor Angerer, vice-president and general manager of Wm. Wharton, Jr., & Co., Inc., Philadelphia, his subject being "Special Track Work."

Mr. Angerer stated at the outset of his address, which was illustrated by a large number of admirable lantern slides, that, until the October meeting of the club, he had felt some doubt as to whether frogs and switches formed a sufficiently important part of the mechanism of street railways to enable a paper of general interest to be prepared upon the subject. His doubts were dispelled, however, by the papers of Messrs. Steward, Hodges and Curtin (abstracted in the STREET RAILWAY JOURNAL, Nov. 5).

The speaker then reviewed the history of rails and special work, which, he stated, should preferably be termed "special track work." As a result of the cable and early electric operation, five different types of special work were evolved, viz.: (1) Steel castings, made as closely as possible to join up to the rolled rails, somewhat improved in quality, but still softer than the rolled rail, and also more porous; (2) steel castings with pieces of the rolled rail electrically-welded to the ends of the first kind, and also to reduce the number of joints on a given lay-out; (3) chilled cast iron with rolled rails cast into the ends, with the joints, therefore, as good as in the rest of the track, but brittle; (4) rolled rails, planed and fitted similarly to the built-up work; (5) a combination of cast-iron and rolled rails, with the cast iron in parts exposed to wear. Some of these types are still in use in places where the traffic is so light that it does not pay to put down a more expensive kind of work. All have the common point of weakness in that the parts which receive the greatest wear, where the same surface has to bear the traffic of more than one line, or where a narrower surface than the width of the wheel tread has to support the weight of the car, naturally wear down much faster than the rest of the work, and when the wear at these parts becomes objectionable, the entire piece has to be renewed. This weakness is inherent in all frogs, especially steam railroad frogs built up of ordinary rails, but it is immensely accentuated on street railways with the narrow wheel treads which are necessarily used. The width of the wheel tread cannot be wider than the width of the head of the rails, without danger of striking projecting paving stones on the outside of the rails, and again, the width of the rail head is in many cities restricted by ordinances, mostly dating back to the old horse-car times. This width of wheel tread is in most cases insufficient to span the groove of an intersecting track at the point of the frog, or of the main track in branching off at the point of the mate. It has therefore become almost necessary in street railway work to provide at intersecting grooves a riser or flange bearing—i. e., the groove is filled up at its bottom so that the flange of the wheel will run on this filler and the wheel run on its flange where it theoretically loses its tread bearing. In castings, the metal of the casting is carried up; in built-up work separate pieces of metal are inserted, or the work constructed from specially rolled rails with shallow grooves. The surface of a wheel flange presents a cutting edge rather than a bearing surface, hence these risers are soon cut down, and then the wheels begin to pound and quickly destroy the parts where they have this insufficient bearing or where they have to jump across the space of the intersecting grooves. The effort to protect these parts led to the adoption of what is called "hard center work," and from that time dates the battle royal between the special track work on the one side, and the wheels, increasing weight of cars and frequency of traffic on the other side, almost like the conflict between the armor plate and the gun in somewhat less peaceful pursuits.

Various metals have been tried, including Harveyized steel, manganese, chrome and tungsten steel, as well as various methods of holding the metal in the frog. The results of hard-steel center work can be pronounced satisfactory in general, and probably no street railway would consider the use of anything else in important and complicated layouts. Some steam railroads have also adopted hard center work for their tracks in streets and for sidings. The renewal of the centers has not always been an entire success. If both lines crossing the center are about equally worn, a good job can be made by the renewal, but when one line is worn much more than the other only one line can be made fairly good by the renewal, as the difference in wear can in no practical way be compensated for in the new center.

The idea of having the center remain serviceable as long as the surrounding parts, has been practically accomplished by the manganese steel center, except in cases where defects have developed. One curious result, however, appeared through the fact that it is impossible to construct the centers in exact proportion to the wear at each point of the surface. The parts of the center which carry the wheel on the full tread do not wear down as fast as either the point of the parts of ordinary steel beyond the center, so that after some service these places appear as hills in the track and make the cars ride a little roughly, apparently calling for a renewal of the center, although the center is not by any means worn out. A better way to remedy this trouble is to grind these high places off from time to time to re-establish the surface of the track.

The joints have given little trouble in special track work, due to the greater stability of the curves over straight rails and the great stability of the heavy special pieces. The ever increasing weight of the pieces, however, is a source of trouble to the trackman, and modern appliances, such as cranes, are now introduced to facilitate handling. The bugbear of special work is the compromise joint at the end of a layout where it joins up to the various sections of rail used in the straight track. No matter how carefully a compromise joint is fitted in the shop to pieces of rail available, the rail in the ground is likely to vary from these, producing an inferior joint. This difficulty has largely been overcome by the use of compromise rails—i. e., short pieces of the sections to be joined, connected by some welding process.

To-day the weakest part of special work is the pivot part and heel of the switch tongue. The tongue itself, made of hard forged steel or manganese steel, with a hard metal bed, wears well enough, but the pivots and supports at the heel end have to a great extent proved insufficient to withstand heavy service. A number of devices are now on trial, but it remains to be seen which best meets the case. Where the curve is comparatively little used, an unbroken main line switch can often be installed to advantage, obviating the great wear at the heel from the main line traffic.

Later improvements in special track work have mostly consisted in the strengthening of it to meet the ever increasing weight of cars and in the finer working out of the details. The lines of special work layouts, to insure the smooth running of cars on curves, have been greatly improved by the introduction of easements or spirals on the ends of curves, although this has to a large extent been overdone. Mr. Angerer here submitted an illustration of one of the simplest spirals, designed for curves of less than 62-ft. 6-in. central radius. It had changes of curvature every 3 ft. 6 ins. By simply dropping out the first few radii, a 100-ft. radius switch can be set into this spiral without disturbing the alignment of the balance. Spirals for curves of larger radii are derived from this base by multiplying the base functions by $1\frac{1}{2}$, 2 and 3, respectively, and these four spirals cover the entire field up to curves of 500-ft. radius. There are several systems of spirals in use, prescribing ten or more different spirals to cover this range. Each manufacturer and many of the large street railways have systems of their own, requiring different calculations for each one in applying them to different layouts, while practically, when laid down alongside of each other, the lines of all these different spirals for a given curve vary less than $\frac{1}{4}$ in. at any one point. Some uniform standard in street railway spirals is badly needed.

It is impossible to state how long a piece of special work should last. It depends on the amount and condition of traffic, weight of cars and passengers, speed, weather conditions, tendency of the wheels to slide or turn at some points, and no uniform basis can be established. Mr. Angerer said that he had tried by careful measurements of impressions taken of track in the street, to average the wear of manganese steel centers per car, but he had to give it up. The results varied from .0012 in. to .0020 in. of vertical wear per 10,000 cars. Mr. Hadfield, of England, the originator of manganese steel, in working similar tests, observed a vertical wear of from .0008 in. to .0032 in. per 10,000 cars at different points of one layout. Variations of 100 per cent to 200 per cent admit of no conclusions. It is also difficult to state just when a piece of special work is worn out. (The speaker here showed a slide of a center which had carried 2,570,000 cars without showing very much wear.)

The next step in the future development of special track work for city streets is uncertain. Whether it will be made throughout or at least the entire surface of manganese steel seems doubtful. The points of greatest wear would then last no longer than they do now. For general use it would seem that the period of the hard center work is liable to be extended for many years to come.

When the street railways branched out into the country, where they were not restricted by the regulations of a city or bothered by the city pavement, the use of T-rails and the general practice of steam railroads naturally followed. Split switches are now commonly used on such track, as are spring rail frogs, which are the best kind to take care of traffic of different kinds of cars with large and small wheel flanges on the same track. Where team traffic on the country highways is liable to encroach upon the track, tongue switches, built up of T-rails and fixed frogs, have to be used.

Manganese steel rails have been used in the Boston Subway and on street and steam railroad tracks for curves in steam railroad frogs, and a test is now going on with split switches having manganese steel points to the rails.

The making of the working plan for each special track work layout involves intricate calculations and a careful consideration of all conditions. As it finally passes into the hands of the track layer it must contain data for properly locating the work in the street, as well as for fitting of the work in the shop. Each detail should be designed to suit the rolling stock in use at the particular place, and therein lies one of the greatest difficulties of the special work manufacturer. There seems to be no limit to the different sizes of wheels, wheel flanges and wheel bases of cars in use, and yet each of these factors, combined with the radii of the curves, calls for a different groove. The truck of a car on a curve stands on a chord to the circular line, and the wheels take a skewed position relative to the running line of the rails. This calls for a wider groove than would be required to pass the flanges of the wheels on straight track. Just how much wider for a given flange, radius, diameter of wheel and wheel base can easily be determined by the graphical development of the flange on the angle of the skew. A table worked out on this basis of the width of grooves called for by the combination of the more representative wheel flanges in use, and the prevalent wheel bases, together with the radii of curves—the wheel diameter being omitted, as a negligible factor—shows the great variety of the width of grooves necessary. Of late, the tendency of wheel makers has been to increase the thickness of the wheel flanges of a given depth, which has proved very troublesome in the making of special work. A piece of special work can only be made to suit one of these combinations, and other cars with different wheel bases and particularly different flanges run over the work will shorten the life of the work from what it would be if only one kind of cars and wheels wheel were used on it. It is the same case as a machine which wears too rapidly when the parts fit too closely.

THE QUESTION BOX

At the suggestion of a number of subscribers, the Street Railway Journal has decided to institute a question box on topics connected with street railway construction and operation. The popularity of this form of collecting and publishing information was demonstrated at the Utica convention of the New York State Street Railway Association, and at recent meetings of the Accountants and Master Mechanics' Associations. Other bodies which have successfully employed the question box are the Pennsylvania Street Railway Association and the National Electric Light Association. There are many reasons, however, why such a series of questions and answers can be published with more desirable results in a weekly periodical than at an annual meeting. One obvious advantage is that the answers printed to one question often call for a reply, which can be published in a succeeding issue of a weekly periodical. Again, a reply on one topic often suggests another worthy of discussion, and which can be presented for consideration in the following issue.

It is proposed to start the question box by printing in this and the next weeks' issues of this paper a series of questions which has been prepared to cover certain of the main divisions of street railway operation. Copies of these questions have also been mailed to a number of companies. Replies are requested, however, from any or all of the readers of this paper who have opinions to offer. The name of the contributor will be withheld from publication in any case where a request to this effect is made.

The questions have been divided into nine sections, entitled, respectively, A, general; B, employees; C, parks and pleasure resorts; D, the express and freight question; E, the master mechanic's department—cars and car parts; F, steam engineering; G, the engine room; H, the line department; I, the track department. While the questions in the aggregate may appear somewhat formidable, it has been considered desirable to commence with a fairly large number, so that those interested in any one section may omit the others from consideration. In replying, it is not necessary to repeat the questions, the key numbers are sufficient. Answers are requested in detail and with reasons, as "yes" and "no" are of slight value. Progress is made by each person giving to the other the benefit of his experience, and the co-operation of all is requested in this general exchange of information.

A. GENERAL.

A 1.—What various methods do you employ for advertising your road and its attractions?

A 2.—How much money do you spend annually for advertising?

A 3.—How much money can be spent profitably by an electric railway company for advertising?

A 4.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling and a fairer treatment on the part of the public press of its community?

A 5.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling toward it on the part of the public?

A 6.—Several electric railway companies are publishing regular leaflets or periodicals for public distribution, with the idea of bringing about a better relation between the company and the public. What do you think of this suggestion?

A 7.—Have you ever tried the suggestion of publishing such a periodical? What were the results?

A 8.—A company wishes to carry its own fire insurance, by setting aside a certain percentage of its gross receipts each year to cover fire losses. What would be a safe percentage to allow?

A 9.—Under what conditions can an electric railway company venture to carry its own fire insurance on its various properties?

A 10.—What percentage of your gross receipts are you paying out through the claim department?

A 11.—A company wishes to set aside a certain fund each year to cover all accident claims. Should this fund be based on a definite sum per car mile, or on a percentage of the total gross receipts? What would be a proper allowance?

A 12.—What is a proper basis on which to compute accident liability insurance?

A 13.—In the electric railway business, is an accident liability insurance company—mutual or otherwise—feasible? Why?

A 14.—Do you carry United States mail over your road? If so, please describe how you do it.

A 15.—Relative to carrying United States mail and mail carriers, what are the salient points of the contract between your company and the Government?

A 16.—What would be a proper basis on which to formulate contract with the Government for carrying United States mail on electric railways?

A 17.—At one time the use of trail cars was quite general on electric railways throughout the country. Then came a period when the running of trailers was looked upon with more or less disfavor. There seems to be a decided tendency at the present time to go back to trailers. Please give your ideas and experience relative to trailers. Under what conditions do trail cars properly find a place in the operation of a modern electric railway? Do trail cars cause a greater number of accidents? If they do, what can be done to make them safer? What is the economy in running trailers?

A 18.—Give suggestions based upon your experience for handling the extra traffic during the rush hours, and on special occasions, as ball games, fairs, etc.

A 19.—Has the running of so-called "sightseeing cars" been a popular and profitable experiment?

A 20.—When "sightseeing cars" are operated over an electric railway system by outside parties, what is the usual compensation paid by the "sightseeing" company to the railway for the use of the tracks?

A 21.—Is there any reason why an electric railway company should not operate its own "sightseeing cars"?

A 22.—Has the running of funeral cars been a popular and profitable experiment?

A 23.—What is the best form of funeral car? (Please give description with photographs and drawings.)

A 24.—The editor will appreciate receiving extracts from your franchises, setting forth what you consider particularly noteworthy features and provisions.

A 25.—What are the salient points that go to make up an "ideal electric railway franchise"; one that would be absolutely fair to the public as well as to the company?

A 26.—Is it not true that if the capital invested in electric railways should be exempted from all special taxation, the public would be benefited through increased electric railway facilities?

A 27.—It is commonly held that electric railway companies should make some return to the local municipality in exchange for the right to use the streets. What is the fairest basis upon which this compensation can be accomplished?

A 28.—Is a franchise tax a fair and just method of taxing electric railways? Give the reason for your opinion.

A 29.—What, in concise form, are the best arguments that can be brought to bear in favor of private ownership of electric railways when a community is being agitated with the municipal ownership theory?

A 30.—Is it true that a properly regulated monopoly of street railway interests in any community is conducive to the best service of the public? Please give your reasons for your answer.

A 31.—On a high-speed interurban electric railway, what precautions should be taken to protect crossings where the line cuts a public highway? Please describe the precautions you take at such points.

A 32.—Where an electric railway crosses a steam road, what is the usual arrangement between the electric road and the steam road for the maintaining of a flagman at such points?

A 33.—When grade crossings are to be abolished or avoided, what portion of the expense should be borne respectively by the electric railway company, the steam railroad and the municipal authorities?

A 34.—What have you done toward abolishing grade crossings on your system?

A 35.—What precautions do you take to avoid accident to persons getting on or off at points where it is necessary for conductors to go ahead to flag over crossings or other dangerous points?

A 36.—In making up a schedule of fares for an interurban road, is it better to base rates on mileage or with reference to municipal boundaries? What is your practice?

A 37.—What is the best method of collecting and checking fares on interurban roads?

A 38.—What are the underlying principles upon which a traffic agreement between a city road and an interurban road for joint use of city tracks should be made?

A 39.—Where an interurban company seeks the right to run cars over a city company's tracks, what compensation should be paid by the interurban company for this privilege, and what should be the basis upon which the compensation should be determined?

A 40.—When an interurban company uses city tracks jointly with a city company, what is the best agreement as to the handling of crews; as to the responsibility in case of accident; as to collection of fares within city limits; as to the various mechanical questions involved, including weight and type of cars, dimensions of wheels, power, etc.?

A 41.—What is the best method of keeping records of deeds to real estate, rights-of-way, etc.?

A 42.—Information is requested as to the best ways of handling the snow-removing problem. Please state in detail your snow-fighting methods. Please give all the steps taken from the time the first flurry of snow appears until the battle has been won and schedules restored.

A 43.—What is the most effective form of snow-plow?

A 44.—Do you use snow fences? Are they effective? What form of fence do you use? (Please give description with photographs or drawings.) Give particulars as to how and where fences are placed. What do you do with the fences in summer? How much do the fences cost to build?

A 45.—What arrangements does your company make with the municipalities for removing snow?

B. EMPLOYEES

B 1.—What are the requirements demanded of applicants for conductors and motormen on your road? The editor will appreciate receiving copies of all the blanks used in your employment department.

B 2.—How are the men employed on your road? Do you have an employment bureau, or are applicants examined and hired by the manager or superintendent? Under what conditions does it become advisable to establish a separate employment department?

B 3.—For conductors and motormen do you prefer married or single men and country bred or city men? Please give your reasons for your answer.

B 4.—Do you employ men who have had previous experience on other electric roads? Why?

B 5.—What process do you go through after an application has been filed in determining whether the applicant has told the truth?

B 6.—Do you consider it a good idea to make applicants swear to the statements in their application blanks? Why?

B 7.—Do you bond motormen? What is the process?

B 8.—Do you bond conductors? What is the process?

B 9.—What physical examination do you require of applicants?

B 10.—What is the method of testing for eye-sight and hearing?

B 11.—What methods do you employ for training new motormen and conductors as to their duties?

B 12.—If you have a regular school, please give full description of the apparatus used and the methods of teaching.

B 13.—Do you require accepted applicants to pass an oral or written examination before they are put to work? If so, please send list of questions asked.

B 14.—Please send copies of any special rules for the government of conductors and motormen which you think particularly desirable.

B 15.—What is your process for paying off motormen and conductors?

B 16.—Has the method of letting conductors and motormen take their day's wages from each day's receipts proven satisfactory?

B 17.—Have you any system of special rewards or prizes to conductors and motormen for meritorious service? Please give complete details of the system and the results secured.

B 18.—What is the best method of reprimanding and punishing employees?

B 19.—What do you think of requiring motormen to pay for damages caused by their carelessness?

B 20.—Do you require conductors to make good shortage in their accounts and do you pay back to them any overages?

B 21.—What are you doing to better the condition of electric railway employees and create among them a spirit of greater loyalty to the company's interest?

B 22.—Do you have a benefit association for the men? How is this association handled and what advantages does it offer? The editor will appreciate receiving copies of the constitution, by-laws and reports of association of this kind.

B 23.—What are the advantages in providing club rooms for the use of employees? What is your practice in this regard?

B 24.—What do you think of organizing employees' bands, ball clubs, bowling clubs, etc.? What is your practice in this regard, and what advantages have been gained?

B 25.—How do you handle your extra list?

C. PARKS AND PLEASURE RESORTS

C 1.—Give suggestions, based on your experience, as to the best method of handling park travel.

C 2.—Give some suggestions on how to make a pleasure park pay.

C 3.—Is it better for the railway company to operate a park and its attractions or to induce outsiders to operate them on a percentage basis?

C 4.—On what basis do you determine the percentage to be paid for lease of attraction privileges at your park?

C 5.—What are some of the methods of maintaining interest of the public in a pleasure park?

C 6.—What are the relative merits as drawing attractions of vaudeville and light opera?

C 7.—What is the best form of theater for ordinary electric railway park? Please discuss seating arrangements, methods of supporting roof, acoustic properties, arrangement of stage, etc.

C 8.—Please send rough sketch with description of general layout of your park theater.

C 9.—What do you think of the "new idea" in pleasure parks, i. e., having an enclosed area on the idea of "Dreamland" at Coney Island, where a small fee is charged for admission to the enclosure and where the attractions consist of a limited number of free shows, and a number of side shows or attractions to which additional admittance fee is charged?

C 10.—A company is thinking of establishing a pleasure park. Please give suggestions, ideas and pointers as to what should be done, and what should not be done.

C 11.—What is the best form of car terminal at a park, with reference to preventing congestion of cars and crowds? Please discuss the theorctical and practical questions involved.

C 12.—Please send rough sketch of the car terminal at your park.

C 13.—Based on the results of the past three seasons, has your park or attraction resort proved a profitable investment? Please give itemized statement of receipts and expenses in this connection

D. THE EXPRESS AND FREIGHT QUESTION

D 1.—What general advice and suggestions would you give to the manager of an interurban road who is thinking of starting an express and freight business—particularly on the subject of rates and classification?

D 2.—To what extent does an express or freight business assist the development of the passenger business?

D 3.—As far as the electric railway business is concerned, what is the difference between "express" and "freight" matter?—in other words, define each term. How do you classify various material?

D 4.—Do you recommend the adoption of regular official classification class rates, or special rates to meet circumstances?

D 5.—Is it advisable for an electric railway to compete with a steam railroad in carrying freight at or below the rate made by the steam road?

D 6.—Is it advisable to compete with a regular express company in carrying express matter at or below the rate made by such express company?

D 7.—Do the steam railroads and regular express companies interchange traffic with you? If not, why not? What can be done to bring about interchange relations between electric railway companies and steam railroads and old line express companies.

D 8.—An interurban electric railway wishes to make an agreement with a city road for the joint handling and exchange of express and freight matter. What is a fair basis upon which to form such an agreement? What arc the essential features of your agreement covering this matter?

D 9.—Does it pay to handle express matter by electric cars? Does it pay to handle freight by electric cars?

D 10.—As a broad proposition, can express or freight matter be hauled as cheaply per ton mile by electricity as by steam?

D 11.—What does it cost per ton mile to haul express or freight matter by electricity—including all items of expense properly chargeable to this department.?

D 12.—Will you please give the following information concerning your express business:

Gross receipts,
Operating expenses,
Cost of power,
Interest on investment,
Total expenses,
Net income,
Total tonnage,
Average rate per 100 lbs.,
Gross earnings per express car mile per day,
Dollars received per car hour?

In connection with above statistics, please give statement as to general character of express or freight business transacted.

D 13.—What has been your experience with handling heavy commodities or rough carload freight, such as ice, coal, wood, stone, etc.?

D 14.—What has been your experience with handling milk on electric cars? Please give details.

D 15.—Under what conditions can an electric road do a profitable business in hauling milk?

D 16.—What has been your experience with handling light packages? Please give details.

D 17.—What has been your experience with carrying baggage? What rates do you charge, and how is the baggage carried?

D 18.—Under what circumstances is it advisable to give wagon collections and deliveries?

D 19.—What methods do you employ for soliciting express and freight business?

D 20.—What arrangements do you make for local agents at different points on your line?

D 21.—Do you handle shipments destined to points at which you have no agents? If so, how?

D 22.—Is it better to pay local agents commission or salary?

D 23.—How often and how should local agents remit express receipt?

D 24.—Do you not find it advisable to make the accounting reports as simple as possible, combining as many as possible in one form? How do you accomplish this? The editor will appreciate receiving copies of blanks devised to simplify and concentrate express accounts and reports. Please add comments and explanations.

D 25.—How often should abstract reports be made of express matter received and forwarded?

D 26.—Who should audit the express accounts?

D 27.—What is the best form of shipper's receipt. The cditor will appreciate receiving two copies of the receipt you use, with any comment or explanations you may care to make.

D 28.—What is the best form of way bill to use?

D 29.—How do you handle your unclaimed express or freight?

D 30.—What per cent of your gross receipts from express and freight do you pay out in settlement of loss and damage claims?

D 31.—What have you done to reduce amount of lost and damaged shipments?

D 32.—Is it advisable to handle express matter on combination passenger and express cars? Why?

D 33.—What is the best form of combination car for handling passengers and express matter? Please give description with photograph or sketch.

D 34.—Do you have your own warehouse at each station, or make other arrangements?

D 35.—Please give suggestions as to best arrangement for terminals in which to handle express and freight.

E. THE MASTER MECHANIC'S DEPARTMENT—CARS AND CAR PARTS

E 1.—What do you consider the essential features of a satisfactory set of car specifications?

E 2.—What can be done in the direction of adopting a standard form for car specifications?

E 3.—What is the best type of car for cities of less than 50,000 population? Why?

E 4.—What is the best type of car for cities with population between 50,000 and 250,000? Why?

E 5.—What is the best type of car for cities with population over 250,000? Why?

E 6.—What is the best type of car for a combined city and suburban service?

E 7.—What is the best type of car for moderately high-speed suburban service (suburban service as distinguished from interurban service)?

E 8.—What is the best type of car for high-speed interurban service?

E 9.—Under foregoing questions relating to best type of car, please discuss seating arrangements; length and form of platform; general dimensions; design and construction.

E 10.—What is the longest car that can be carried safely and economically on a single truck?

E 11.—What can the master mechanic of the average surface road do to render his cars more nearly fireproof?

E 12.—Have you had trouble from fires on cars attributable to the lighting or heating circuits? What have you done to eliminate these troubles?

E 13.—Have you had trouble from fires on cars attributable to the motor or controller circuits? What have you done to eliminate these troubles?

E 14.—What is the best form of flooring for the inside of cars?

E 15.—Have you had any trouble with car floor rotting out prematurely? If so, to what do you ascribe the cause and how can the trouble be remedied?

E 16.—What is the best form of handle for trap-door lifts in cars?

E 17.—What is the most satisfactory covering for car seats? Why? Please give relative costs.

E 18.—What are the arguments for an against heating cars by (a) electricity; (b) hot water; (c) stoves?

E 19.—What do you find is the cost of heating cars by electricity on your road?

E 20.—What has been your experience in the use of car fenders?

E 21.—Do you consider a projecting fender better than a wheel guard, and if so, why?

E 22.—If a projecting fender is used, how far should it project in front of dashboard, and how near the rail can it be safely carried at a fixed point?

E 23.—Can a projecting fender be used equally well on both a single and double-truck car?

E 24.—Without mentioning trade names, what form of projecting fender do you consider the least expensive to keep in repair, and at the same time do effective work in saving life?

E 25.—In the use of a projecting fender, do you consider it desirable to have the fender so arranged that it can be dropped to the track, and if so, do you favor an automatic drop, or one worked by the motorman?

E 26.—Is it practical to use the same kind of fender on city and interurban cars?

E 27.—In the use of fenders on suburban and interurban cars, does not the high speed of the car prohibit the use of a projecting "pick-up" fender? Do you consider the "pilot" better on this kind of car?

E 28.—With a car running at a high rate of speed, say, 40 or 50 miles per hour, has the use of a projecting fender been found practicable, and if so, on what roads?

E 29.—Does the oscillation of a single-truck car interfere with the use of a projecting fender?

E 30.—What have you to say on the question of first cost of car fenders? To what extent should the first cost be considered if the fender will do effective work?

E 31.—In your experience, have you found it less expensive to keep a cheap fender in repair than the more expensive ones?

E 32.—What are the relative advantage and disadvantages of two-motor and four-motor equipments?

E 33.—Is there any advantage of four motors over the same motor capacity combined in two motors?

E 34.—What are the relative advantages and disadvantages of outside and inside hung motors? Which method do you prefer?

E 35.—What is the best and most convenient method of connecting motor leads to the motor, especially on short city cars? (This question is suggested with the hope of bringing out some way of reducing the time necessary to disconnect motors when cars come into the shop.

E 36.—For armature bearings, which form of lining do you prefer, babbitt or brass? Please give your experience with either,

E 37.—What has been your experience with casting babbitt bearings in your own shops? Do you consider it profitable to do so? Please give statement of costs in this connection.

E 38.—What formula for babbitt metal do you consider satisfactory?

E 39.—What devices do you use for rebabbitting journals? Please give descriptions with photographs or drawings. (Rough sketches will do.)

E 40.—Do you consider it necessary to bore babbitt bearings after pouring? Why?

E 41.—Please describe your method for boring babbitt bearings.

E 42.—After the armature shaft has become worn, how do you insure good fit at the bearings?

E 43.—What is the best length for armature bearings?

E 44.—What is the best length for axle bearings?

E 45.—A road is having trouble with motors becoming hot on hills. What can be done to keep motors cool under these conditions?

E 46.—State experience with use of oil instead of grease for motor lubrication.

E 47.—Give description, with sketch of journal box, suitable for using oil for motor lubrication.

E 48.—How can the ordinary journal box designed for use with grease be changed to use with oil as a lubricant?

E 49.—In lubricating armature bearings, is there any advantage in using both grease and oil at the same time, feeding oil with a wick from below, and grease from cups above the bearings?

E 50.—Are you in favor of split or solid gears? Please give your experience with either. What are the relative advantages and disadvantages of each?

E 51.—If split gears are used, what do you do to prevent bolts and nuts from becoming loose?

E 52.—What can be done to prevent the gear case dropping into the street when the bolt breaks?

E 53.—Are you in favor of having the gear case cast as a part of the lower half of the motor frame? Why?

E 54.—Have you had any experience with wooden gear cases? If so, please describe the form of case used and the results secured.

E 55.—The question of cast-iron versus steel-tired wheels is receiving considerable attention. Please give us your contribution on this subject.

E 56.—What is the best method of re-tiring steel wheels?

E 57.—A road has had trouble with wheels becoming loose on axles. What is the probable cause and what the remedy?

E 58.—When pressing wheels on axles, what difference do you allow between diameter of axle and wheel bore?

E 59.—At what pressure should wheels be forced on axles?

E 60.—What play do you allow between gage of wheels and gage of track? State your experience along this line.

E 61.—What is the chief cause of flat wheels?

E 62.—What can be done to prevent flat wheels?

E 63.—Give details as to how you treat flat wheels. In regrinding flat wheels, what precautions should be observed?

E 64.—Is a 36-in. wheel desirable? If so, why? If not, why not?

E 65.—Have you given any special study to the question of brake rigging? Please give the results of your observations along this line.

E 66.—What can be done to prevent the brake rigging from knocking off motor lids?

E 67.—What composition do you use for trolley wheels, and why?

E 68.—What is the best size and shape of trolley wheel for high speeds?

E 69.—What is the best size and shape of trolley wheels for city service?

E 70.—A road has had trouble with trolley rope leaking current when very wet. How can this be remedied?

E 71.—What pressure do you maintain on the springs in trolley bases?

E 72.—How often do you thoroughly wash your cars?

E 73.—What kind of soap or cleansing compound do you use for cleaning cars?

E 74.—What has been your experience with cleaning cars with oil?

E 75.—What is the best kind and grade of oil to use for car cleaning?

E 76.—Many of the steam roads dry-wipe their cars without the use of any water. Do you think this method is applicable to electric cars?

E 77.—How many cars can one man thoroughly wash in a day? (State size of cars in answer.)

E 78.—Has any electric road employed women for cleaning cars? What were the results?

E 79.—Should the matter of cleaning and washing cars come under the transportation department or the master mechanic's department? What are the advantages and disadvantages of either system?

E 80.—Please describe a good arrangement of stand and room for washing cars.

E 81.—What is your method of washing car window glass?

E 82.—What can be done to prevent car windows from sticking or binding at the sides?

E 83.—Do you know of an improved form of table or rest for expediting the work of varnishing window sash? If so, please give description, with photograph or drawings. (Rough sketch will do.)

E 84.—Please give description with photograph or sketch of good form of rack for holding freshly varnished window sashes.

E 85.—What are good ways of heating the paint room?

E 86.—What can be done to prevent trouble from dust in the paint room?

E 87.—What is a good form of scaffolding for use when painting cars?

E 88.—What do you find to be the cost of painting cars? (This question has been made broad purposely. The idea is to start a comprehensive discussion on the subject of "cost of car painting." Itemized statements of labor, material and costs of car painting are particularly requested.)

E 89.—What are the relative advantages and disadvantages as regards cost, durability, etc., of the two general systems of painting cars, i. e., that known as the "knifing" process, using a foundation coat of pure lead and linseed oil, rubbed in with a putty-knife; and that known as the "rough-stuff" method?

E 90.—What can be done to reduce the cost of painting and varnishing cars without sacrificing durability?

E 91.—Please describe in detail your method of painting cars from start to finish.

E 92.—Do you favor the use of rubbing varnish on the exterior of cars? Why?

E 93.—Have you ever tried mixing varnish in body colors in order to make the body coats more elastic? What were the results secured?

E 94.—What is the best way to remove old varnish?

E 95.—What has been your experience with the use of ammonia for removing old varnish? What solution do you use?

E 96.—Do you know of any good varnish renovator?

E 97.—How do you "burn off" a car that needs repainting? Please describe the apparatus used. (Photograph or sketch will be very acceptable.)

E 98.—What have you done in the direction of eliminating beading, superfluous decoration and fancy work from your cars?

E 99.—What is the best method of treating car roofs to secure tight roofs?

E 100.—The suggestion is made that the regular daily inspection of cars should be made at the terminals of the lines, between regular trips. Is this feasible, and what are the advantages to be gained?

E 101.—Please describe in detail your system for inspecting cars.

E 102.—What is your system for inspecting trolley bases, poles, harps and wheels?

E 103.—Please state in detail the extent and exact nature of the nightly inspection of cars as practiced on your road.

E 104.—Please describe in detail your system for keeping records of cars, by which it is known when any given car should be sent to the shop for general inspection and overhauling.

E 105.—Should general inspection and general overhauling of cars be done on a mileage basis, say, after 20,000 miles, or on a time basis? What are the advantages and disadvantages of each system?

E 106.—If cars are overhauled on a time basis, what is the proper time limit; if on mileage, what is the proper mileage basis?

E 107.—If a car is sent out of the shop in good, all-round condition, what part of the equipment—accidents barred—will first require the return of the car to the shop?

E 108.—When a car is sent to the shop for some particular trouble—say low bearings—how much additional general inspecting and overhauling should be done at that time?

E 109.—For the average repair shop, what is the best method of driving the tools?

E 110.—What is the best method of keeping track of small tools, as drills, bits, etc.?

E 111.—When doing repair work on double-track cars, which method is preferable; lifting the bodies from trucks and doing the work from the top, or doing the work from the pit? Please state what you consider the advantages and disadvantages of each method.

E 112.—The master mechanic of a 20-car road has been told he can save money for the company by making all his own armature and field coils. Can he? What are the deciding factors in the case? Please give relative costs in this connection.

E 113.—As a general proposition, is it cheaper for a road to make its own armature and field coils than it is to buy them?

E 114.—What is a good and safe method of moving and handling armatures around the repair shops?

E 115.—Please describe your mode of procedure in rewinding an armature, outlining each step in the process. (Photographs illustrating the various processes will be very acceptable.)

E 116.—Do you consider it necessary to bake armatures after rewinding?

E 117.—How long and at what temperature do you bake armatures after rewinding?

E 118.—What is the nature of the compound you use for dipping new armature coils?

E 119.—Is there any satisfactory substitute for cotton tape as a covering for armature and field coils?

E 120.—Is there any economy in attempting to rewind and re-insulate motor field coils?

121.—What method or device do you use for scraping and straightening old field coil wire?

E 122.—What is the nature of the compound you use for dipping rewound field coils?

E 123.—How long and at what temperature do you bake field coils after rewinding?

E 124.—How do you locate faults in damaged armatures?

E 125.—How do you test repaired armatures at the shops?

E 126.—What is a good way of testing armatures and fields without removing the motors from the car during regular inspections, particularly on small and medium size roads?

E 127.—What is the best way of removing armatures and fields from cars, particularly on small and medium size roads?

E 128.—How do you test for low armature bearings?

E 129.—Have you found any scheme for securing better contact between motor commutators and carbon brushes?

E 130.—What improvements have been made in motor brush holders?

E 131.—What is the best method of turning down a motor commutator?

E 132.—To what various uses can compressed air be put in electric railway repair shops?

E 133.—What methods are available for securing compressed air in electric railway repair shops?

E 134.—If compressed air is used in repair shops, what pressure per square inch will best serve all purposes?

E 135.—An engineer wishes to install air compressing plants in several repair shops of different sizes. How will he go about it to determine size and capacity of compressing plant for each?

E 136.—In terms of per cubic foot capacity, what will be the cost of installing an air compressing plant?

E 137.—What is a fair estimate of repair and depreciation cost of an air compressing plant?

E 138.—A master mechanic wishes to use compressed air for various purposes in his repair shops. After the compressing plant has been installed, how much will the air cost per cubic foot at the point of application (air being used at, say, from 50 lbs. to 80 lbs. pressure)?

E 139.—Is it practicable and economical to use air brake compressors on cars for furnishing compressed air to clean cars and for other shop purposes?

E 140.—Do you attempt to rewind electric heater coils? If so, please describe your method of doing the work.

E 141.—Plans and descriptions of a "home-made" sand drier are requested. How do you dry sand on your road?

E 142.—Do you know of any satisfactory machine for taping coils? Please give sketches or photographs and descriptions, together with statement of results secured.

E 143.—What kind of rack or support do you use for holding armatures while they are being repaired or rewound? Please give description with photograph of drawings. (Rough sketches will do.)

E 144.—Please describe any of the labor-saving devices you use in the work of repairing armatures, winding armature coils, field coils, etc.

E 145.—Please describe the oven you use for baking armatures, etc. (Photographs or sketches will be very acceptable.)

E 146.—Do you know of any cheap and convenient form of small gas or electric furnace for heating soldering irons, etc.? If so, please give description, with photograph or drawings. (Rough sketches will do.)

E 147.—Do you know of any satisfactory "home-made" air or electric crane for general shop purposes? If so, please give descriptions with photographs and drawings. (Rough sketches will do.)

E 148.—What apparatus do you use for removing and replacing wheels and axles under cars? Please give descriptions, with photograph or drawings. (Rough sketches will do.)

E 149.—What form of hoist do you use for lifting car bodies? If the hoist was made from your own plans, please give details and drawings. What do you consider the best form of car hoist for repair shops?

E 150.—What is a good way of moving car trucks around the shops?

E 151.—How do you straighten a bent axle?

E 152.—How do you straighten a bent trolley pole?

E 153.—What is the best method of cutting circular holes in car dashers for headlights?

E 154.—What is the best method of cutting circular discs of glass for headlights?

E 155.—Do you use the sand blast for any purpose in your shops? If so, please describe the apparatus used and the results secured.

E 156.—If you are using any device or labor-saving scheme around your shops not brought out in the foregoing questions, please send description and photographs or drawing. Progress in the business is made by giving others the benefit of your experience and by your taking the benefit of theirs.

E 157.—What is a convenient and satisfactory method of unloading cars from flat cars?

E 158.—To what extent can the "piece system" of paying repair shop employees be used on small and medium size roads?

E 159.—On your road, what is the average life of the following:

Gears,
Pinions,
Babbitt linings in armature bearings,
Axle bearings,
Wheels (iron),
Wheels (steel),
Trolley wheels,
Trolley rope,
Bell rope?

E 160.—Computed on basis of first cost and total miles run during whole life, what do you find as the cost per mile run for the following:

Gears (split),
Gears (solid),
Pinions,
Armature bearings,
Axle bearings,
Wheels (iron),
Wheels (steel),
Trolley wheels?

E 161.—What can be done to reduce trouble from burned-out cables on snow-plows?

E 162.—State instances where automobiles have been used to advantage in carrying on any phase of electric railway work? Give details.

E 163.—Has the automobile tower repair wagon proven efficient or economical in electric railway work?

E 164.—Please state in detail what trouble you have had with lightning striking cars. Then please state in full what steps you have taken to prevent damage from lightning (with particular reference to protective precautions placed on the cars themselves).

E 165.—Is there any advantage in placing recording wattmeter on cars for the purpose of checking amount of current consumed by each motorman? Please give particulars of any instance where, to your knowledge, the placing of wattmeters on cars has resulted in saving of current through the more careful handling of the controller by the motorman.

E 166.—If it has been decided to place wattmeters on cars in order to determine the amount of current used, what is the best procedure, in detail, to secure the best results from their use?

E 167.—What are the relative advantages and disadvantages of running cars the same end on? Please discuss the effect on the bearings, motors, car framing, wheels, etc., and questions arising in relation to terminals.

E 168.—Does running cars the same end on insure better inspection of motor and controller parts?

E 169.—When do conditions justify the adoption of multiple-unit control on the average electric road? What are the deciding factors in the situation?

CAR HOUSES.

E 170.—Contributions are wanted on the subject of "The Ideal Car House." Please give your ideas, suggestions, etc., along this line.

E 171.—Please send in a description of your car house, together with drawings, sketches or photographs, that will show general layout and construction.

E 172.—What are the relative merits of slow-burning mill construction and other available types of construction for car houses?

E 173.—What is the best form of roof for car houses?

E 174.—Please give details and cost of "saw-tooth" roof for car houses. What are the advantages of this form?

E 175.—Have you had any experience with using old T or girder rails as supporting columns for buildings? If so, please describe the method followed in detail.

E 176.—What is the best layout for entrance tracks to car houses?

E 177.—What is the best material for car house floors? How should floors be laid?

E 178.—What is the best form of pit for car houses?

E 179.—What are good ways of lighting pits?

E 180.—What are good ways of heating pits?

E 181.—What specific acts or precautions instituted by your company have resulted in securing low fire insurance rates? Give details and results secured.

E 182.—Please describe the sprinkler system at your car house. How is the pressure maintained? How do you prevent the sprinkler system from freezing up?

E 183.—Are the interest and maintenance charges on an effective sprinkler system greater than the saving in insurance?

PAPERS AT THE MEETINGS OF THE CANADIAN STREET RAILWAY ASSOCIATION

An account was published in the last issue of this paper of the first meeting of the Canadian Street Railway Association. Below will be found abstracts of the two papers presented on that occasion. The authors were E. A. Evans, manager of the Quebec Railway, Light & Power Company, and D. McDonald, manager of the Montreal Street Railway Company:

HANDLING EXPRESS BY ELECTRIC SUBURBAN RAILWAYS BY E. A. EVANS

The writer had the honor of submitting a paper to the members of the Canadian Electrical Association in 1902 upon electrical suburban railways, in which he took the ground that, in the near future, steam railroads will handle their suburban and short distance interurban passenger traffic and mail, express, baggage and light local freight by electric motive power. In this paper the writer submitted statements showing the results from passenger traffic, of carrying out this theory upon the existing steam railway running between Quebec, Ste. Anne and St. Joachim, a distance of 25½ miles. These results showed that during the year 1889-1890, the first year's operation, 95,563 passengers were carried, and in 1899-1900, 261,175 passengers were carried; this under the old regime of steam railroading. The next year, 1900-1901, with the electric system, 537,933 passengers were carried, and last year, 1903-1904, 877,310 passengers were carried; of this number, 155,980 passengers were carried by the steam trains. By way of explanation, it should be stated that the same number of steam trains, arriving and departing at the same hour, are being operated now as in 1899-1900. The passenger receipts, which averaged $38,246.47 a year during the eleven years of steam operation, last year amounted to $96,943.47. From this it will be noted that the average fare per passenger has decreased from 18.17 cents to 11.05 cents, showing that the more frequent service permits of and encourages the residents along the railway to visit from village to village. Under the old system this practice was not so general, and as there has been no apparent increase in population, this custom accounts for the large increase in travel.

In 1900, the writer issued instructions to all agents to make a report of all parcels, hand valises, baskets, canes, umbrellas, etc., which were handed in to them to be taken charge of and for which no charge was being made; in other words, the agents took charge of these parcels merely as an act of courtesy and without responsibility. The results showed that large numbers of parcels were being left, and an inspection of the reports showed that these parcels at the Quebec office consisted principally of groceries, meat, laundry, etc., whereas at the wayside stations, they were made up largely of vegetables, cut and uncut flowers, fowl, laundry, etc. Consequently, in the spring of 1901, parcel offices were opened at each station, and agents were instructed not to accept the care of any package without making a charge of 5 cents for each article for the first twenty-four hours, and a similar charge for each additional day. A supply of parcel checks was issued at the same time. This change created considerable opposition on the part of the regular passengers, who, having had this privilege for over eleven years, now claimed it as a right. As a consequence, receipts which were anticipated from agents' reports to amount to several hundred dollars a year, did not aggregate $100. A careful watch, conducted at the different stations at this time, revealed the fact that residents would bring their parcels to the station, wait the arrival of some friend who was traveling, and then request this friend to take charge of the package and bring it either to or from town. Grocers in town would be telephoned to from say Mrs. B. to meet a certain train and hand her parcel to Mr. H., who would take charge of it, Mrs. B. sometimes, and generally, meeting Mr. H. at destination to take the parcel from him. This condition naturally led to the establishment of an express, baggage and light local freight department earlier than was anticipated.

Under steam railway rules, the freight charges are determined according to the classification of the Canadian Freight Association. The different railways, of course, have their own rates, but abide by the classification made by the association. Rule 30 of this association provides for such articles as the Quebec Railway, Light & Power Company is now carrying under its express baggage and light local freight department, as follows: "Small consignments of one class, or including articles of several classes, will be charged at actual weight, according to the classification of each article, but no single shipment will be taken for less than 100 lbs., first-class, exclusive of cartage, minimum charge, 35 cents, with an additional charge of 10 cents for each cartage performed by the railway company's cartage agents." It will be seen that under this tariff the company would have been unable to carry any parcel, no matter how small, for a less charge than 35 cents—in many cases more than the value of the package of rhubarb or other vegetables that were being sent to town. It was therefore necessary not only to make new rates suitable to the special requirements of the district, but also to adopt new rules and regulations regarding this class of traffic. These rules and regulations went into effect on Dec. 1, 1902, the tariff being as follows:

Any station to any station:
For all parcels, small boxes, etc., from 0 to 10 lbs. 5 cents.
For all parcels over 10 lbs. to 20 lbs., 10 cents
For all parcels over 20 lbs. to 30 lbs., 15 cents.
For all parcels over 30 lbs. to 50 lbs., 20 cents.
For all parcels over 50 lbs., and not over 100 lbs., 25 cents.

The rules governing these goods are as follows:

Express Freight.—All goods weighing less than 100 lbs. and offered for shipment, will be carried on any regular passenger or electric train, with all despatch possible.

Each parcel, box, etc., must be properly packed and addressed in full before a receipt (Form B 32) is given to the sender. Fresh fish, fresh meat and any other perishable articles must be prepaid. Any dangerous articles will not be accepted except on special orders from the superintendent.

Agents will use form B 33 when way-billing, which must be made in duplicate, one copy of the way-bill to be given to the driver of the electric train or the baggageman of the steam train, and the goods must be forwarded by the first train due to leave after the goods have been accepted for shipment; the other copy of the way-bill will be kept by the agent and accounted for in the same manner as regular freight.

Agents receiving express freight will issue Form B 34, and notify consignee as quickly as possible, and when goods are delivered a receipt must be taken on Form B 33, opposite article for which receipt is required. Way-bills received will be accounted for in the same manner as regular freight.

Conductors of all regular trains may accept goods for shipment at any flag station, using form B 31 for billing express freight.

Any article weighing over 100 lbs. to be carried by the regular freight trains only and under Canadian Freight Classification rules. These regular freight trains are operated by steam in the usual manner.

Agents were instructed to despatch all parcels under the above regulations by the first passenger car at any time of the day or night, and to give them in charge of the motorman on electric cars and the baggageman on steam trains. They were also informed that no excuse would be accepted for not despatching these parcels by the first train.

The public immediately took advantage of the facilities thus offered, and the parcel office, while still open for the accommodation of travelers, is practically unused. The receipts from this source of revenue the first year amounted to $300, and last year practically doubled, and is still meeting the approbation of the public. Passengers in the villages along the line, instead of purchasing from small stores near their residences, travel to town to purchase goods from different stores. They usually have their purchases made into one parcel, which is sent to the station to be forwarded by express to destination, instead of having it deposited in the parcel office and having the trouble to call for it and transport it themselves. Again, vegetables of all kinds, cut flowers, etc., are being daily expressed to town during the summer from the villages to supply the hotels, boarding houses, etc., in the city. In conclusion, it is pleasing to be able to state that during the two years in which this business has been in operation, only three complaints of delays have been received and not one single package has been lost or gone astray.

Of course, it will be noted that the conditions mentioned are different from those on most suburban electric railways because of their having no agents at the different stopping places. This difficulty, however, can be overcome in most cases. There is usually some responsible man or woman residing close to the stopping place or flag station, with whom arrangements can be made to take charge of the packages for a small consideration or commission.

RELIEVING CONGESTED TRAFFIC AT RUSH HOURS.

BY D. McDONALD

Of the 1000 operating electric railway companies on this continent probably less than 100 have to deal with the overcrowding problem. If we take the existing conditions in towns of 300,000 to 400,000, we will frequently find that a quarter of this number, or say 100,000, work in a business or downtown section about 1 mile in length and ¼ mile or ⅓ mile in width. Seventy-five thousand of these people wish to get home quickly and a large part of them want to board cars in ten or fifteen minutes, about 6 o'clock. If each car has a capacity (seated or standing) of fifty to sixty passengers, 1300 cars would be required to transport this crowd, in addition to those needed elsewhere on the system. It is not only financially impracticable for an operating company to furnish such a number of cars to be used for a small fraction of the day, but the element of "time" contributes an even greater difficulty. A business center, such as that under consideration, is generally provided at most with two streets where the greater part of this traffic must be carried on. The closest headway that may be run by cars, at 5 m.p.h. or 6 m.p.h. speed, is about 20 seconds. Hence we must find a means of running 1300 cars over four tracks in 15 minutes or 900 seconds; that is to say, we must run 325 cars over each track in 900 seconds, which means that the interval between cars must be less than 3 seconds. This is a material impossibility, and if each car must have a headway of 20 seconds we arrive at a total time space of ($325 \times 20 = 6500$ seconds $= 108$ minutes) or 1 hour and 48 minutes to let the procession go by.

It is evident from the above figures that the possibility of relieving congestion with an unlimited number of cars, even if it were approved as a commercial venture, cannot be done without sacrificing time and speed, which would probably entail a larger general loss than that mentioned above, and would also give rise to greater recrimination than the disagreeable quicker ride that passengers must endure under present conditions. There is a maximum in all calculations, and the limiting number of cars that a city street may accommodate is pretty nearly covered by the service that most companies are at present giving in the heart of busy cities.

The European plan of numbering and limiting passengers, which, by the way, is generally disregarded in most European countries during Sunday and holiday rushes (for they do business calmly and amuse themselves rapidly), would not suit our speedier temperament. It might be desirable from the standpoint of the companies, as it would reduce the actual loss caused by missing fares, but it yet remains to be seen with what public favor such a limitation would meet in this busy country. We are forced, consequently, to the following conclusions:

(1) That congestion at rush hours cannot be avoided.

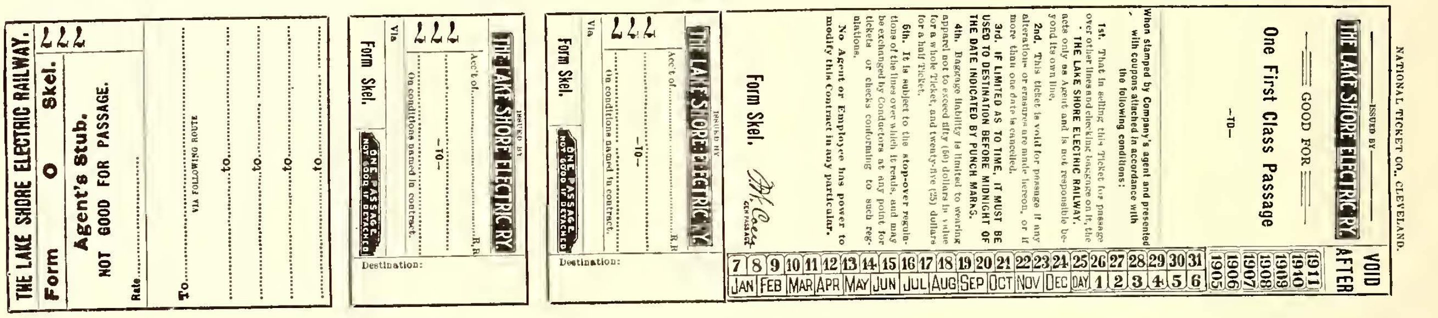
(2) That it may be possible to relieve the crush by the addi-

tion of a reasonable number of cars to a limit where speed must not be sacrificed.

(3) That with a view to further increasing the maximum number of cars that may be run without loss of time, most cities should consider the advisability of increasing the speed and giving clearer right of way to allow space for more cars, and thereby afford greater and better accommodation to the public.

INTERLINE TICKETS ADOPTED BY OHIO ASSOCIATION

At a meeting of the Ohio Interurban Railway Association, held at the McKinley Hotel, Canton, Dec. 29, a standard form of interline ticket was adopted. For some time a number of the Ohio roads have been selling tickets to points on other lines, but there has been no uniformity of ideas either as to the form of tickets, limitations or methods of accounting. The result is that some roads have had one method for doing business with one connecting line and another for another connecting line, and there has been much confusion. A wide range of ideas as to details was brought out in the discussions, and while the subject was thoroughly thrashed out and a uniform ticket was adopted by those present, it is unfortunate that this action does not insure that the standard form will become absolutely uniform on all Ohio roads, or even with the roads represented at the meeting. Before the discussion opened, President Harrie P. Clegg, of the association, brought out the point that any



FORM OF INTERLINE TICKET ADOPTED BY THE OHIO ASSOCIATION

action taken at the meeting would not bind a road to accept or use the ticket, but that it was the desire to secure and put together the best ideas and experiences of those interested in order to devise a form that would be satisfactory to the largest number of roads. He said that some roads undoubtedly had arrangements with roads outside the association, and it would be necessary to agree to some of the requirements of these roads, but he urged that members of the association doing business with each other should at least follow the principles of the agreement, even though they departed from it in certain details as might better suit their own requirements.

F. J. J. Sloat, chairman of a committee appointed at a previous meeting to investigate the subject, presented a form of interline ticket that embodied a large number of ideas presented to him by traction managers as well as by steam passenger men. He admitted that the form was a trifle cumbersome and contained clauses that could doubtless be eliminated, and he suggested that the ticket be taken up section by section, discussed and voted upon.

It was agreed that safety paper should be used for all interline tickets. The form of agent's stub was agreed upon, but some roads wanted an auditor's stub, others a general passenger agent's stub as well as auditor's stub, while others did not want either. It was agreed that those roads that desired them could have an auditor's or general passenger agent's stub, to be identical with the agent's stub, and to contain the initial point, the destination, the route and the rate. It was also agreed that the agent's and auditor's stubs should be placed at the bottom of the ticket rather than at the top, so that in case an agent found it necessary to use a ticket containing a number of coupons for a shorter trip, he could return the remaining coupons to the auditor, with his stub, thus preventing blank coupons from remaining in the agent's hands.

The form contract proposed by Mr. Sloat contained twelve clauses, but before the session was over these had been simplified and boiled down to five clauses. The form of the contract is shown in the accompanying illustration.

There was much discussion over the advisability of requiring a passenger to sign a first-class, one-way or round-trip ticket, for which regular fare was paid, but it was the general sentiment that it was undesirable and unreasonable to place such a restriction upon a first-class ticket. The limitation upon responsibility for damage to baggage was placed at $50, although a number of roads had heretofore allowed a greater amount, while others had said nothing about it in their contracts.

The question of limiting a first-class ticket also brought out much discussion.

E. S. Dimmock, general manager of the Canton-Akron Company, said he thought it was placing a hardship upon a passenger who paid a full fare to require him to use a ticket within thirty days, as proposed, and said that he should hesitate to attempt to collect fare from a man who presented a ticket that had expired.

President Clegg, of the association, emphasized the point that the electric roads ought to be liberal on that point, especially on a first-class ticket. He said that the steam roads were showing a tendency to reduce their efforts to circumvent scalpers, as it was found that it cost more money to fight them than was gained in the long run. He said that the interurban lines had made a very favorable impression with the general public through their liberality, and he did not want to see restrictions placed on the use of tickets until it had been demonstrated that such restrictions were necessary.

Vice-President Will Christy, of the Northern Ohio Traction & Light Company; Secretary F. W. Coen, of the Lake Shore Electric Railway, and several other prominent managers voiced similar opinions.

General Manager Sloat, of the Cincinnati, Dayton & Toledo, said that his company willingly refunded money on tickets after they had expired, but urged that for the convenience of the auditing departments that the thirty-day limit be placed on the ticket.

General Passenger Agent Morrell, of the Dayton & Western, stated that they placed the thirty-day limit on all tickets they used, for the benefit of the auditing department, but that they did not refuse local tickets if presented after the limit had expired. He thought it would be well to use the same policy in the case of the interline ticket, although he would be inclined to refuse to honor the round-trip portion of an interline ticket if presented after the thirty days; however, he favored refunding the money or extending the limit in such a case.

Another manager said his conductor had instructions to take an expired ticket if the passenger said nothing about it, but if a passenger asked if the ticket was good, the conductor was advised to refuse it and to inform the passenger that the money would be refunded at the office. On a rising vote, it was decided to insert a clause providing that if the ticket was limited as to time, it must be used to destination before midnight of the date indicated by the punch marks, and providing the ticket with spaces for the year, month and date, to be punched in case the ticket was limited. It was also understood that agents were to be instructed to limit the ticket to thirty days.

Mr. Sloat proposed that each road should be given a distinguishing number, and that each coupon should contain the number of the issuing road and that of the road over which the coupon was good. It was thought that this would add to the complication of making out the ticket, and it was decided that each coupon should contain the name of the issuing road in heavy type, with space for the initials of the collecting road.

The question of suitable colors for tickets brought out an immense amount of discussion, more time being spent on this than any other subject. One manager wanted a different color for each road, so that an auditor would know at a glance what road had issued a certain ticket. Another manager advised that each road be permitted to select different colors or combinations of colors for all the different combinations of routes over which he would be likely to sell tickets, arguing that this would prove a safeguard against alteration of tickets, and would also facilitate the handling of tickets by agents, as each agent would become familiar with the kind of ticket required for a certain route. A Dayton manager stated that at the Dayton station, which was used by several roads, they had sixty to seventy different varieties of tickets, each possible destination point being designated by a ticket of a certain color or combination of colors. He thought that with the immense variety of possible combinations of colors, it would be possible to have a different ticket for any interline ticket that might be required.

A ticket manufacturer who was called upon for his opinions, said that his people would be delighted to get up all the combinations that could be thought of, but he freely admitted that the cost of such an enormous variety of tickets would be prohibitive. He said that there were only four or five colors that were distinctive under artificial light, and the steam roads had found it advisable to reduce the number of colors to the smallest possible limit.

Mr. Sloat urged against permitting a conductor or agent to place any dependence upon the color of a ticket; he said a ticket should be carefully written out and read to guard against errors. On Mr. Sloat's motion, the number of colors for tickets was limited to four—half-fare single trip, half-fare round trip, full-fare single trip and full-fare round trip. This was afterward reduced to two; half-fare tickets to be made by printing "Half Fare" across the face of each coupon on a full-fare ticket. Single-trip tickets will be green, and round-trip, gray. The various ticket companies represented were asked to get up samples of the tickets and submit them to the various roads, and some orders for the tickets were placed on the spot, as a number of roads are experiencing demands for interline tickets, and some of them have been holding off until a standard could be adopted.

The matter of a standard form for a special excursion ticket and for a party ticket was left to a committee, which was authorized to act in the matter of preparing forms, which, however, are to follow as closely as possible the tickets already adopted.

The standard form for reporting tickets used by a number of steam roads, and also used by the Lake Shore Electric in its interline business with steam roads, was adopted. This is illustrated. Under this arrangement, each road will send each other road a monthly statement of tickets sold, and settlements will be upon this basis and not upon a basis of tickets collected by other roads, as it was pointed out that conductors frequently neglect to take up a ticket, and under this arrangement a road would receive pay for a ticket whether it was collected or not. Tickets returned for redemption would, of course, be charged to the foreign road and not to the road that sold the ticket, although either party will be authorized to make the redemption.

The basis of settlements resulted in a long wrangle, and came near tying up the entire proposition, as some of the managers wanted to leave the question to the decision of their directors. Some proposed that each road should settle with each other road on the point of whether settlements should be on a basis of balances or in full. Secretary Merrill pointed out that settlements on the interchangeable coupon books were made on balances, and that one form of report would do for both. He said that the various roads had been following this plan, and that thirty minutes a month was all the time required to make out all bills and mail checks for balances. General Manager Carpenter, of the Western Ohio, said that the interline ticket business had grown to be a very important factor in their business. They receive as high as $3,000 in a month from tickets sold by a connecting line over their road, and he felt assured that his directors would object to the plan of permitting another road to have that amount of their funds. He said it was a much simpler and safer plan for each road to make its monthly statement and settle on the balance.

F. J. Sloat thought settlements would be made more promptly and with greater safety to all concerned if each road sent its monthly statement of tickets sold over a road and authorized that road to draw a draft for the amount due in full. F. W. Coen argued along the same lines, and stated that his company had followed this plan in doing business with connecting steam and electric lines. A rising vote resulted in a tie, and finally Mr. Coen withdrew his objections, and the motion to settle on balances carried.

Owing to the absence of Edward Spring, chairman of a committee on interline checking of baggage, no attempt was made to settle on a standard form and method, and the matter will be taken up at the next meeting. This is a very important question, and it is one that will take much discussion to adjust. Many of the roads feel that rates are so low at present that they

FORM 51

The Lake Shore Electric Railway Company

ACCOUNTING DEPARTMENT

Norwalk, Ohio,..*190*.......

REPORT OF COUPON TICKETS

Sold over the..*R. R.*

during the month of.., *190*.......

N. B.—If any discrepancies are found in this report, please make no alterations, but advise by letter and corrections will be made in subsequent statements.

A. C. HENRY, AUDITOR

	FROM	TO	FORMS	Consecutive Nos.		No. Sold		Through Rate	Prop'n	AMOUNT
				Com. No.	Clos. No	R T	S T			

FORM FOR ACCOUNTING FOR INTERLINE TICKETS cannot afford to check baggage free of charge, while others hold that the plan of charging 25 cents or more for each trunk, frequently turns the business over to the steam road. F. W. Coen, of the Lake Shore Electric, stated that all baggage was checked free of charge and that it is carried on all their limited cars, and on the express cars where there are no baggage compartments on the regular local cars. Frequently it precedes the passenger. He felt satisfied that the plan brought them an immense amount of business that otherwise they would not secure. He said that if each road attempted to collect 25 cents a trunk, on a long interline trip, it would prove a tremendous drawback to the business. Mr. Morrell, of the Dayton & Western, said that they were checking baggage from Dayton to Indianapolis, and that each road received its regular charge. The amount is collected in advance and a coupon check is attached to the baggage, each road taking up its coupon and settling on this basis. He thought this a good plan.

A representative of the Central States Guide Publishing Company, of Norwalk, Ohio, stated that his company is now publishing the time-tables of all electric roads in connection with its official steam road guide, and pointed out the advantages of having these guides thoroughly circulated among all ticket agents, hotels, etc., and he quoted rates at which the books would be supplied to members of the Ohio Association.

President Harrie P. Clegg outlined the features of the trip recently made by Indiana managers over Ohio roads, reference to which was made in recent issues of this paper, and stated that the officers of the new Indiana Electric Railway Association had agreed to co-operate with the Ohio Association in all matters of common interest. He expressed the opinion that a merger of the two associations would result ultimately, and said that practically the only point which debarred such a step at present was the fact that the Indiana Association had in view certain legislative plans which, of course, could not be acted upon by an interstate association.

General Passenger Agent Morrell, of the Dayton & Western, announced that beginning this week limited service would be inaugurated between Dayton and Indianapolis. The buffet parlor cars owned by this company will make three trips each way a day. The running time for the 108 miles will be four hours and fifteen minutes; fare, including excess of 50 cents, will be $2.25.

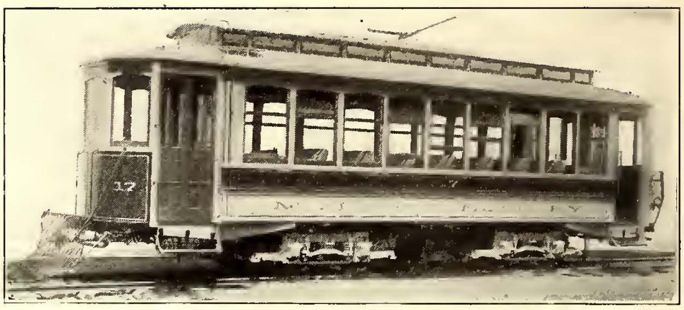
The next meeting of the Ohio Association will be held at the Algonquin Hotel, Dayton, Jan. 26. This will be the annual meeting, and much interest is attached to the election of officers, as several men are understood to be in the field for the presidency of the association.

Nine new members were admitted to the association, including representatives of the Detroit, Flint & Saginaw Railway, the Springfield, Washington C. H. & Chillicothe Traction Company, Northern Ohio Traction & Light Company, Ft. Wayne, Van Wert & Lima Traction Company and the Detroit, Monroe & Toledo Short Line, none of which had been represented at previous meetings.

SEMI-CONVERTIBLE CARS FOR PHILADELPHIA SUBURBS

The illustration presented herewith shows one of five cars lately delivered to the Media, Middletown, Aston & Chester Electric Railway by the J. G. Brill Company, which are the first of this semi-convertible type to be used on this road. The company's lines extend in a westerly direction from the suburbs of Philadelphia, traversing a beautiful country which is thickly populated and contains several colleges and schools of national repute, country clubs and fine residences. In summer the cars carry many sightseers, for the country along the lines is noted for its beauty. Cars of this semi-convertible type are in use in other suburbs of Philadelphia, and everywhere meet with the hearty approval of the public. A car of this kind was recently placed on the lines of the Philadelphia Rapid Transit Company for trial, and was so well liked that the company has ordered sixty from the builders.

The cut shows a number of windows held at different heights, and gives an idea of the lowness of the window sill. The large windows and the light woodwork of the interiors make the appearance within very attractive, and the ability to raise all the sashes into the roof pockets at any time suits the car to all sorts of weather. The width over the posts at belt is 8 ft. 2 ins., and the interior width is 7 ft. 10 ins., allowing the seats to be 36 ins. long and the aisle 22 ins. wide. The seats



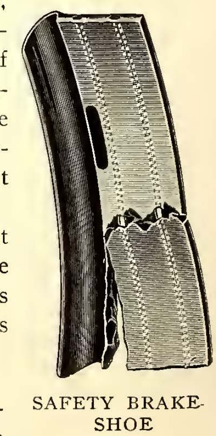
SEMI-CONVERTIBLE CAR USED IN THE VICINITY OF PHILADELPHIA

are of the builders' step-over type with arm rests on the window sills. The length of cars over the end panels is 25 ft. 4 ins., and over the vestibules, 34 ft. 9 ins. A device lately patented by the builders prevents the folding doors at the platform entrances from moving in any but the desired direction. The windows in the vestibules are arranged to drop into pockets in the wainscoting. Angle-iron platform center knees extend well back of the body bolster, relieving the ends of the car of much of the strain of the platform load. The side sills are 4 ins. x 6¾ ins., with 12-in. x ⅜-in. plates on the inside, to which the bases of the posts are attached. These wide plates take the place of inside trusses, and have the additional advantage of stiffening the posts. The end sills are 5¼ ins. x 6⅞ ins., the corner posts 3¾ ins., the side posts 3¼ ins., and the sweep of the posts 1¾ ins. The cars are mounted on the builders' No. 27-G type of truck, having a 4-ft. wheel base, 33-in. wheels and 4-in. axles. Four motors of 25 hp each are used per car, and the total weight of a car with trucks, motors, etc., is 34,140 lbs.

THE SAFETY BRAKE-SHOE

The accompanying illustration shows a new brake-shoe recently brought out by W. W. Whitcomb, the brake-shoe expert of Boston, and entitled by him the "Safety." The feature of this shoe is the fact that extending lengthwise through the casting are two pliable steel rods which will hold the parts together, in case of fracture, and prevent their falling beneath the car.

These rods are not cast into the shoe, but are forced through holes provided in the casting. In this way the inventor claims that strains are avoided and the shoe is more reliable.



SAFETY BRAKE-SHOE

The Old Colony Street Railway Company has increased the rate of fare on some of its lines. The fare from Brockton to New Bedford is 50 cents, as against 35 cents before Jan. 1, and the fare to Taunton from Brockton is 25 cents, as against 20 cents. General Manager Goff, of the company, says that street railways cannot be operated on a fare of less than 1½ cents a mile.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 11, 1905.

The Money Market

The money market continues to show extreme ease in all its departments, and despite the unfavorable showing made by the banks on last Saturday, and the continued exports of gold to Europe and South America, rates for all maturities during the week have ruled at the lowest points attained for several months, and, according to some of the local bankers, there is nothing in the situation at the present time to warrant the expectation of any material improvement in the near future. It is pointed out that while the present strength of foreign exchange may develop into a considerably larger movement of gold to foreign countries, the losses sustained on this account would be more than offset by the heavy return movement of funds from the interior. Money on call and on time has been in abundant supply, while the demand from Wall Street houses and commercial sources has been practically at a standstill. At the opening demand money loaned at 2¾ per cent, but subsequently the heavy offerings of funds forced the rate to 2 per cent, the ruling rate for the week being about 2½ per cent. In the time loan department business has been practically at a standstill. The banks and individual lenders offered freely at extremely low rates, but borrowers have shown a disposition to await lower interest charges before entering the market. Sixty and ninety day funds were 2¾ bid, and offered at 3 per cent, while for periods extending from four to six months 3 per cent was bid, with offerings at 3¼ per cent. Mercantile paper, after ruling at 4 per cent for several months, declined to 3½ per cent for the choicest grades, to conform with the extreme ease in time money. There was no great change in the European discount rates during the past week. Considerable importance is attached, however, to the reduction in the Imperial Bank of Germany's rate from 5 to 4 per cent, indicating that the demand for gold there has slackened. France, however, continues in the market for the yellow metal, and it is not at all improbable that shipments to that point will be made in the shape of gold coin. At the present time the entire output of Assay Office bars is engaged ahead of time, and should the demand for remittance continue at the present rate, shipments of gold coin will be the only alternative.

The bank statement was very disappointing. The preliminary figures of the known movement of funds indicated a gain in cash of about $7,000,000, but instead, the local institutions sustained a loss of nearly $800,000. Loans increased over $3,000,000, and deposits increased $5,119,500. Reserve required increased $1,279,875 over the previous week. The surplus was $11,608,250, as against $14,686,975 in 1904, $14,810,300 in 1903, $12,958,450 in 1902, $22,398,050 in 1901 and $16,707,350 in 1900.

The Stock Market

There was a considerable falling off in the volume of business in the local securities market this week, but, although price movements displayed an irregular tendency, the general tone was firm. In the early dealings values generally showed strength, but the improvements were soon lost by selling induced by a decidedly poor bank statement, and the efforts made at Washington to put through at the present session of Congress, a bill looking to the adjustment of railway rates. Otherwise, the news of the week was of a decidedly favorable nature, but it had very little influence upon values, there being a general disposition on the part of the larger interest to hold off for the present. Money was extremely easy, rates for all classes of accommodation ruling at the lowest levels attained in several months. The reduction in the Imperial Bank of Germany's discount rate from 5 to 4 per cent, was generally expected, and indicates that the demand for gold at that center has been satisfied. Railway traffic returns continued to show substantial increases over the corresponding period of last year, and the improvement in the general business situation was reflected in increased dividend on the shares of several minor railway and industrial concerns. At the close the market strengthened materially, but the trading was confined largely to the speculative element.

The local traction issues were weak throughout, the declines being attributed to the falling off in traffic during the recent storms. Brooklyn Rapid Transit declined nearly 2 points to 60¼. Manhattan sold from 168 to 166, and Metropolitan Securities lost 3¾ to 75¼. Metropolitan Railway sold as low as 114½, but at the close there was a sharp rally to 115⅞.

Philadelphia

Very little interest was manifest in the local traction issues this week. Trading was extremely quiet, but prices generally ruled strong. United Gas & Improvement was the most animated of the group, about 2000 shares being traded in at prices ranging from 105¾ to 105⅛, the final transaction taking place at 105½. Philadelphia Traction advanced from 99 to 99¼ on the exchange of about 900 shares, and Philadelphia Rapid Transit brought 17⅞ and 17¾, for about 500 shares. Consolidated Traction of New Jersey showed decided strength, upward of 500 shares changing hands at from 79½ to 79¾, the closing transactions being made at 79⅝. Philadelphia Company common was traded in at 41½ and 41¼, while the preferred changed hands at 47. American Railways was quiet, about 400 shares selling at 48⅛ and 48. Upward of 500 Union Traction brought 59 to 58⅞.

Chicago

Developments in local traction affairs were of more than ordinary interest this week, and indications now point to a speedy settlement of the question at issue to the entire satisfaction of all concerned. John J. Mitchell, president of the Illinois Trust & Savings Bank, and John H. Eckels were in New York this week, conferring with J. P. Morgan and others on matters pertaining to the consolidation of the City Railway and the Union Traction Companies, and although official announcement is wanting, the belief prevails that the matter has been practically settled. It is said that a syndicate composed of Chicago and New York capitalists has been formed and has purchased control of the Chicago City Railway, at $200 per share. This is considered a very important step in the solution of the local traction problem, inasmuch as it is believed that by merging the two companies the whole situation will soon be cleared up.

Another important development was the settlement of the fight for control of the North and West Chicago Street Railway Companies by the contesting interests. At the annual election of both companies held on Tuesday last a compromise board of directors was elected in each instance, which is satisfactory to both the local and Eastern interests. It is stated that all litigation against the New York parties is to be stopped, and that the adjudication of further questions that may arise shall be brought about privately among the parties concerned, and that the dominant interests in the Union Traction Company are to finance the receivers' certificates of the Union Traction Company that are to be issued.

The city council committee on local transportation has made a move which ultimately may result in universal transfers on the street cars of this city. It has recommended for passage an ordinance compelling the exchange between the principal lines of the City Railway and the west division of the Union Traction Company. The ordinance, if passed, will depend for its enforcement upon the police powers of the city.

The local traction stocks were practically neglected during the greater part of the week, there being a general disposition on the part of traders to await developments in the local situation. Chicago City Railway at the opening sold at 180¾ and 184 for small amounts, but in the announcement that a "deal" had been consummated, the price advanced sharply to 194, a gain of over 14 points for the week. West Chicago stock was bought liberally at the same time around 60, while the consolidated 5s advanced to 82 on large transactions. The elevated railway stocks were practically neglected; Chicago & Oak Park sold at 7¾ for about 200 shares. Metropolitan preferred brought 60, while Northwestern common and preferred changed hands at 23 and 63, respectively.

Other Traction Securities

The feature of the Boston market was the active buying of Boston Elevated early in the week, unusually large amounts of the stock changing hands around 158¼. Subsequently, however, the price receded and closed at 157, the lowest for the week. Massachusetts Electric brought 13½, while the preferred declined from 60 to 58 and rallied at the close to 58½. West End common advanced from 94 to 95 on the purchase of small lots, while the preferred broke from 113½ to 112, and closed at 113. In the Baltimore market interest centered largely in the United Railway issues, and especially the incomes; about $100,000 worth sold at from 53 to 52½. Of the 4 per cent bonds, about $40,000 sold at

93, while the stock brought 14½ and 14. City and Suburban 5s sold at 113¼. Lexington Street Railway 5s brought 103, and a fairly good business was transacted in Norfolk Railway & Light 5s at 91¼ and 91. On the New York curb, Interborough Rapid Transit scored a sensational rise on comparatively small transactions. From 168, the closing figure of a week ago, the price advanced to 187½, an extreme gain of 19½ points. About 35,000 shares were traded in. The advance was attributed to a steady accumulation of the stock by parties closely identified with the management of the company. There were also reports of phenominal earnings, some estimates placing the combined earnings of the Interborough and the Manhattan Railway Company at 20 per cent. Washington Railway & Electric common continued strong, with sales at 28. New Orleans Railway preferred was firmer, sales taking place at 10¼ to 11, while the 4½s sold at 75. Public Service Corporation sold at 140 for 200 shares, a gain of 5 points above the last previous sale. There were no dealings in the Buffalo companies securities during the week, but bid prices for both the consolidated 5s and the debenture 6s ruled decidedly strong. International collateral trust 4s, ex-January coupons are quoted at 78½ bid, 79½ asked. North Jersey Street Railway stock was unchanged at 24 bid, without sales, but $10,000 of the 4s brought 77½.

Interest in the Cincinnati, Dayton & Toledo leasing plan caused activity in the securities of that company at Cincinnati last week. About 500 shares of the stock sold at 22 to 23, while $73,000 worth of the 5 per cent. bonds sold at 84¾ to 85. Cincinnati, Newport & Covington common was quite active, about 3000 shares selling, most of it in one large lot; range from 31¾ to 32¼. Several lots of the preferred sold at 91 to 91¾. Cincinnati Street Railway was firm at 144½. Detroit United advanced to 78½. A block of Indianapolis Street Railway 4s sold at 87½, and a block of Columbus Railway 4s at 91.

Northern Ohio Traction & Light has been the active feature of the traction list in Cleveland of late. Sales reached about 1200 shares in the past week and the price advanced from 18½ to 20½, with sales at 60 days delivery as high as 21. There is no news to explain this activity except that the earnings of the road are showing good increase. About 400 shares of Cincinnati, Dayton & Toledo sold at 22½ to 23½. Northern Texas Traction made a new high mark of 44, with a deal at 45 for future delivery. The last statement of this road shows 23 per cent. increase in gross earnings. Western Ohio receipts advanced from 12 to 14 and are scarce at less than 20. Syracuse Rapid Transit made a high mark of 82½, due to the near approach of the time when the property will be included in the proposed New York Central merger. Aurora, Elgin & Chicago preferred sold up from 40 to 45 on small lots.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with two weeks ago:

	Dec. 31	Jan. 14
American Railways	47½	47½
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	156¾	156½
Brooklyn Rapid Transit	60¼	60¼
Chicago City	180¾	192
Chicago Union Traction (common)	9¾	12
Chicago Union Traction (preferred)	40	45¾
Cleveland Electric	74¼	74¼
Consolidated Traction of New Jersey	78½	78½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	77½	77¾
Interborough Rapid Transit	168	186
Lake Street Elevated	—	—
Manhattan Railway	166	167¾
Massachusetts Electric Cos. (common)	13⅛	13½
Massachusetts Electric Cos. (preferred)	58½	58½
Metropolitan Elevated, Chicago (common)	22	22
Metropolitan Elevated, Chicago (preferred)	60	59
Metropolitan Street	118	115¾
Metropolitan Securities	77	75
New Orleans Railways (common)	2	2¾
New Orleans Railways (preferred)	10½	11
New Orleans Railways, 4½s	74	74½
North American	99	100¼
Northern Ohio Traction & Light	17	17
Philadelphia Company (common)	24	24
Philadelphia Rapid Transit	41	41
Philadelphia Traction	17½	17¾
South Side Elevated (Chicago)	96	96
Third Avenue	131	127
Twin City, Minneapolis (common)	104¾	105¼
Union Traction (Philadelphia)	58¾	58¾
West End (common)	94½	95
West End (preferred)	113	113

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says that the monthly blast furnace statistics are almost startling in the revelation they make of the enormous current consumption. December product of anthracite and coke iron was 1,614,000 gross tons. In spite of this large output, stocks of the merchant furnaces declined 121,000 tons, indicating a rate of consumption in a winter month of over 1,750,000 tons. The steel companies produced in December 1,019,841 tons of pig iron and more will be made in January. How enormous the requirements are is shown by the fact that the Carnegie Company has forty-eight out of fifty blast furnaces going. Yet it is short of pig iron, and is today closing purchase of 25,000 tons for January delivery. Pittsburg reports a good deal of activity in the steel market, with premiums over official prices on billets and steel bars. Further sales steel rails, about 32,000 tons, have been effected in the Chicago district, but otherwise the market is quiet. Up to Jan. 1 the associated mills had sold 650,000 tons.

HUDSON RIVER TUNNEL DEVELOPMENTS

The Hudson Companies, a construction company with a capital of $21,000,000, was incorporated at Albany on Monday, Jan. 9, to take over the work of completing the construction of the two tunnels under the Hudson River, from Hoboken to Christopher Street, in New York City, the proposed crosstown line under Ninth Street, and the extension from Greenwich Street north under Sixth Avenue, for which the Rapid Transit Board has already granted franchises. The tunnel work is now being done by the Hudson Improvement Company, which is now to be merged in the new company.

The Hudson Companies will also take up the work of building the two tunnels under the Hudson from the Jersey City station of the Pennsylvania Railroad to the corner of Cortlandt and Church streets, in New York, work which the Knickerbocker Improvement Company had previously been organized to undertake. The former scheme is that of the New York & New Jersey Company, of which William G. McAdoo is the president, and the latter the franchise of the Hudson & Manhattan Company, also known as a McAdoo enterprise.

More important, perhaps, than the mere announcement of the formation of the new company is the fact made public by Harvey Fisk & Sons, that they have succeeded in financing the company and that the capital stock of $21,000,000, of which $16,000,000 is 7 per cent. preferred, has all been subscribed for and allotted. The officers of the new company have not yet been announced, and the names of the incorporations and directors, made public at Albany, give no hint whatever as to the financial backers of the scheme.

So far, it is the expectation that the Hudson Companies will be only a construction company, the operating companies remaining as at present, the New York & New Jersey Company for the up-town tunnel, and the Hudson & Manhattan Company for the down-town tunnels, and the officers of these two companies will not be changed in the least by the appearance of the new company.

It is also announced that the Hudson Companies had secured a 500-year contract with the Pennsylvania Railroad Company for the transfer of its passengers from the Jersey City terminal of the road to this city through the tunnel to Cortlandt and Church streets, and thence by connection with the Subway at Dey Street, either to Brooklyn or up town, as the passenger may wish to go. The Hudson Companies has secured for the operating company the right to construct a terminal under the present Jersey City railroad station as its passenger and baggage room, and in return will give the Pennsylvania Railroad the use of the tunnel terminal in this city at Cortlandt Street as a down-town station.

From one source it is said that while details are not yet arranged, the Hudson Company expects to be able soon to announce that it has completed arrangements now pending by which it will connect from its Hoboken terminal, now building, by a spur track with the Delaware, Lackawana & Western Railroad on the north, and the Erie and the Central Railroad of New Jersey stations on the south, thus giving their passengers direct tunnel communications with this city over either the Christopher Street or the Cortlandt Street lines.

APPLEYARD PROPERTIES IN RECEIVERS' HANDS

Three of the Appleyard properties in Ohio have been placed in the hands of receivers. The companies are the Central Market Street Railway, the Columbus, London & Springfield Railway and the Dayton, Springfield & Urbana Railway. J. C. Schmidlapp, president of the Cincinnati Union Trust Company, Cincinnati, and Myron H. Wilson, treasurer of the Cleveland Trust Company, are the receivers. Preliminary to the application for receivers was the filing of suits against each of the roads and the entry of immediate judgment with the consent of representatives of the roads. The General Electric Company entered suit against the Columbus, London & Springfield for $5,982, and against the Central Market Street Railroad for $10,688, and Horace Power, an Eastern capitalist, brought suit against the Dayton, Springfield & Urbana for $10,140. The roads mentioned do not include all the so-called Appleyard properties in Ohio, although some of the other roads are under lease by these companies.

The Central Market Street Railway operates sixteen miles of city tracks in Columbus. It was built to provide entrance for interurban roads and it is now used by all the lines entering the city. The company has a capital stock issued of $1,250,000, and a bonded indebtedness of $500,000, and its earnings for the year ending April 30, 1904, were $51,582.

The Columbus, London & Springfield Railway operates 52 miles of interurban line between Columbus and Springfield. It has a capital stock of $2,500,000, bonded indebtedness of $1,500,000, and its earnings for the year ending April 30, 1904, were $157,200.

The Dayton, Springfield & Urbana Railway owns and operates 45 miles of interurban line between Dayton, Springfield and Urbana. It has a capital stock of $1,500,000, and bonded debt of $750,000. The company owns the capital stock of the Springfield & Western, $250,000, and guarantees the principal and interest on $155,000 of bonds and operates its 8 miles of track. It also leases and operates the Urbana, Bellefontaine & Northern Railway, 21 miles, guarantees principal and interest on its bonds, which amount to $500,000, and owns practically all the capital stock of the company, which amounts to $500,000. It also owns the capital stock of, and guarantees the principal and interest of the bonds of the Kenton & Southern Railway, which has not yet been built. The earnings of the entire property for the year ending April 30, 1904, were $231,145.

As originally laid out the Dayton, Springfield & Urbana was one of the best paying propositions in the Central West, but the saddling upon it of two new and weaker propositions depleted its surplus. Up to six months ago the road paid dividends on its preferred stock, but recently these were discontnued. An indignation meeting of stockholders, held two weeks ago, resulted from the action, and demand was made for an explanation.

The Columbus, London & Springfield Company ought to prove a very good property, as it is well built and connects two large cities with good territory between, besides being part of the through system from Columbus to Indianapolis.

According to Theodore Stebbins, general manager of the properties, the great trouble with all of these roads has been that their rates of fare have been too low for profit. On the interurban lines the passenger rates were based upon 1½ cents per mile, with 1¼ cents per mile for mileage books, and even lower rates for commuters. On the Central Market system, in Columbus, the company sells eight tickets for 25 cents, and also receives 2½ cents from each interurban passenger in and out of the city. Low fare advocates have claimed that short lines traversing the thickly populated sections of large cities could thrive on three-cent fare, but the claim does not seem to have been borne out in this case.

It has been known for a long time that the properties were in poor financial shape, and it is stated that the failures were due to large floating indebtedness rather than to excessive capitalization. The difficulty was undoubtedly precipitated by A. E. Appleyard's connection with recent bank failures in Boston and Buffalo.

It is stated that the receivers will arrange to secure funds sufficient to make some needed improvements, and it is understood that Theodore Stebbins will continue for the present in active charge of the properties.

As yet there is no intimation that the failure effects the Columbus, Grove City & Southwestern, the interurban line running south from Columbus, or the Dayton, Lebanon & Cincinnati, a steam road also controlled by Appleyard. A report from Zanesville states that at the recent annual meeting of stockholders of the Ohio River & Western Railway, another steam road purchased by Appleyard with a view to electrifying it, two sets of directors were elected; one representing Appleyard interests, and the other parties who formerly owned the road. It is claimed by the latter that Appleyard failed to pay for his stock, and that according to the terms of the contract his claim was forfeited Jan. 1.

The opinion is generally expressed in Ohio traction circles that the Appleyard properties will be taken over by some strong syndicate, as they occupy strategical positions in the much-talked-about through systems of Ohio and Indiana. It is known that recently Mr. Appleyard made a proposition to the so-called Elkins-Widener syndicate and that this proposition was turned down. It seems reasonable that if the properties are offered for sale the Philadelphia people would be interested in acquiring them.

HUDSON VALLEY RAILWAY COMPANY OBTAINS IMPORTANT DECISION FOR NEW YORK COMPANIES

A few years since the Hudson Valley Railway Company, at great expense, went through to the Court of Appeals on the question of the right of a street railway in New York State to force connection with steam railroads for the interchange of freight. The company eventually got a decision that unquestionably was a victory for every street railway in the State.

After enjoying for two or three years such benefits as naturally go with such connection, the Delaware & Hudson Company suddenly discovered that the decision of the highest court of the State, in the opinion of the legal department of that railroad, simply entitled the Hudson Valley Company connection without interchange of cars, and refused to deliver to the electric company cars from other roads consigned to the electric company's customers. The Delaware & Hudson Company also induced the Boston & Maine Railroad to take this position, and arbitrarily annulled such arrangements as had been entered into for the business, even declining to operate under contracts. The Hudson Valley Company took up the subject of its rights, not only to connection, but to such interchange of business, and on Jan. 3 obtained a favorable opinion by Justice John M. Kellogg, before whom the company proceeded, after having secured a temporary injunction. The company expects to carry this case through to the Court of Appeals, as it did the original subject of connection between electric and steam roads.

The decision is so lengthy as to preclude printing it in full here. The part of it that seems particularly pertinent is the review by Judge Kellogg of the action brought by a constituent company, going through to the Court of Appeals, which he says gives to a street railroad company the same right of connection as a steam railroad company, and says the court has not the right to force a physical connection that does not carry with it the right to interchange cars. Assuming if an interchange of cars is impracticable, or not to be had, then a physical connection cannot be required.

The Judge refers to the contention of the defendant in the case of the People ex rel, etc., as receiver of the Oneonta, etc., Railroad Company vs. the Delaware & Hudson Company, recently decided by the appellate division, as disposing of the question in suit. "In that case," he says, "the special term, without opinion, refused to compel the defendant by a mandamus to accept cars from the plaintiff road. The defendant in the appellate division contended that the decision of the court below was simply a denial of the remedy by mandamus. Upon the facts it appeared that the relator in that case was indebted to the defendant for similar services, was in the hands of a receiver and that its road was not suitable for freight traffic. There being no opinion, either at special term or in the appellate division, it is difficult to decide just what was determined in that case, and it is conceded by counsel on both sides that there are no other decisions in this State upon the question." "Therefore," he says, "it is fair to assume that the appellate division would not have decided that question without a statement of the reasons for such decision." He concludes: "Under all the circumstances it is fair to assume that the special term denied the writ in the Oneonta case as a matter of discretion, refusing the extraordinary remedy, and leaving the plaintiff to an equitable action to enforce its rights, and that the appellate division, viewing such decision as a matter of sound discretion, affirmed the order without opinion."

The lengthy review and argument made by Attorney Carr of cases similar to this in other states, notably Colorado and Kentucky, Judge Kellogg says, "furnish us but little aid. The question to be determined is, what are the rights under the New York statutes?"

It was suggested by the plaintiff's attorneys at the trial that the disposition of the action of one defendant should govern the other. Attorney Carr would not consent. The court has filed the following memorandum with reference to the Delaware & Hudson Company, defendant:

"The questions in this case, so far as they relate to receiving from or delivery to plaintiff's road of cars or freight, are disposed of by the decision in Hudson Valley Railway Company vs. The Boston & Maine Railroad Company at this term of court, and the injunction will cover the same points and also prevent a removal of the connection now existing at Lake George and Glens

Falls. The connections formerly existing as South Glens Falls and Saratoga were put in under special contract for the sole purpose of aiding the plaintiff in getting rails and material to be used in the construction of its road, and after such material was moved were to be removed whenever the plaintiff required. This court cannot prevent the removal or require the restoration of those connections in violation of the terms of the contract between the parties. This is not a proceeding to establish a physical connection. It may be that the temporary physical connection as established is at a place or is different in construction than the parties would require, or desire for permanent use. If the order is not agreed upon it will be settled on ten days' notice."

THE RAPID TRANSIT WEEKLY

The "Rapid Transit Weekly" is the name of the new publication issued in the interests of several of the interurban electric railways in the vicinity of Chicago. It is a four-page sheet, newspaper size, and while the general make-up is similar to that of a daily, a better quality of paper is used, so that half-tones may be printed. The roads interested in the paper are the Aurora, Elgin & Chicago Railway Company, Elgin, Aurora & Southern Traction Company, and the Joliet, Plainfield & Aurora Railroad. Besides time tables, maps and views along the lines, the paper contains a summary of the amusements in Chicago for the current week, time tables of steam roads centering in Chicago, advertisements and miscellaneous matter. The publication office is at 126 Market Street, Chicago.

E. C. FOSTER RECEIVER OF NEW ORLEANS COMPANY

On application by Attorney-General Robert H. McCarter, as counsel representing the New York Security & Trust Company, United States District Court Judge William M. Lanning has reappointed E. C. Foster, president of the New Orleans Railways Company, as receiver for that company. Mr. Foster had been appointed receiver by Judge Lanning, sitting in camera Saturday, Dec. 31, in anticipation of the company's default on Monday, Jan. 2, in the payment of interest on $2,500,000 mortgage bonds held by the Trust Company.

The appointment of Mr. Foster as receiver last Saturday was followed by the appointment by the United State District Court for the district of Louisiana, of Mr. Foster and Pearl Whyte, the latter being a large bondholder in the New Orleans Railways Company, as ancilliary receivers, and when the default in the payment of the interest due on Monday occurred, Mr. Foster was reappointed pursuant to foreclosure proceedings instituted by the New York Security & Trust Company.

The New Orleans Railways Company operates all the trolley lines in that city. The amount of interest in default is said to be $400,000.

ST. PETERSBURG TRACTION PROJECT

Murry A. Verner, of Pittsburg, Pa., returned on the North German Lloyd liner Kronprinz Wilhelm, Jan. 11, after a brief sojourn in St. Petersburg, where he went to confer with the authorities regarding the construction of a very extensive network of electric lines contemplated in and around the Muscovite capital.

When seen by a representative of the Street Railway Journal, Mr. Verner was extremely reticent in giving information as to the possibility of his Pittsburg interests securing the contract for the building of the system which will involve an expenditure of some $20,000,000. He said that negotiations had got to such a pitch that it would be inpolitic to make any statement at the moment. Mr. Verner's visit to Russia was made at the special invitation of the St. Petersburg authorities.

The American syndicate of which Mr. Verner and Sellers McKee are the leading interests, has been after the St. Petersburg contract for fully two years past. While what is referred to in diplomatic circles as the sugar affair was at its height, there was an intense anti-American feeling in Russia and the municipal authorities of St. Petersburg refused to seriously consider the overtures of the syndicate regarding the electric traction project. Mr. Verner, however, took the matter up with the government and it was understood at the time that the Minister of the Interior would encourage the scheme. The Russian attitude toward Americans is at present, however, very friendly. The contract is expected to be fixed up within the next three months at latest.

The Russo-Japanese war will be no hindrance to the deal going through, as according to Mr. Verner the hostilities have affected St. Petersburg business interests little or none at all. As to the result of the war, Mr. Verner says, the utmost confidence is displayed by all classes that the Czar's forces will win in the long-run.

IMPORTANT TURN IN CHICAGO AFFAIRS

A special wire to the Street Railway Journal from its Chicago office, on Wednesday, Jan. 11, at 11:15 a. m., announced the confirmation in Chicago by Mr. Govin of negotiations completed in New York which make possible the consolidation of the Union Traction Company and the Chicago City Railway Company. Messrs. J. P. Morgan & Company and H. B. Hollins & Company, of New York, and Marshall Field, John J. Mitchell and the Armour interests, of Chicago, have secured control of both properties, but actual consolidation is dependent on franchise matters. Details will, of course, all be decided later. Another announcement of interest is that the contest between the Union Traction Company and the underlying companies was compromised peacefully at the annual meeting on Tuesday.

In December Messrs. Hollis & Company sent to the stockholders of the North and West Chicago Companies a lengthy circular in which the statement was made that their holdings in these companies were so large that they would not be entrusted to any but the most experienced and able guardianship, and that they were prepared to enter upon the reconstruction of the properties. Accompanying the circular was a letter from Alfred Skitt, formerly of the Manhattan Elevated Railway, of New York, giving in brief his views concerning the Chicago traction properties and the situation in that city. In this letter, Mr. Skitt, who made a thorough study of the situation, says there is a bright future for the properties under just such arrangement as it now seems likely will be carried out.

THE STREET RAILWAYS OF NEW YORK IN 1904

A summary has just been issued of the reports made to the Railroad Commissioners of New York by the steam railroads and the street railway companies of the State. At this time there will be appended merely a few comparative totals, the plan being to publish an extended extract of the pamphlet in next week's issue.

The board reports the cost of street railway equipment for the year at $470,668,920, a gain of $16,000,000 over 1903. Net earnings from operation were $20,567,122 in 1904, and $20,715,127 in 1903. These roads still have in their equipment 4443 horses, but the number shows a decrease of over 600 since 1903. The report contains the following comparison:

	1903.	1904.
Number of passengers carried, including transfers	1,267,563,057	1,341,766,931
Number of transfers	305,548,230	312,860,257
Tons of freight carried	514,460	633,674
Passenger car mileage	192,583,102	199,767,097
Freight and express mileage	724,950	1,097,498
Mail car mileage	214,698	219,790

During the year 193 persons were killed on street surface roads and 878 injured.

A NEW SURFACE COMPANY TO BUILD IN NEW YORK

The New York City Interborough Railway Company, whose right to build surface street railway lines in Bronx Borough, New York, has been upheld by the Appellate Division of the Supreme Court, is to be operated in harmony with the Interborough Rapid Transit Company, controlling the subway and the elevated lines in New York. This announcement was made last week, after the election to the directorate of the New York City Interborough Company of W. G. Oakman, Andrew Freedman, George W. Young, Alfred Skitt and Walter Luttgen, all directors of the Interborough Rapid Transit Company. The other directors of the Interborough Railway Company are Robert C. Wood, Cornelius Vanderbilt, W. J. Fransioli and Arthur Turnbull.

In a statement to the public the Interborough Railway Company says its intention is to build a line from the One Hundred and Eighty-First Street station of the subway in Manhattan accross the Washington Bridge to Bronx Park, and also its other lines, five in number, this to be done as soon as a few minor legal details are adjusted. The definite statement is made that traffic arrangement has been made with the Interborough Rapid Transit Company whereby passengers will be carried over both systems for a reduced fare. The rate of this fare is not given, but it is generally assumed to be on the basis of eight cents for a transfer from one system to the other. The new company will become a competitor of the New York City Railway Company, which operates in the Bronx through its subsidiary the Union Railway Company.

APPOINTMENT OF COMMITTEE ON AN INTERNATIONAL FORM OF ACCOUNTING

President W. G. Ross, of the Street Railway Accountants' Association of America, has appointed a committee to take up the subject of an international form of street railway accounting. It will be remembered that in his presidential address at St. Louis, ex-President F. E. Smith, of the Accountants' Association, called attention to the fact that there are several different methods of street railway accounting in use abroad, and that these systems differed radically from that employed in this country. He recommended that a committee be appointed to take up the subject of a standard form of street railway accounting with the British and Continental street railway organizations, and others interested. It was his hope that a form could be adopted which would be international, and which would enable investors in street railway properties, no matter where situated, to compare the results of operations of companies in which they might be interested. The committee which will take up this subject for the Street Railway Accountants' Association of America, consists of W. G. Ross, of Montreal; C. Nesbitt Duffy, of Chicago, and W. B. Brockway, of New York.

ANNUAL MEETINGS OF THE OHIO INTERURBAN RAILWAY ASSOCIATION AND OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual meetings of the Ohio Interurban Railway Association and of the New England Street Railway Club are to be held on Jan. 26, the former at the Algonquin Hotel, in Dayton, and the latter at the Hotel Brunswick, in Boston. The meeting of the New England Street Railway Club will commence with a business session, which will be held at 3 o'clock, and at which the officers for the ensuing year will be elected. The annual banquet will be held at 7 p. m., with a reception at 6:30; the charge for tickets is $2.50, and members are requested to make prompt application if they desire to secure seats in the main dining-room.

The meeting of the Ohio Interurban Railway Association will convene at 5 p. m.

NEW YORK, WESTCHESTER & BOSTON PERFECTING ORGANIZATION

The New York, Westchester & Boston Railway Company, which plans to build an electric railway from New York to White Plains and the Connecticut State line at Port Chester, is perfecting its organization. Last week the company announced that it had secured the services of William Barclay Parsons as chief consulting engineer, and that William A. Pratt will be retained as chief engineer of the company for a period of at least two years. The company informs the STREET RAILWAY JOURNAL that at the annual meeting, to be held shortly, a full board of directors will be elected. William L. Bull, senior member of Edward Sweet & Company, will continue as president of the company, and Samuel Hunt, who is connected officially with several roads in the West, will continue as vice-president. Mr. Hunt will have entire charge of the building of the line.

Mr. Parsons, who has been retained by the company as its chief consulting engineer, was chief engineer of the New York Rapid Transit Commission during the building of the subway and now acts as consulting engineer to the commission. All plans and material used by the Westchester Company will first have the approval of Mr. Parsons. The franchise of the company calls for the construction of a road practically similar in equipment to the present subway system of New York, and it is believed by the financial interests connected with the Westchester enterprise that Mr. Parsons' experience in building the subway, coupled with his executive and engineering ability, will make his services of inestimable value to the company, as well as insure the construction of the most improved type of railroad.

Mr. Pratt, who has been retained for a period of at least two years as chief engineer of the company, has just resigned as chief engineer of the Staten Island Rapid Transit Railroad Company, which is part of the Baltimore & Ohio Railroad system. He has had more than twenty-five years experience in the location, construction and maintenance of railroads, principally in the service of the Baltimore & Ohio and the Chesapeake & Ohio Railroads. He was for a number of years civil engineer of the Philadelphia division of the Baltimore & Ohio. Mr. Pratt and the staff that will work under him have just established themselves in offices at 30 Broad Street, New York, and will actively proceed with the completion of the work now necessary so that construction may begin as soon as the weather will permit. In the meantime, the company's right of way for a considerable portion of its route will have been purchased.

John Bogart, formerly State engineer, who, as engineer for the company, had mainly to do, up to the present time, with the preparation of its plans, will continue as a consulting engineer of the Westchester Company.

OTTAWA VOTES NOT TO BUY STREET RAILWAY

There was referendum at the municipal election in Ottawa, Ont., last week, on the question of the purchase by the city of the property of the Ottawa Electric Railway Company. The proposition was voted down. A price of $250 a share was placed by the company on its stock.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED DEC. 27, 1904

778,256. Electric Railway; Joseph Dela Mar, New York, N. Y. App. filed March 8, 1904. A protecting housing for the third rail, the roof of which is the contact surface for the car shoe, being sectional and connected with the rail by sliding bars actuated successively by the car.

778,356. Railway Signal; Frank L. Fuller and Charles S. Banghart, New York, N. Y. App. filed March 21, 1904. The car on entering a block runs over an insulated section of the rails and the signal is then closed through the car wheels and axles, the current used being entirely independent of the propelling current.

778,376. Trolley Harp and Guard; Stephen G. Reynolds, Easton, Pa. App. filed June 29, 1903. A trolley guard comprising a generally U-shaped yoke in the opposite inner faces of the trolley-harp and having its free ends bent inwardly and rearwardly to overlie the groove in the trolley wheel.

778,520. Trolley; John S. Weckman, Carnegie, Pa. App. filed Sept. 22, 1904. Details.

778,643. Controller; John P. Durkin, Philadelphia, Pa. App. filed Oct. 15, 1904. An automatic catch on the controller handle strikes a stop at each position of the handle, requiring slight backward movement of the handle to release the catch before it can be moved forward.

778,655. Crossing for Street Railways; Henry M. Gleason, Philadelphia, Pa. App. filed April 30, 1904. A pivoted oscillating grooved member between the ends of abutting transverse rails and automatic means operated by the wheel of the approaching car for shifting said grooved member so that the groove shall be in alignment with the grooves of the abutting rails in the direction of the travel of the car.

778,706. Metallic Street Car; Frederick H. Rapley, New York, N. Y. App. filed Dec. 26, 1903. Details of construction.

778,729. Brake Operated Signal or Tail Light; Samuel N. Wilcoxson, Collingwood, Ohio. App. filed June 7, 1904. A circuit closer is attached to the brake rigging of a car so that when the brakes are applied a tail lamp will be lighted.

778,806. Street Railway Switch Mover; Samuel C. Smith, Philadelphia, Pa. App. filed March 21, 1904. Relates to means for throwing the switch from a moving car.

778,832. Electric Traction; Henry B. Greenwood, Buenos-Aires, Argentina. App. filed July 16, 1904. A tube containing sheet metal links rests upon the main conductor, the links being successively lifted by a magnet carried by the car into contact with the top of the tube, so that the car may take current therefrom.

UNITED STATES PATENTS ISSUED JAN. 3, 1905

778,987. Trolley; William W. Mercer, Norfolk, Va. App. filed May 28, 1904. Details.

778,933. Trolley Catcher and Retriever; Charles F. Wilson, New York, N. Y. App. filed Aug. 19, 1903. A spring-drum and ratchet device for controlling the trolley.

779,150. Third Rail System; Giosue D'Esposito, Pittsburg, Pa. App. filed March 12, 1904. Relates to the mounting of the third rail and guard therefor.

779,199. Motor Controller; Charles E. Parry, Schenectady, N. Y. App. filed Sept. 24, 1903. By the initial movement of the controller handle the motorman can either throw the motors first into series or into parallel depending upon the conditions under which the train is to be started.

779,204. Electric Railway System; George L. Campbell, Nyack, N. Y. App. filed Oct. 11, 1902. Switch boxes in the road bed provided with covers built up of magnetic and non-magnetic laminations to thereby increase the effective pull of the magnet on the car, upon the switch-operating armature in the box.

779,213. Car Fender; George A. Fullipp and Charles Huszka, East McKeesport, Pa. App. filed July 20, 1904. Details of construction.

779,390. Signaling for Railways; William S. Berry, Pittsburg, Pa. App. filed May 25, 1903. In systems where the signal mechanism is operated by the trolley current, the automatic interposition of resistance protects the signal magnets against variations in the current.

779,401. Trolley Pole Controller; Arthur W. Harrison and Eugene H. Fostick, Los Angeles, Cal. App. filed June 2, 1904. The trolley base contains an air chamber and carries a solenoid by which the pole can be drawn downward and its motion controlled.

PERSONAL MENTION

MR. FRANCIS G. GILL, claim agent and adjuster of the street railway department of the Public Service Corporation of N. J., is dead, aged fifty-two years.

MR. ERNEST F. LEAMED, of Boston, has gone to Minneapolis in connection with power developments in the vicinity of the Twin Cities in which Stone & Webster are interested.

MR. LOUIS H. HAYNES has resigned as electrical engineer of the Boston Suburban Electric Companies to accept a position on the engineering staff of the New York, New Haven & Hartford Railroad.

MR. C. E. WARWICK has been appointed chief inspector of the Galveston City Railway Company to succeed Mr. Edward L. Lawson, who has become connected with the Fort Worth-Dallas Interurban Company.

MR. RUSSELL ROBB has been admitted into the partnership of Stone & Webster, of Boston. Mr. Robb is a graduate of the Massachusetts Institute of Technology in the class of 1888, and has been connected with Stone & Webster since 1892.

MR. ANTHONY J. BEMIS, formerly resident manager of the Brockton & Plymouth Street Railway at Plymouth, Mass., is now manager of the Cape Breton Electric Company, Ltd., at Snyder, C. B. Both of these properties are controlled by Stone & Webster, of Boston.

MR. B. J. ARNOLD has been retained as consulting engineer by the city of Chicago to make an exhaustive study and report on the possibility of deadening noise on the Union Loop in that city, and also on the practicability of the through routing of cars on the elevated lines.

MR. MILES LEWIS PECK has been elected president of the Bristol & Plainville Tramway Company, of Bristol, Conn., to succeed Mr. Charles S. Treadway, resigned. Mr. Peck has been treasurer of the Bristol Savings Bank since 1872, and is prominent in local affairs in that city.

MR. G. G. ROSE, of New Castle, Pa., has been appointed general freight and passenger agent of the Pennsylvania & Mahoning Valley Railway Company, succeeding the late Mr. Fred Carpenter, who was killed by accident a short time ago. Mr. Rose has been with the company some time.

MR. J. G. BANKAT, master mechanic of the Schenectady Railway Company, will act as chief engineer of the company in the future. Mr. C. C. Lewis, who resigned from that position, has, as previously mentioned in the Street Railway Journal, entered the employ of J. G. White & Company, Ltd., for whom he will superintend the electrification of the tramway system at Montevideo, Uruguay.

MR. NORMAN BERRY has just been appointed general manager of the Huntsville Railway, Light & Power Company, which operates the street railway system, and supplies the electric lighting in Huntsville, Ala. Mr. Berry has just returned from Soa Paulo, Brazil, where, for the past three and a half years he has been superintendent of car repairs of the electric railway system in that city.

MR. P. E. MITCHELL, who for several months past has been superintendent of the Knoxville Electric Light & Power Company, has been appointed to the position of general superintendent of the Knoxville Traction Company to succeed W. G. Woolfolk, who has become general superintendent of the Philadelphia & West Chester Traction Company. Mr. Mitchell will continue to act as superintendent of the Light & Power Company.

MR. WILLIAM BARCLAY PARSONS, consulting engineer to the New York Rapid Transit Commission, chief consulting engineer of the New York, Westchester & Boston Railway, and a member of the Panama Canal Commission, is expected to sail for the Isthmus next week to make an examination in behalf of the Government of the work that has been done by the engineers on the final surveys for presentation to the authorities at Washington.

MR. E. D. LEAVITT, of Cambridge, Mass., was presented with a handsome silver service on Jan. 2, by thirty-eight men who have been in his employ within the last thirty years, in appreciation of the sound engineering training given by him. Mr. Leavitt is well known to the engineering profession as consulting engineer of the Calumet & Hecla Mining Company, the Manhattan Elevated, the Metropolitan Water Board and other clients, and this tribute will be generally appreciated as a fitting recognition of his personal inspiration to his employees.

MR. C. E. D'ORNELLAS, of the French Thomson-Houston Company, of Paris, is spending a few months in this country. He is on a trip of inspection to study the latest developments in electrical engineering, but is devoting the greater part of his time to traction matters, particularly interurban roads and subways. He expects to return to France during February. Mr. d'Ornellas is a brother of Mr. T. V. d'Ornellas, whose appointment as electrical engineer of the Peruvian Government was mentioned in the Street Railway Journal for Dec. 31.

MR. JOHN P. COONAN, former superintendent of the Montoursville Passenger Railway Company and the Montoursville Electric Light Company, died at Montoursville Dec. 25, 1904, at the age of thirty-two years. Mr. Coonan began his railroad career with the Conestoga Traction Company, of Lancaster, Pa., in 1892, as conductor, and then took the position of general repair man. Leaving that company in 1898, he went to Montoursville as electrician. In 1901 he was appointed superintendent of the company, which position he held until his death.

MR. SOLOMON LE FEVRE DEYO, chief engineer of the Interborough Rapid Transit Company, operating the subway and elevated lines in New York, was the guest of honor at a banquet given by about 150 members of the engineering staff of the company to celebrate the completion of the engineering work on the subway. Practically all the officials of the company were present. As a token of appreciation there was presented to Mr. Deyo as coming from his associates a five-gallon silver punch-bowl, gold lined and suitably embellished. Mrs. Deyo and a number of the wives of members of the party participated in the dinner.

MR. W. B. GRIMSHAW has resigned as general freight agent of the Trenton, Lawrenceville & Princeton Railroad, the Yardley, Morrisville & Trenton and the Newtown & Yardley Street Railways, all controlled by the New Jersey & Pennsylvania Traction Company, of Trenton, N. J., and is succeeded by Mr. J. O. B. West, who has served the company in various capacities. Mr. Grimshaw built up an entirely new business on the Yardley and Newton lines. He was formerly general freight agent of the West Chester, Kennett & Wilmington Street Railway, operating between Kennett Square, Pa., and Brandywine Springs, Del. The Trenton, Lawrenceville & Princeton Railroad is the only electric railway operating under a steam charter in New Jersey that does a freight and express business. Mr. West, the new freight agent, is well acquainted in Trenton and along the respective lines.

MR. CHARLES N. BLACK, chief engineer of the Metropolitan Street Railway Company, of Kansas City, Mo., has been appointed general manager of the company, and hereafter will act in the dual capacities of chief engineer and general manager. Mr. Black will thus be responsible for the operation of the entire system, succeeding in these labors Mr. Bernard Corrigan, who heretofore has acted as president and general manager of the company. Aside from this change, the personnel of the company will remain unchanged. Mr. Satterlee will continue as assistant general manager and claim agent, and Mr. J. W. Carter will continue as general superintendent. The selection of Mr. Black to assume the new duties is an expression of appreciation of service that began with the reconstruction of the Metropolitan system and really made that reconstruction the success it has proved. Mr. Black came to Kansas City as chief engineer to Ford, Bacon & Davis, to whom was entrusted the work of rebuilding the system. In this capacity he was responsible for all the work done by the company, and when in September, 1903, this work was finished, he was induced by the Metropolitan Company to become chief engineer of the system. Mr. Black is by profession an electrical engineer. Princeton is his alma mater. In 1888 he was graduated from the regular course with the degree A. B. For the next two years he studied under Professor Brackett and secured the degree of E. E. Then began Mr. Black's commercial career. He was subsequently connected with the Brush Electric Company, the Short Electric Railway Company, the Walker Company and others.