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Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 269,600 copies, an average of 8171 copies per week.

Pump Locations in Power Plants

The location of pumping machinery in a power plant depends so largely upon the available space that in many cases the designer has little choice in the matter. Fortunately there is a wider latitude usually to be found in the location of equipment in a railway plant than in an installation for office building or hotel service. In some of the higher-class isolated plants, a separate room is now provided for pumps, and there is no doubt that in certain railway generating stations such a course would be advantageous.

In some cases the pumping equipment is installed in the engine room, and the principal advantage of so doing is the increased amount of attention the pumps receive from the engineering staff of the station. In general the boiler room is not an ideal place for moving machinery, and although steam-driven feed and circulating pumps are rugged pieces of apparatus, there is no question that constant exposure to coal dust and dirt increases the rate of depreciation. Pumps and piping need care as well as anything else, and it is too much to expect the same attention in the boiler department as in the engine room.

The location of pumps in the engine room is open to the serious objection that such a course tends to crowd the equipment too closely together in plants where there is quite a number of pumps to be installed. Aside from boiler feed pumps, many plants are equipped with air and circulating pumps for condenser service, step bearing turbine pumps, oil pumps, drainage, artesian well and fire pumps. The piping complications which these entail are a disadvantage to the free movement of objects in the engine room, and to the clear vision of the operating force. The most modern stations are conspicuous for the way in which similar equipment is co-ordinated in groups of operating units; ample clearance is allowed between units, and the grouping plan permits the widest flexibility in case of trouble. Thus, if all the boiler feed pumps are installed in a parallel row in a separate pump room, the piping can readily be arranged to enable any pump to take up the load with minimum loss of time in case of trouble. If the pumps are scattered promiscuously around in odd corners the pipe layout can not be as simple and hence as low in first cost, or the control as immediate and concentrated. Air and circulating pumps are almost always installed in the basement close by the condensers which they serve, but there is often the same opportunity for co-ordinating these in a group, with the feed and oil pumps, step bearing pumps, etc., that there is when the pumps are located in a separate compartment on the floor above. The pump installation ought to be well under the hands and eyes of the operating shift, in any case, and the plan of segregating this equipment in a group apart from the boiler and engine room apparatus is well worth bearing in mind in designing new plants. There is no reason why traditional practice in the location of pumps in the boiler room should not be departed from in cases where it seems advisable.

The "Everybody Busy" Principle

Overworking men in the services of an electric railway company is not to be advocated, but it is certainly the part of a good manager to get a full day's work out of every employee on the system. Some companies do not get all the work out of their men that could reasonably be expected,

and, further, it is the fault of the companies themselves that they do not do so. There are many duties about a system that require practically nothing but the constant attendance of a man and necessitate very little actual work on his part. Again, there are many odd jobs upon which these men could work without interfering with their duties. Considerable economy would be effected if men in such positions were given enough work to keep them busy. The sub-station attendant, for instance, could undertake small electrical repairs, or probably he could be kept busy winding armatures. After starting the apparatus in the morning there is generally little to be done except to throw a circuit breaker occasionally. Of course, at times, in case of derangement of the apparatus, his whole attention is required for several hours continuously; but, ordinarily, a great deal of electrical repair work could be obtained from the average sub-station attendant without any interference with his duties, and he would probably be better satisfied with his work through being relieved of some of its monotony. Some companies employ for sub-station attendants low-priced men who are not mechanics and who would not be capable of doing electrical or mechanical work. This is sometimes done in view of the fact that derangement of sub-station apparatus is so infrequent that the services of a high-priced man are seldom required. For cases of this kind a lower grade of work can often be found. For instance, the attendant could be trained to take care of the headlights and marker lights, which may then be left with him by the train crews. On the other hand, by adding armature winding or electrical repairs to the sub-station man's duties, a company can afford to put a better man in a sub-station than if he is to be idle most of the time.

In addition to sub-station attendants, there are others who might be kept busier. Switchmen are often kept at points where their duties are such that they could be given extra work, and sometimes it is necessary to maintain station agents at points where the regular duties require a small portion of their time. In the latter case, the clerical force in the central office might be diminished by distributing some of the work to the otherwise idle agents. The emergency line crews also could be kept busy at some kind of work when on duty.

A great deal of enforced idleness of men is caused by delays of train crews on sidings. A Western interurban road, realizing the savings possible by keeping everybody busy, is building a line car large enough to contain a workshop in which apparatus can be repaired and line material gotten ready for use. A work bench of convenient size is built along one side and necessary tools, supplies and repair parts are kept at hand. Often the line car is delayed on a siding for an hour or more at a time, and in such instances on most roads the crew has a good excuse for loafing. With this car there will be no occasion for this, as there will be almost as good an opportunity to work as when in the shop.

In demanding extra work from men with regular duties, care should, of course, be taken that the extra work does not interfere in any manner with their regular duties. They should be given to understand that the extra work is of secondary importance.

When attempts are made to introduce the "everybody busy" principle, there will, to be sure, be serious objections on the part of some of the workmen, but not from the best ones. It would, of course, require a little thinking on the parts of heads of departments to keep all their men busy, but in most instances a little attention to this detail of managing will pay good returns in the resulting cutting down of the cost of labor.

Care of the Water Coolers on Cars

It is certainly aggravating to a traveller on a hot, dry day to approach a water cooler on an interurban car and find it either empty or filled with lukewarm water or with a fluid so muddy and so dirty that the bottom of the cup cannot be seen. It would be far better not to provide a water cooler on the car than to have one not properly taken care of and which invites simply to disappoint.

The care of water coolers is of such importance that on interurban systems operating ten or fifteen cars or more, if possible, one man at a central point should be made responsible for their condition. If it is nobody's duty in particular to fill them and supply them with ice, it is almost an assured fact that they will be empty or the water in them will be warm as often as otherwise. The most important point to be remembered in their care is to use a good quality of water. It is often the practice to put in water from a city system which is of such a quality that the people ordinarily do not regard it as fit to drink. If this kind of water is all that is available, a filtering plant should be brought into service. On the larger systems where storage batteries are employed in the power house or sub-station, there is usually a still in the power house for purifying water for use in the storage batteries, and water from this still may be used in the coolers. Distilled water, to be sure, has a rather flat taste, but when iced it is not so objectionable.

Of second consideration, but also of importance, is the supplying of ice to the cooler. When people go to a cooler expecting ice water, they are likely to express their opinion of the care of the traveler by the operating company in a rather forcible manner when greeted with a lukewarm stream.

Another point to which attention should be given is the kind of cup kept with the cooler. Evidently some companies go on the principle that it is best to have an old, rusty cup that no one would have rather than provide one decently clean and have it stolen. But cups are cheap. The ordinary tin cup can be purchased for about 2 cents, and it would be far better to lose one by theft occasionally rather than to supply a dirty, rusty cup which would make any water taste bad, and which in all probabilities would assist in spreading disease. The suggestion to scald with boiling water or wash out the interior of the cooler with soda water and a brush or to give it a thorough cleaning in some other manner at frequent intervals may at first thought appear to many to be pushing the matter of the care of water coolers to an extreme. But a little consideration of the faults and shortcomings of the present type of cooler will show it to be a very sensible suggestion.

This gives us opportunity to say a word regarding the type of water cooler usually found in both steam and electric coaches. The opening inside is so deep and narrow that it is very difficult to clean them, and further it is almost impossible to tell when they are dirty. It might be argued that if nothing but pure water is put into them that there is no occasion for their getting dirty. But when one is reminded of the condition in which glass water pitchers get when not washed at frequent intervals, the argument will have very

little support; and, further, clear water is not always supplied. Even if the water did not soil the coolers, there are other ways whereby they become unfit for use if not washed frequently. A car is often kept in the shops for a month or more at a time for repairs, and during these intervals the cover is not always on the water cooler. It may have fallen off or, owing to a lack of covers, the cooler may have been "robbed" of it for use on a car in service. Of course, the passenger knows nothing about the inside condition of the water cooler, but it is safe to say that if he did he would not be so eager to get a cool "refreshing" drink out of it, even if he carries his own private drinking cup.

It appears that, in general, improvements in water coolers for cars have not kept pace with the general progress in car construction and the developments of sanitation. The coolers in use at the present time are practically the same as those employed several years ago. At a cursory glance it appears that improvements could be made somewhat along the line of the type of cooler frequently found in offices. In this type an inverted glass bottle containing the water is supported above a chamber in which are placed ice and cooling coils. The feature of this type of cooler that would be highly desirable in a railway car cooler is that the water and the condition of the greater part of the retaining vessel as regards cleanliness can be seen. The railway system which first adopts a satisfactory cooler will certainly gain in favor with its patrons.

Until some improvements are made, certainly more attention should be bestowed upon coolers, and in the interests of general health they should be given frequent scaldings and cleanings.

The Worker Under Public Ownership

We have recently received a paper by H. T. Newcomb, Esq., on this topic, which ought to be read by every one who has been bitten by the municipal ownership idea. It was read a few weeks since before the American Association for the Advancement of Science, so that it will be readily available to the public. It is a keen, if somewhat acrid, analysis of the claims of the advocates of municipal and State socialism. We do not agree with all the opinions of the author, who, very evidently, holds a brief for things-as-they-are, but certain points not commonly considered are brought out with great force. Mr. Newcomb's view is largely moulded upon observation, and perhaps experience of the Government as an employer. With its hard knots of red tape, its unbending system and the frequent parsimony of Congress, the position of the Washington or other Government employee is not altogether enviable. In the pay of its higher positions, Uncle Sam is notoriously stingy, the head of a great department getting pay not one-half what would be considered a fair recompense for the same responsibility in civil life. Yet, on the other hand, taking the rank and file of the clerical force, one reaches another conclusion, for the average pay on a per hour basis is on the whole unusually good—better than that under private employment for the same grade of labor. This is in fact one of the very weakest points of municipal ownership—that the tendency would be toward insufficent pay of the responsible heads and large pay for short hours as regards the great mass of employees with votes. If Mr. Newcomb's claim of poor pay were justified, one would be forced to the conclusion that the supply of labor for Government employ would be small rather than large. It is quite true, as Mr. Newcomb states, that, in spite of the increased cost of living, Uncle Sam has not naturally increased the pay of his force, but, for that matter, neither has the private employer, save when driven to it; and during the steady rise of living costs, wages have been repeatedly cut down under private management, while the Government employee has been holding his own.

No, municipal laborers at least are likely to get all they are worth so long as they keep in close touch with the machine, in which respect they perhaps differ from the Washington force which Mr. Newcomb has in mind. And there are no restrictions against municipal employees pulling any ropes they can to get an increase of pay. It is perfectly true that Government employees are estopped from employing Mr. Newcomb or any of his brother attorneys from lobbying in their behalf, and it is well that they are, for there is too much lobbying all the time for any decent citizen to contemplate with patience. We can hardly imagine so sensible a restriction being placed on the workmen of a municipally-owned railway. On the contrary, the whole force would pretty certainly be voted in regular blocks and have its wages fixed to suit the bosses. As to chief officials, these would be heelers of the sort usually found in street departments, and we can hardly imagine a municipal tramway put in charge of the best available men, irrespective of party or residence. Mr. Newcomb makes one very strong point in favor of private employment in bringing to the front the fact that civil-list pensions are unknown in this country, while the pension is rapidly becoming a common feature in the large corporations engaged in quasi public works. A civil list would be perhaps the finest opportunity for graft ever made available, and for a municipal civil list we have no adequate words available. The corporation pension schemes have not been long tried, and their continuity of purpose may sometimes be open to question, but they exist and do pay pensions to the veteran workman's great benefit. Public ownership could hardly embody pensions without great risk, and, as Mr. Newcomb intimates, is likely to limit the individual freedom of the workman. This is already limited by the procedure now possible under injunction proceedings, and we fail to see how a workman would be less free to strike under municipal ownership than he now is—if such freedom be considered an essential part of personal liberty. Frankly, Mr. Newcomb's diatribe against restrictions placed on contract breaking by employees does not ring true. If the employer can be held to his contract or criminally prosecuted for conspiracy in case of a black-list, why should the other party to the contract be irresponsible? We do not believe that the sensible American workingman wants "liberty" of this kind. In point of fact, the restrictions placed by some corporations are quite as objectionable, for instance, those of the workmen in the South African diamond fields. Of such possibilities Mr. Newcomb's paper says nothing. That there are abuses in the Washington red-tape office is notorious, but they are not the same in kind or degree that would be found in municipal ownership of tramways for instance. It is well to have the public understand that Government employment is no bed of roses, and the paper under discussion makes this point painfully clear. The objections to municipal ownership are only too well known even from present experience. Let us have none of it, until human nature is regenerated, in any form which has yet been devised.

THE ELECTRIC CAR EQUIPMENT OF THE LONG ISLAND RAILROAD—II*

BY W. N. SMITH

ELECTRICAL EQUIPMENT

The selection of the electrical equipment of the motor cars of the Long Island Railroad, whether operated singly or in trains, required the most careful study of the loads to be handled, the schedule conditions under which the apparatus is to be operated, and the limitations of the apparatus itself. Whether all cars of a train should be motor cars; whether all axles of the motor cars should be equipped; what the motor characteristics, the ratio of gearing, and the wheel diameter should be; the maximum speed that could be depended upon to make up time, and the amount of time to be allowed for "laying over" at terminals, were, among others, considerations of the utmost importance in coming to a decision on the equipment that would most economically serve the purpose of the Long Island Suburban lines.

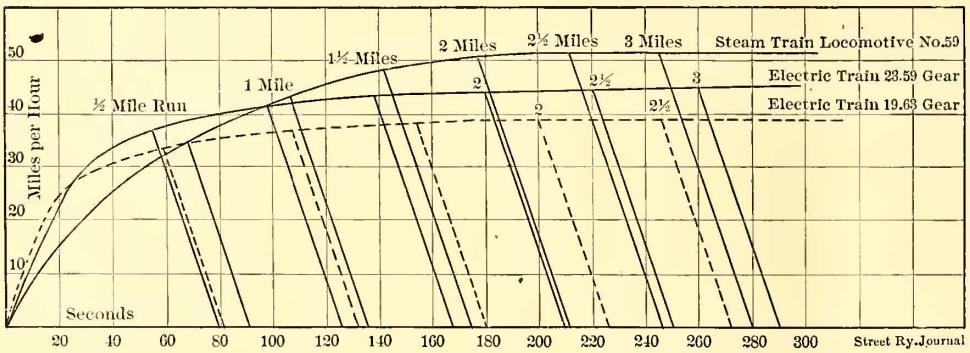


FIG. 17.—SPEED TIME CURVES

The variable number of motor and trailer cars per train caused some variation in the load per motor on different trains. There were also various classes of express and local service to deal with, involving different schedule speeds and average lengths of runs between stops, for all of which it was desirable to provide a uniform equipment, so that any car could be devoted to any desired type of service without discrimination. The motor equipment to be adopted must handle traffic efficiently under any and all of the varying conditions of train weight and schedule speed that occur in the operation of the suburban lines of the Long Island Railroad.

Careful investigation showed that the greatest flexibility would result from a two-motor car equipment, using the most powerful motors practicable. The limitations were mainly the dimensions imposed by the largest trucks that could be operated under the conditions prescribed by the tunnel and curve clearances, which restricted the wheel base of the motor truck to 6 ft. 8 in. This restricted the size of the motor to about 200 hp, and the study of the conditions was consequently reduced to an examination of the characteristics and gear ratio most suitable for this motor, and of its power of endurance to resist overheating.

At the outset, a series of speed tests was made on various steam trains of the Long Island Railroad in order to compare the actual running time with that laid down in the time tables, and with the times which the railroad officials desired to be met by the electrical equipment. An ordinary passenger coach was fitted with speed-recording devices and a number of speed curves were obtained. The best performance of a relatively light steam locomotive train weighing 171.9 tons with the locomotive is shown in Fig. 17. The difference in the running time of an equivalent electric train is shown in the same diagram, and in general indicates that for all average lengths of run between stops in suburban service up to about two miles the electric train is the faster. The average length of a run over the Atlantic Division, the first to be equipped, was originally estimated at 1.6 miles, but in practical operation since the road was equipped this has been reduced to about one mile, giving the electric trains a still greater advantage in speed, due, of course, to their higher rate of acceleration. These same tests also threw some light on the time to be allowed for various delays to which the trains were likely to be subjected, and, together with the actually derived speed curves and calculated best performance curves, showed the relation between the schedule time ordinarily allowed for a train on a given run and the best time that it could possibly make over the same distance.

An idea of the scope of the problem may be had from the statement that there had to be compared about twenty-three different types of train runs, local and express, on eight different routes, with the average distance between stops (herein called average length of run), different in practically every case. The results given in the accompanying table show a comparison of steam and electric runs of average length, based upon the curves mentioned, and others of similar character. The runs in this table are partly express and partly local; for the sake of simplicity the elapsed times of each run shown are those made by a three-car train, although the length and weight of train was in practice expected to vary considerably on some of the lines at different times of the day. The general solution of the problem was worked out by the aid of speed-time curves.

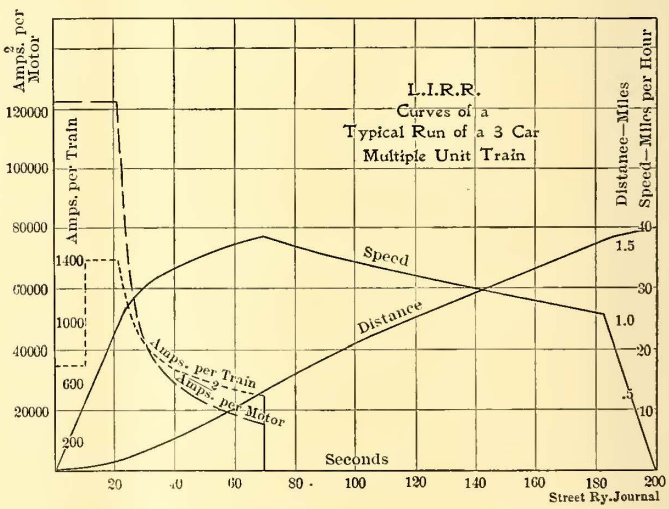


FIG. 18.—CURVES OF A TYPICAL RUN OF A THREE-CAR MULTIPLE-UNIT TRAIN

Considerable work was done in the early stages in comparing results previously obtained by former experimenters with a view to determining the train resistance which had to be properly assumed in order to compute the speed of trains, and the power required by them. With this data secured, the next step was to determine, first, the schedule speeds that

* For previous articles on the Long Island Railroad electrification, see Street Railway Journal for Nov. 4, 1905; April 7; June 9, 16 and 23, and Aug. 11, 1906.

could be maintained by certain motor and train combinations; second, the heating effect upon the motors when run continuously through the cycles of operation representing the average length of run, and the minimum permissible lay-over at the end of a run, for trains in continuous operation; and third, the power consumption of the system, with average and maximum service.

The schedule speeds were derived directly from the speed-time curves. The most rational method available for estimating the heating effect developed in each motor was to compute the "square root of the mean square" current per motor, averaged over the entire time of any given run or succession of runs, and to compare it with the limiting value set by the manufacturers for the motor selected. The power consumption was easily computed from the current-time curve corresponding to each speed-time curve. The time-distance curve was used to determine the location of the amount of current at any instant, thus enabling the ready computation of third-rail and track drop, and the distribution of load between sub-stations. Fig. 18 gives each of these curves for a typical run of three-car, multiple-unit trains.

DATA FOR SUBURBAN RUNS—L. I. R. R. TRAIN SHEETS FURNISHED BY L. I. R. R. CO., NOVEMBER 6, 1902 AND JANUARY, 1903. OMITTING RUNS WHERE NUMBER OF STOPS IS SAME AS HEREIN, BUT TIME AT STOPS IS LESS

RUN.	Distance. Miles.	Run, Letter.	Time, Minutes.	Train Sheet Schedule Speed, Entire Run.	Intermediate No. of Stops per Trip.	Time Out for Stops.	Average Length of Run, Miles.	Time of Average Run, Minutes.	A. Average Speed Between Stops, M.P.H.	B. Limit Average Speed Best Steam, M.P.H.	Ratio A. / B. % Steam.	C. Limit Average Speed, Elec. Train 23–59 G. Ratio.	Ratio A. / C. % Elec.
L. I. City—Port Washington	18.18	a	41.5	26.3	7	4.5	2.27	4.62	29.5	36.	81.9	35.5	83.2
		b	43.0	25.4	8	5.0	2.02	4.22	28.7	34.0	84.4	34.0	84.5
L. I. City—Whitestone Landing	11.75	c	31.0	22.8	7	3.5	1.47	3.44	25.6	30.8	83.2	31.8	80.5
L. I. City—Rockaway Park	16.3	d	39.25	24.9	5	2.5	2.72	6.12	26.7	37.5	71.2	36.5	73.2
		e	39.0	25.1	6	2.75	2.33	5.18	27.0	36.0	75.0	35.5	76.1
		f	40.0	24.4	7	3.5	2.04	4.57	26.8	34.0	78.8	34.0	78.8
		g	41.0	23.8	8	4.25	1.81	4.08	26.6	33.	78.8	33.5	79.5
		h	43.0	22.8	10	4.0	1.48	3.55	25.0	30.8	81.2	31.8	78.7
		i	43.75	22.3	11	4.5	1.36	3.27	25.0	30.0	83.3	31.0	80.7
		j	47.0	20.8	14	5.5	1.09	2.76	23.7	27.0	88.	29.0	81.8
L. I. City—Valley Stream	22.97	k	59.5	23.1	11	7.5	1.91	4.33	26.4	33.7	78.4	33.7	78.3
L. I. City—Manhattan Beach	16.1	l	37.0	26.1	3	3.0	4.03	8.5	28.5	41.0	69.5	39.0	73.0
		m	38.0	25.4	4	2.5	3.22	7.1	27.2	39.0	69.8	37.5	72.6
		n	40.0	24.2	5	3.75	2.68	5.87	27.4	37.5	73.2	36.5	75.0
		o	44.0	22.0	11	6.5	1.34	3.12	25.8	29.8	86.5	31.3	82.5
Flatbush—Rockaway Park	15.88	p	39.5	24.5	7	4.	1.98	4.56	26.	34.	76.5	34.	76.5
		q	44.75	21.5	11	5.	1.32	3.37	23.9	29.5	81.2	31.	77.2
		r	45.5	20.9	12	5.75	1.22	3.06	23.9	28.5	84.	30.	79.6
		s	47.	20.2	15	6.5	.99	2.53	23.5	26.5	88.6	28.5	82.5
		t	48.	19.8	16	6.75	.93	2.43	23.0	26.0	88.5	28.	82.2
Flatbush—Jamaica	9.63	u	19.	30.4	1	1.	4.81	9.	32.	42.5	75.3	40.	80.
		v	23.	25.1	5	3.	1.61	3.33	29.	31.5	92.1	32.5	89.2
Flatbush—Valley Stream	22.55	w	60.5	22.4	13	9.	1.61	3.68	26.1	31.8	82.0	32.0	82.4

The general result of the motor computations, as determining the size of the car equipment, was that a medium gear ratio (25:58 for the No. 113 Westinghouse motor) was fixed upon and the number of motor cars and trailers per train was recommended in accordance with the following table:

Length of Train.	Local.	Express.
Two-car train.	Two motor cars. No trailers.	One motor car. One trailer.
Three-car train.	Two motor cars. One trailer.	Two motor cars. One trailer.
Four-car train.	Three motor cars. One trailer.	Two motor cars. Two trailers.
Five-car train.	Three motor cars. Two trailers.	Three motor cars. Two trailers.
Six-car train.	Four motor cars. Two trailers.	Three motor cars. Three trailers.
Seven-car train.	Four motor cars. Three trailers.	Four motor cars. Three trailers.
Eight-car train.	Five motor cars. Three trailers.	Four motor cars. Four trailers.

Two motors are used per car, and both motors are mounted on the same truck.

MOTORS

The No. 113 motor was brought out in 1905, and was fully described in the Street Railway Journal for Sept. 23, 1905. It was the first motor built by the manufacturers to use the diagonally divided field frame. With this frame the armature can be taken out without removing the motor from the truck by lifting off the top half of the frame, or the motor can be lifted entirely from the truck by removing the gear case and axle cap. Nose suspension is employed, and the motor is oil lubricated from below.

The pinion has twenty-five teeth, 2½-in. pitch, and is cut from a solid steel forging. It is keyed to a tapered seat on the armature shaft and held in place by a nut and lock washer. The gear has fifty-eight teeth and is machined from solid cast steel and pressed and keyed to the axle. The diameter of the gear seat is 7 13-16 ins., and the face of the gear is 5¼ ins. wide. The gear case is of malleable iron, divided in halves horizontally and supported at both the front and rear ends by lugs projecting from the motor frame and housing.

CONTROL SYSTEM—MODIFICATIONS FROM PRECEDING TYPES

The Westinghouse electro-pneumatic multiple control is employed, and the equipment on the Long Island Railroad differs somewhat from that used in any other important installations made by the Westinghouse company, such as on the Metropolitan West Side Elevated of Chicago,[1] the Brooklyn Rapid Transit,[2] and the South Side Elevated Railway, of Chicago.[3]

As the principal features of the electro-pneumatic system of control are familiar to the readers of this paper, it will be necessary only in this article to point out such modifications as have been made in previous equipments and the reasons for their adoption, and include a diagram of the connections as used on the Long Island cars.

In the Metropolitan Elevated and Brooklyn systems, which were the earlier installations, the unit switches were grouped in a turret, whereas on the South Side and Long Island installations the switches are arranged in a row in a long box in such a manner that a hinged cover gives

[1] See Street Railway Journal, April 22, 1905.
[2] See Street Railway Journal, May 6, 1905.
[3] See Street Railway Journal, May 19, 1906.

access to the main contacts on one side and to the interlocking fingers on the other. The unit switches are, therefore, practically the same as those on the South Side Elevated Railway and illustrated in the issue for May 19, 1906.

The master controller, which might be considered the next important feature of the system, is the same in all of the installations, with the exception of that on the Long Island it is fitted with a connection for operating an automatic brake cut-out somewhat similar to that used on the Interborough Subway cars in connection with the type-M control. This cut-out permits the handle of the master controller, when on the central notch, to complete a circuit which energizes the emergency train brake magnet valve, immediately releasing the air from the train pipe and setting the brakes. This arrangement makes effective the "dead man's handle" feature of this type of control. If the motorman removes his hand from the master controller handle from any cause whatever, it returns immediately to the central position and sets the brakes.

On the face of the Long Island master controller there are nine notches or stops, one in the center and four on either side, which engage the spring catch of the handle. The central portion, as stated, causes an emergency application of the train brakes.

The first notch is really the "off" or coasting position of the controller, and when the handle is at this point the train brakes are not applied, but all switches, including the line switch, are open. Reversal is accomplished by moving the handle to the opposite side of the center notch.

When on the second notch or switching position, the controller establishes such connections with the train line that the reverse switch is thrown to the correct position, the line switch is closed, and the switch group closes the circuit of the motors with all the resistance in, thus effecting a slow movement of the train. This, of course, can only happen with all the train line jumpers connected up, so that the auxiliary control apparatus on each motor car is in parallel across the wires of the train line.

The third notch is the series running position, and the fourth and last notch is the multiple position.

One new feature, in addition to those mentioned, is in the arrangement of the motor cut-out switch. This switch, in the Metropolitan installation, actually cuts the motor circuits, but on the Long Island road does so by rearranging the control circuits. In Brooklyn and on the South Side Elevated it is not made a part of the control circuits. The Long Island cut-out switch is placed under one of the seats in the center of the car, and, of course, is designed to enable the motorman to cut out either or both of the motors under the car. It consists of a small drum-type controller with a permanently attached operating handle, which may be moved to four different positions under which the conditions of the motor connections are as follows: (1) Both out, (2) both in, (3) No. 1 out, (4) No. 2 out. The drum upon this control cut-out switch is provided with a number of contact segments which engage with fourteen fingers which are directly connected into the auxiliary control system. When this control cut-out switch is in the off position, none of the fingers makes contact, so that the auxiliary control system is then entirely open circuited. In the other three positions, however, the connections are so made in the auxiliary circuit or so rearranged that the desired effect is obtained by enabling only certain switches to be closed, the balance remaining open.

A line relay is used, as in the Metropolitan installation, it is not employed on the South Side Elevated nor in Brooklyn. This coil is connected across between the main motor control circuit, after passing the line switch, and the ground. That is, it is a 500-volt coil. When the line switch closes and there is a current on the motors, the coil of the line relay is energized and lifts the plunger, causing the disc to close the circuit between the contacts. These contacts are directly in series with the battery circuit of the switch group, so that if they are opened the unit switches of the switch group cannot close, and even if closed the opening of the line relay contacts, due to the cutting off of the line e. m. f. for any cause, causes the battery connection to the switch group switches to be instantly broken, and they at once drop open, cutting off the current supply to the motors. In other words, the line relay constitutes a "no-voltage" circuit breaker for the main circuit. This action takes place on each car individually, so that if the current supply is interrupted on any car the switch group on that car will be cut out independently of the other cars in the train. If the current supply is restored after being broken, while the master controller is in one of the running positions (for example, when the car traverses a gap of the third rail that is longer than the distance between its third-rail shoes), the line relay will then lift and restore the battery connections to the switch group, which will then go through the prescribed cycle of operations under the control of the limit switch as above described, and again supply current to the motors, just as if the controller handle had been thrown to the off position and then turned on again. The line relay is mounted upon the switchboard panel at one end of the car, and its object is to prevent a sudden rush of current after an interruption in this circuit, and thus avoid danger of flashing over on the motors.

The reverser and line switches are the same in all four installations. There is a difference, however, in arrangement of the line relay and limit switch, which on the Long Island car are placed on the switchboard, whereas in Brooklyn, and on the Metropolitan Elevated they are carried under the car.

Another slight variation consists in the method of charging the storage batteries. On the Brooklyn and South Side Elevated Railways they are connected to the light circuit, whereas in the Long Island and Metropolitan equipments they are charged through the pump circuit. This is done by connecting the battery in multiple with an adjustable resistance so arranged that the proper charging current will pass through the batteries when the compressor is operated, the circuit through the battery being closed by a relay mounted on the switchboard panel. The position of the battery switches on the switchboard is changed but once a day when the car is in ordinary operation.

The supply system comprises, first, the four third-rail shoes mounted upon the trucks, and previously described. Each shoe is provided with an enclosed fuse. The two shoes on opposite sides of the same truck are connected together by a cable run in conduit. From a point just above the inner terminal of one of the shoe fuses is connected the supply main, which runs direct to a switchboard panel (mounted in an enclosed space in one of the vestibules) with two taps, one of which leads through a bus fuse to a pair of bus-line receptacles at each end of the car. The bus line may be considered as a jumper run from one motor car to the next, tapping at each end through a fuse into the supply main wiring of the motor car, thus equalizing the main motor supply circuits throughout the train.

To make the operation clear a wiring diagram is presented in Figs. 19 and 20, and the connections will be briefly traced.

In these drawings the unit switch interlocks are shown in with the switches open. The master controller, line switch, reverser and cut-out switch are likewise shown in the open position. With the master controller in the central position,

the two fingers *BK* and *B*-plus rest upon the cylinder, closing the circuit through the emergency brake solenoid. When the controller is thrown to the coasting position, all the fingers are free. The next notch in the forward direction puts fingers *B*-plus, 1 and *6A* in contact with the cylinder. The current passing from the drum over the latter finger goes through the line switch cut-out and then continues on to the main cable, which, when the connecting jumpers between cars are in place, is continuous throughout the length of the train. Leaving the central junction box of each car, the circuit being followed continues through one of the coils of the line switch, thence by wire 11 through the two circuit-breaker coils in series to wire 9 and to the motor cut-out box located under a seat in the car, where it is completed by passing to the battery over *B*-minus. The current through this path closes the circuit breaker or the line switch, and in doing so

The series position of the master controller connects finger 4 with *B*-plus. The circuit through this finger leads through the limit switch on the switchboard in the cab by way of the central junction box to the *M*1 interlock over wire *L*. It then continues over *M*1 interlock to 16, through *J* interlock to 17, by way of *JR* interlock to 18, thence over *S* interlock to the operating magnet of this unit switch. The return to *B*-minus over 12 has already been traced by way of the line relay and circuit-breaker trips. When unit switch *S* operates, connections of its operating coil are made over its interlock with *R*. Wire 18 is also connected to 20, closing the circuit to *B*-minus through the operating coil of *RR*1 unit switch. The closing of this switch closes a circuit through *R*1, and in like manner all the resistance switches are closed, *R*3 being the final one to operate.

Throwing the master controller to the multiple position

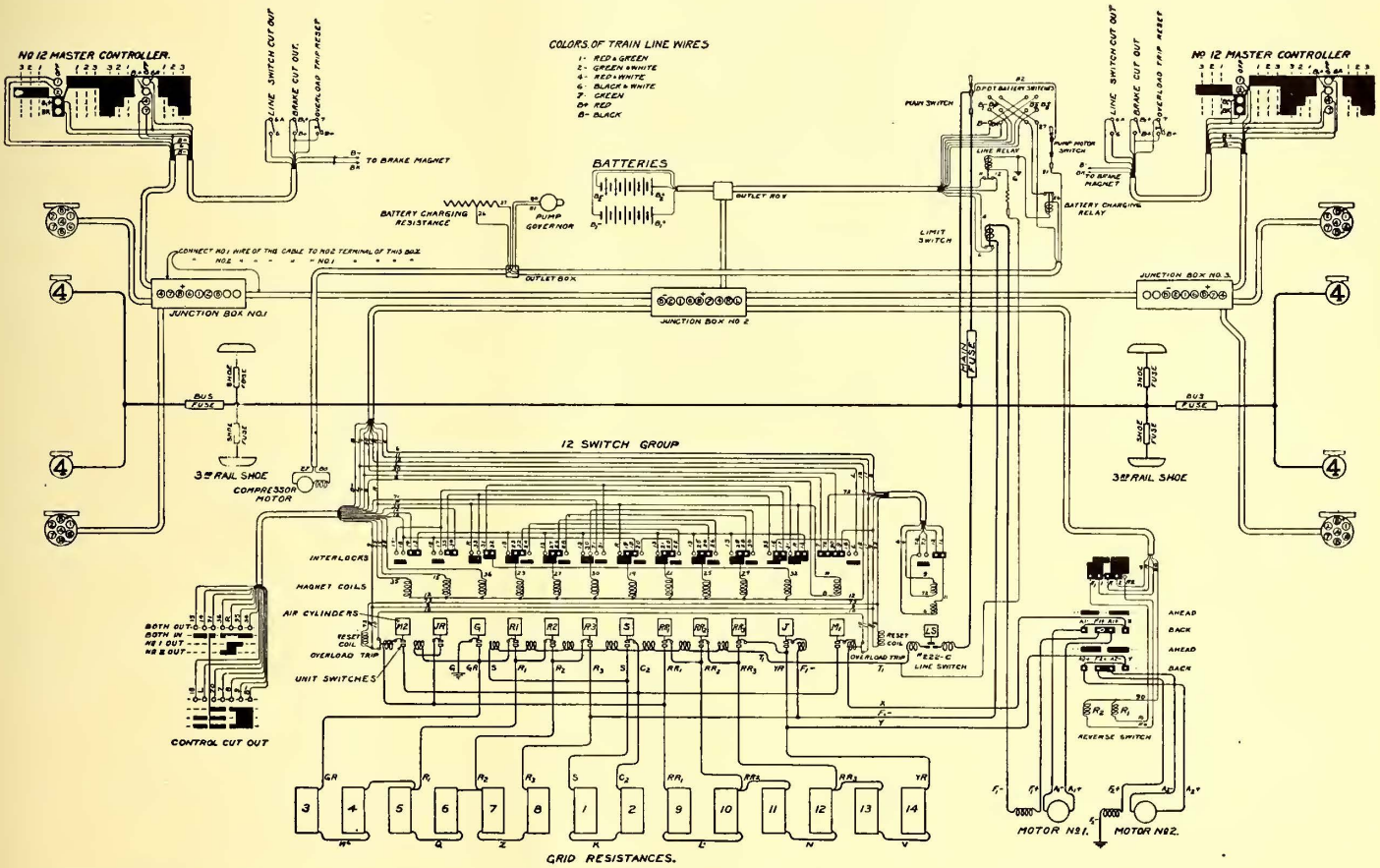


FIG. 19.—WIRING DIAGRAM OF MULTIPLE-UNIT SYSTEM USED ON THE LONG ISLAND RAILROAD

makes the circuit between fingers 72 and 73 of the line switch interlock.

Simultaneously, through finger No. 1 of the master controller the current passes to the reverser and momentarily through one of its coils and to *B*-minus over wires 90 and 9 by way of *M*-1 unit switch interlock and the motor cut-out switch. When the reverser operates, however, the coil is thrown out of the circuit, the current passes from No. 1 wire direct to *R* over the line switch interlock. The path continues to the operating coil of *M*-1 unit switch, closing the switch, and thence to *B*-minus on the motor cut-out switch. A branch from the *R* wire leads over *J* interlock to 13, over *M*2 interlock to 14, by way of the motor cut-out switch to 15, through the operating coil of *JR* switch to 12, thence to 11 by way of the line relay on the switchboard in the cab, and to *B*-minus on the motor cut-out through the circuit-breaker trips.

closes a circuit through finger 7, by way of the motor cut-out switch 71, over *R*3 interlock to 31, over *G* interlock to 32, and thence through *J* operating coil to 12 and to *B*-minus by the path already described. When *J* closes, those switches dependent on current through 17 open as the circuit through this wire is broken at the *J* interlock. Consequently, all the unit switches with the exception of *M*1, *J* and *S* open. The closing of *J*, however, connects wire 33 with *B* plus through 16 and *L*. Current through 33 passes by way of *JR* interlock and wire 34 to the motor cut-out switch. Here it divides to pass through wires 35 and 36 operating *M*2 and *G* unit switches. When *G* closes, the circuit through *J* is broken. The opening of this latter switch restores the former connections through 17 and *R*, and the resistance unit switches are closed in the same order as before. The closing of these switches throws the motors in full multiple.

The current, picking up all of the resistance switches,

passes to L through contacts on the limit switch on the cab switchboard. When an amount of current beyond a predetermined limit passes through No. 1 motor, this contact is broken and the progressive picking up of the switches is stopped until the current through No. 1 motor decreases. Wires R and 13, holding the resistance switches after they are once up, however, are not affected by the operation of the limit switch, and consequently the switches already closed retain their position.

When the line switch is closed, the return circuit from all of the switch magnets with the exception of $M1$ switch passes through the line relay on the cab switchboard. The pick-up coil closing the circuit across the line relay is connected in series with resistance tubes which may be observed near the bottom of the switchboard across the 600-volt circuit, the tap for the magnet being taken off on the car side of the line switch. Should the current be cut off the line for any reason, the plunger of the line relay magnet drops, the battery circuit is opened through wire 12, and all the unit switches with the exception of $M1$ open. They cannot again be closed while the line switch is in until the line current is resumed. This arrangement prevents the motors being held across the line and subjecting them to damage that would result with a sudden resumption of the line current after the car has lost its speed.

When the line switch is open, however, an interlock on this bridges across the line relay, permitting the controller to be operated with the line current off. This allows the motors to be used as emergency brakes irrespective of the condition of the line current.

The magnets operating the circuit-breaker trips located on the ends of the switch group are in series with No. 1 and No. 2 motors, respectively. They are so placed in order that excessive current through either of the motors will operate them. When either is opened, the return circuit from the line switch, as well as from all those unit switches dependent on wire 12, is broken, and these switches drop.

Before the line switch can be closed again, the master controller must be returned to the coasting position and the circuit-breaker reset switch already mentioned must then be pressed down for an instant. When contact is made across the reset switch, current passes through wire 7 to the motor cut-out, continuing through 70 to 72 on the $M1$ interlock and thence through one of the coils of the line switch to B-minus on wire 9. When the line switch closes, contact is made across an interlock and part of the current is shunted around the line switch coil by wire 73 through the two circuit-breaker reset coils in multiple, closing whichever circuit-breaker trip has previously opened.

Wire 7 is also used when the master controller is thrown to the multiple position. Only one of the two diverging paths of 7 from the motor cut-out, over wires 70 and 71 respectively, can be used at one time, the path through the line switch being continuous only when $M1$ switch is open, and the other only when $R3$ is closed, and this latter switch cannot be closed when $M1$ is open.

Only wires of the battery circuit reach the motor cut-out switch. The operation of this switch simply breaks the connections to those unit switches not required to be closed for the operation of one or the other motor. When the switch is thrown to cut out No. 1 motor, the return to B-minus of wire 8 is broken and $M1$ unit switch is prevented from closing. At the same time wire R is connected to wire 35, leading to $M2$ magnet, closing this unit switch on the second notch of the master controller. Connections through wires 15, 36 and 71 are also broken, preventing switches JR, G and J closing. With the master controller in full multiple, then, all the switches are closed with the exception of $M1$, JR, G and J.

Throwing the cut-out switch from the "No. 1 out" to the "No. 2 out" position connects the return wire 8 from the $M1$ interlock to B-minus, wire 35 to $M2$ magnet is disconnected, and 36 operating G is given connection to the magnet operating this switch. With the master controller in the full multiple position, the connections are then such that all the switches with the exception of J, JR and $M2$ are closed.

LIGHTING

The lighting of the car is divided into five independent circuits, for interior illumination, besides a separate circuit at each end controlling the vestibule dome lights and the signal markers. The incandescent headlight is in series with a resistance and independent of all other circuits. Fig. 21 shows clearly the arrangement of the lamp circuits. The headlight is controlled by a separate switch, but the marker and dome lights are so controlled that when the latter are turned out on either end of the car the former are turned on. This is for the accommodation of the motorman, whose vestibule at night must be dark, except for the gage lamp, while the headlight and markers are to be lit only at his end of the car.

The interior of each car is lighted by twenty-six 16-cp in-

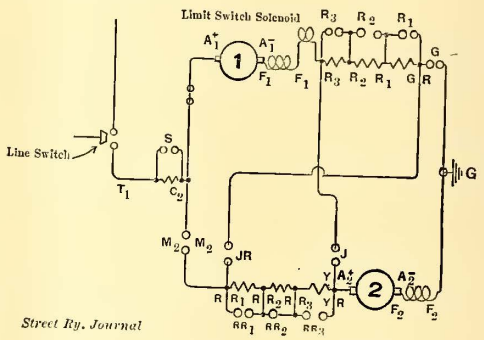


FIG. 20.—MOTOR-CAR CONTROL CIRCUITS

candescent lamps. Two 16-cp lamps are placed in each vestibule in such a manner as to effectively light the platform and the steps. One 16-cp lamp is located in each marker, and a 50-cp lamp is placed in the headlights which are permanently fixed on the vestibule roof between the markers. Snap switches are placed within easy reach of the motorman for the control of the headlight, the markers and the platform lights. All other lights and heater switches and fuses are located on the switchboard.

HEATERS

The cars are heated throughout with electric heaters of the panel type, each having a ventilated sheet-iron back and being placed under the seats. There are twenty-four heaters in the body of the car, and at each end there is one of a special type in the motorman's cab. The heaters inside of the body of the car are proportioned so that each can radiate the heat generated by 600 watts without sufficient rise of temperature to endanger passengers' clothing. The variation in the amount of heat is accomplished by having two sets of heater coils one of twice the capacity of the other. Either or both sets may be cut in by switches, thus providing three degrees of heat, the distribution being uniform in all parts of the car on any step.

The heaters in the steel motor cars were supplied by the Consolidated Car Heating Company, and are of their usual style. Those in the wooden trailer cars were manufactured by the Gold Car Heating & Lighting Company, and are of the truss plank type of construction. The internal arrange-

ment of the Gold heater is of their usual construction, consisting of a special resistance wire wound as a helix and supported on a crimped and enameled steel rod. There are two elements, as in the case of the motor car heaters.

The heating switches are mounted at the top of the switchboard panel at the end of the car.

WIRING

All wires and cables, for whatever purpose, are run in iron conduits. The sizes of wire used in the car wiring were No. 12 and No. 14 for the auxiliary control, and No. 0, No. 00, 144,000 cm and 250,000 cm for the main motor-control circuit. These various sizes of conductor are all made up in standard cable. The stranding and insulation of the various sizes are in accordance with the following table:

B. & S. Gage.	No. of Wires.	Thickness of Rubber Wall.
14	7	4/64 inches.
12	7	4/64 "
0	19	6/64 "
00	37	6/64 "
144,000 circ. mils	450	6/64 "
250,000 circ. mils	61	6/64 "

The insulation of the 12 and 14 wires was laid over a single loose wrapping of fine cotton, and on the larger sizes was laid over one layer of thin paper tape, spirally wound, then the required thickness of rubber, outside of this one layer of saturated cotton tape, wound spirally, and finally two layers of cotton braid made flame-proof. The double cotton braiding on the No. 12 and 14 wires was weatherproof. The rubber insulation was specified to contain not less than 30 per cent of fine Para rubber.

The rubber insulation was tested to show an insulation resistance of not less than 500 megohms per mile after forty-eight hours immersed in water at 70 degs. F. The wires also withstood a puncture test of 3000 volts alternating current at 25 cycles per second on the 4-64-in. rubber wall, and 5000 volts at 25 cycles per second on the 6-64-in. rubber wall.

The No. 12 and 14 wire was used for the auxiliary control. The No. 00 wire was used for the main connections between the line switch, reverser and group switches, and between the third-rail shoes and the bus line. The 144,000-cm cable was used for connection between car body and trailer truck, and for truck and contact shoe connection, and the 250,000-circ. mil cables were used for the bus line. The leads to motors and third-rail shoes from the car body were covered with a coil of spring brass wire for armor, and carefully cleated to the motors and truck bolster to avoid chafing and to reduce their motion to a minimum.

In the vestibule at the motor end of the car is mounted the switchboard (Fig. 22), to which frequent reference has been made. A compartment is provided in the end bulkhead with a metal door lined with asbestos material, which, when

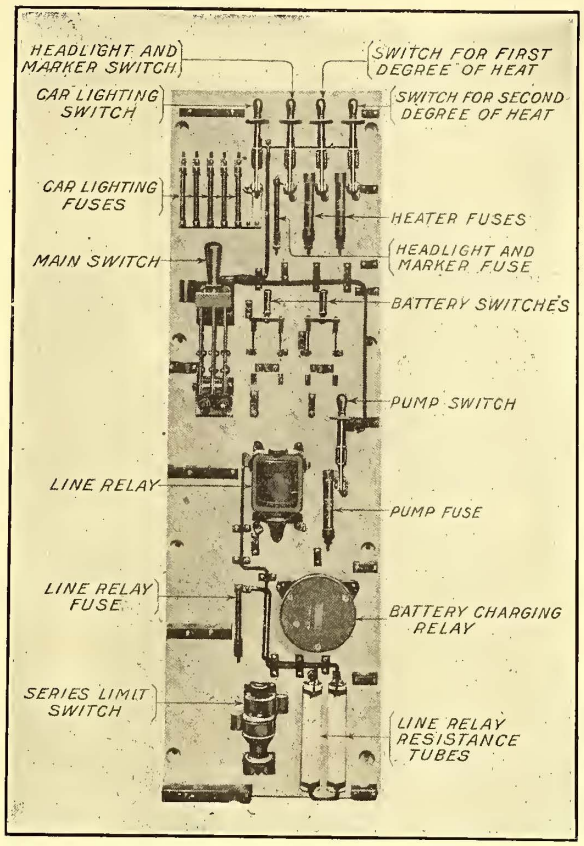


FIG. 22.—SWITCHBOARD ON MOTOR CAR

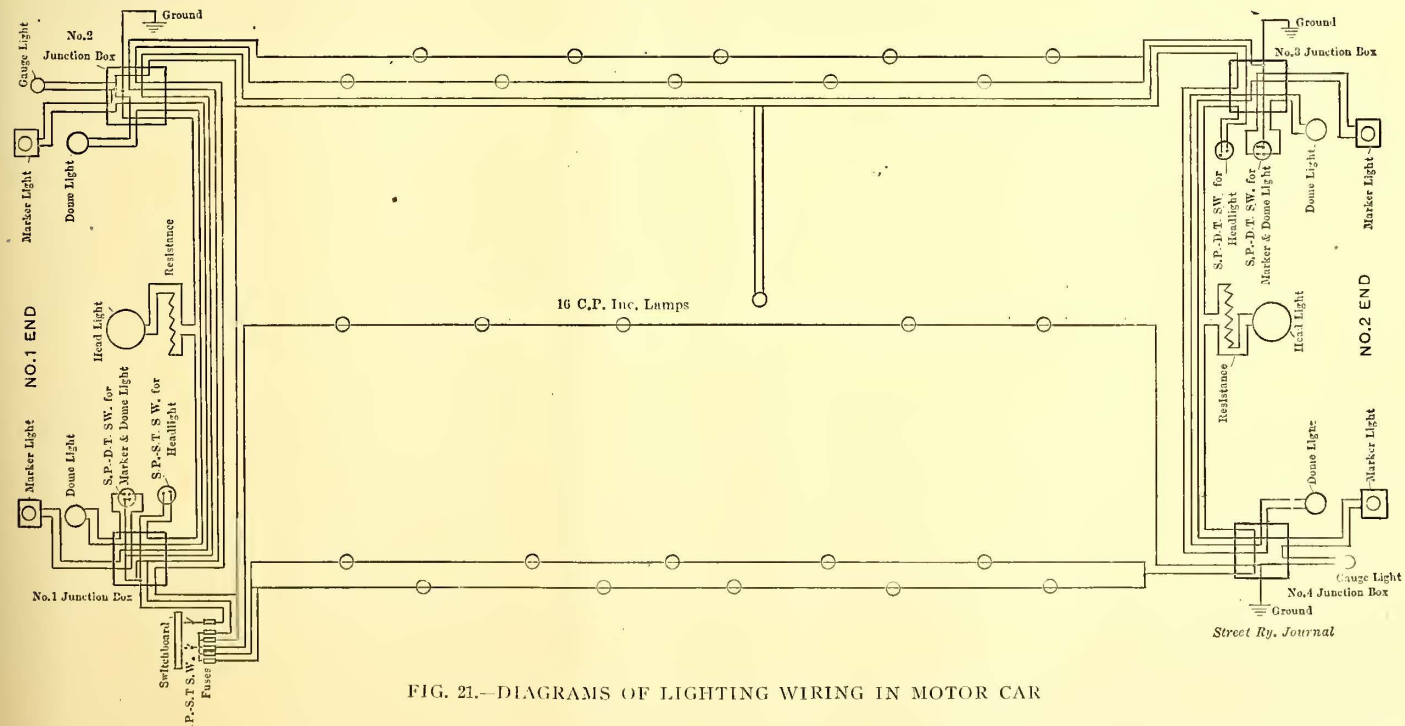


FIG. 21.—DIAGRAMS OF LIGHTING WIRING IN MOTOR CAR

opened, exposes the entire front of the switchboard panel. The panel is supported by a steel frame, being held in it against a rubber cushion, and arc shields of asbestos are provided at all points where arcing from the switches is liable to reach the framework of the car. Additional insulation is provided in the form of electrobestos at the sides and top of the switchboard compartment. The power cables are brought into the bottom of the switchboard through loricated conduit, the ends of which are capped with special bell-mouthed castings fitted with rubber rings to prevent damaging the insulation on the cables.

The conduits are of the "loricated" type, and are run through the framing of the car according to a well-worked-out plan which is uniform for all cars, the framing being drilled at the proper points before the cars left the builder's shops. To aid in this work, a steel subway car was temporarily secured through the courtesy of the Interborough Rapid Transit Company, and upon it the various details of assembling the electro-pneumatic control and the air-brake equipment were so perfected that a standard system of parts, attachments and drillings was determined upon which simplified and hastened the work of installing the equipments upon all cars. A temporary plant was placed in operation at the Locust Avenue shops of the Long Island Railroad, fitted with all the necessary tools for manipaulting the iron conduit, and the work after being started at this shop proceeded with great rapidity until the entire number of 130 steel cars was completely equipped. The motors and all the equipment pertaining to the cars, except the air brakes, were mounted upon them at these shops.

All the switches except the headlight, marker and platform light switches, which are installed in the platform hoods, are mounted upon this switchboard, as well as certain other parts of the auxiliary control system which have been mentioned in various parts of the preceding description.

TABLE OF WEIGHTS

In the following table are given the weights of the principal elements of a steel motor car and its equipment:

Body	31,377
Draw-bars	988
Foundation air brakes	1,165.5
Brake, pipes and fittings	520
Brake schedule parts (including compressor)	2,383.5
Door operating device	340
Supports for electrical apparatus	438
Curtains	99
Seats	844
Motor truck, with gears and third-rail shoes	14,129
Two Westinghouse No. 113 motors	14,430
Trailer truck with third-rail shoes	9,719
Electrical apparatus and conduit	4,857
Lights, heaters, flexible conduit and wire mouldings	848
	82,138
Maximum passenger load, estimated	16,000
Total	98,138

AUXILIARY EQUIPMENT

The steel cars as thus constructed and equipped have now been in successful operation for over a year.

Besides the steel cars above described, fifty-five wooden trailer cars, which had been built six or seven years previously with a view of using them in electrical trains, were equipped to run in trains with the motor cars; provisions had been made in designing these car bodies for conveniently disposing the electric lighting circuits, but the class of work then in use was not considered safe now. These trailers are 46 ft. long and 8½ ft. wide, over all. A view of one of these trailers is given in Fig. 23.

These wooden trailers had formerly been used in certain Long Island Railroad trains that had been run on the Brooklyn Elevated Lines between Flatbush Avenue Station and the Brooklyn Bridge. They have open platforms, side doors and cross seats, and seat fifty-six people. They were wired for electric lighting and heater circuits, and fitted with bus line and train line connections. The lighting and heater circuits

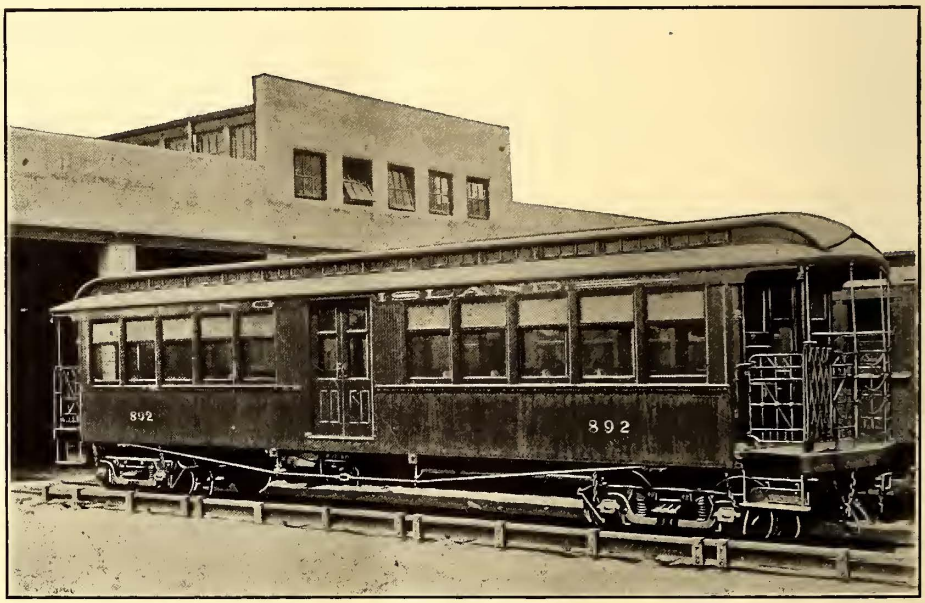


FIG. 23.—VIEW OF WOODEN TRAILER CAR

are supplied by a connection tapped from the bus line through a fuse, and leading to a small switchboard panel from which the distribution is made. There are thirty 16-cp lamps in each trailer.

Five electric express cars were provided, equipped with the standard type of motor and trailer trucks, two 200-hp standard motors, and with the standard multiple-unit control apparatus. These cars are built of wood, 52 ft. 5 ins. over all in length, 9 ft. 9½ ins. in width, and with roof 12 ft. 6¾ ins. above the top of the rails. They are equipped with standard M. C. B. couplers, and haul the old standard steam baggage and express cars as trailers. The weight of these baggage cars is about 76,500 lbs. without load. A view of the completed car is given in Fig. 24.

A rotary snow plow has also been provided, built by the Peckham Manufacturing Company, and equipped with one motor and one trailer truck of standard type, and all of the standard motor car electrical equipment. A set of revolving blades with fan and housings is mounted at each end of the car, operated by one line shaft running through the car and fitted with two friction clutches, one for each end section, the center section carrying two 50-hp railway type motors, run by a series parallel controller of the standard platform type. A view of the plow is given in Fig. 25.

In order that all the electric car equipment might be given a thorough service test, and the apparatus properly adjusted before going into the regular passenger service, the section of the line known as the Old South Road, between Jamaica

and Springfield Junction, was equipped with third rail and all the car electrical equipments were subjected to service running tests in trains of various lengths, and given a continual inspection to insure that all apparatus was in proper order.

These tests also served the purpose of instructing the motormen and familiarizing them with the care and operation of the car equipments and brakes.

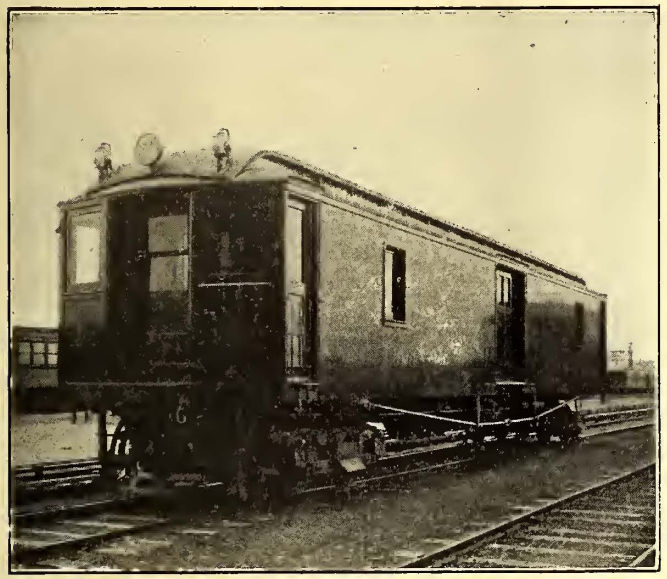
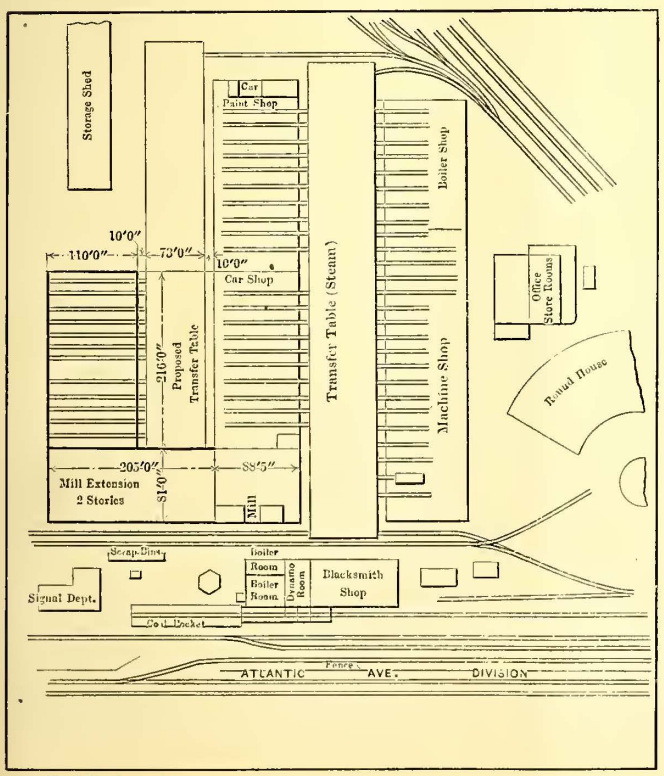


FIG. 24.—VIEW OF ELECTRIC EXPRESS CAR

CAR SHOPS

The facilities for inspection and repair of electric cars of the Long Island Railroad system consist partly of a section of the original car shop at Morris Park, near Jamaica, which has been to a certain extent remodeled to better accommodate the new motive power, and two inspection sheds, one located at Rockaway Park, at the extremity of the Rockaway Beach Division, the other being at Dunton, which is between Morris Park and Jamaica, on the Atlantic Division. The two latter structures are entirely new and are fitted only for the inspection of trains, while the car shops at Morris Park are fitted with the necessary machine tools for executing repair work.



Street Ry. Journal

FIG. 26.—LAYOUT OF ELECTRIC CAR REPAIR SHOP AT MORRIS PARK

At Morris Park a new shop was built paralleling the old car shop, and with a transfer table situated between them.

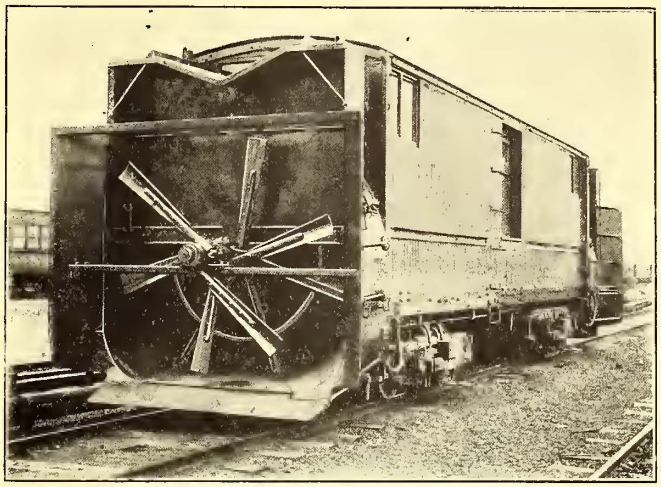


FIG. 25.—ELECTRIC SNOW-PLOW

It is 216 ft. long by 110 ft. wide, and is connected with the mill that runs across the end of the old shop by a two-story structure containing space for pattern, upholstery and brass finishing shops. The walls of the shop are built of brick, and the roof is made in the saw-tooth form commonly used for this purpose. There are thirteen pit tracks, 16 ft. apart between centers. The shop is wide enough to accommodate two 51-foot cars, with a space between the ends of the cars, and 3 ft. between the ends of the cars and walls. The pits are about 26 ins. deep below the top of the rail. A transfer table is 75 ft. wide, and long enough to accommodate the largest type of Pullman coach. The transfer table is operated electrically, and is provided with an electric capstan to assist in moving cars and trucks out of the shops.

Over the two tracks at the south end of the new shop there are light traveling cranes for handling the motors and axles and facilitating general track repairs. These cranes are of about five tons capacity and are hand operated. Hydraulic jacks are used for hoisting the cars.

The original machine shop is already equipped with tools for turning wheels and axles and for pressing wheels and gears upon the axles. The machinery used in the machine shop has since the beginning of electrical operation been operated by three-phase motors receiving current from the Woodhaven Junction sub-station, which is something less than a mile distant. A general plan of the new repair shop, showing its relation with the original plant as maintained for repairing steam equipment, is shown in Fig. 26.

INSPECTION SHEDS

Besides the repair shop facilities at Morris Park, two inspection sheds have also been provided for effecting the periodical inspection and light repairs that are required to keep the cars in fit operative condition. The smaller of the inspection sheds is adjacent to the Rockaway Park Terminal. The walls of this building are of brick, resting on concrete foundations which are carried about 4½ feet above grade, or to the level of the window sills. The roof is 4½-in. concrete slab supported on steel trusses spaced 10 ft. apart. The length of

the building is 242 ft. The extreme width is 49 ft. over the main portion. There is an addition which includes a machine shop, storehouse and office, which is 61 ft. 4 ins. x 20 ft., situated at the northwest corner of the building. The side walls

FIG. 27.—EXTERIOR OF ROCKAWAY PARK INSPECTION SHED

are carried up into a parapet above the roof level, the roof pitching uniformly toward one side of the building for the entire length, the gutters being on the inside of the parapet. The building accommodates three tracks which run completely through it with doors at each end. The doorways have a span of 12 ft. in the clear, and a height of 15 ft. 7 ins. above the rail. The doorways at each end are closed by rolling steel doors. The parapet of the building is protected with a glazed tile coping. Ample light is furnished to the interior by a double row of windows along each side, but skylights are omitted. An exterior view of the sheds as viewed from the east end is shown in Fig. 27. The three tracks are provided with concrete-lined pits throughout their entire length. The rails rest upon 12-in. x 12-in. stringers, the base of the rail being about 4½ ins. above the floor. The floor is of concrete, 7½ ins. thick over the entire interior.

The larger inspection shed is located at Dunton on the Jamaica Division, directly west of Jamaica. This building is about double the size of the former, being designed to afford inspection facilities for all the cars on the Atlantic Division, which is a busy line all the year around. The building is constructed entirely of reinforced concrete, with roof trusses of steel plate girders supported in the center of the building on lattice columns. The building consists of one central and two side sections, the central section extending above these, forming a broad clere story with wide windows. The building is 242 ft. 8 ins. in length over all, and 94 ft. wide in extreme width. The steel girders and columns are placed in extreme width. The steel girders and columns are placed in bents 12 ft. apart; the roof of the side section of the building slopes toward the center, while the roof over the central portion is pitched slightly toward either side. The roofing over the whole building is composed of 5¼-in. reinforced concrete slab, covered with five-ply pitch felt and gravel roofing. The gutters along the eaves of the clere story are of 16-ounce copper, while the counter-flashing between the roof and the side sections of the parapet, which runs completely around the building, is of 14-ounce copper, tacked to a 2-in. x 4-in. wooden strip. The plate girders of the side section are 3 ft. 8 in. in depth at their outer ends, and about 2 ft. 4 in. in depth where they rest upon the columns for supporting the clere story. The six tracks run completely through the building, the doorways being fitted with rolling steel doors. The door lintels are each of two 10-in. I-beams.

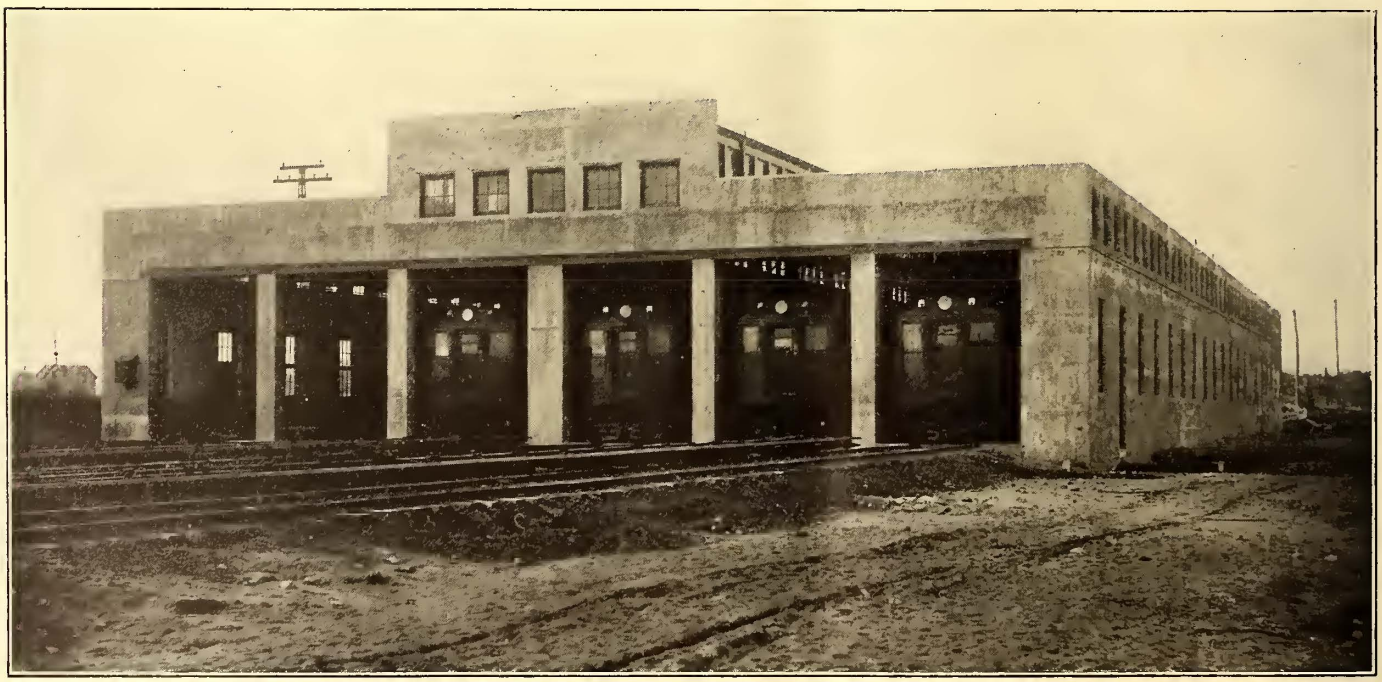


FIG. 28.—EXTERIOR OF DUNTON INSPECTION SHED

The tracks are all provided with pits 3 ft. in depth below the base of the rails, which set about 4½ ins. above the floor

level upon 12-in. x 12-in. wooden stringers. A view of the exterior is shown in Fig. 28, and one of the interior is given in Fig. 29.

The Rockaway Park inspection shed will accommodate twelve cars, and that at Dunton twenty-four. The latter station is provided with room for an office upon a gallery running across one end of the building, reached by an iron staircase coming up between the tracks.

The Dunton inspection shed was built on rather uneven ground, and at one end of it is provided a heating plant, set in a basement which is finished off under one corner of the structure, covering an area of about 34 ft. x 37 ft. x 35 ft. The nature of the ground enabled the construction of this basement without the necessity of excavating, and provided a very convenient location for the heating plant and fuel. Coal can be dumped into this basement through suitable openings placed between the tracks directly over it. Construction details are shown in Fig. 30.

The Dunton inspection shed is equipped with lavatory conveniences. At Rockaway Park the lavatory is situated in the terminal station adjacent.

Both sheds are fitted with electric lighting, the wires being run in iron conduit and receiving current from the third rail. There are 330 lamps in the Dunton shed and 220 at Rockaway Park. Sockets are also provided for enabling temporary connections to be made to the third-rail shoes, so that cars can be moved up and down the tracks, there being no third rail inside the building. A 4-in. fire line with hydrants is also provided at each of the inspection sheds.

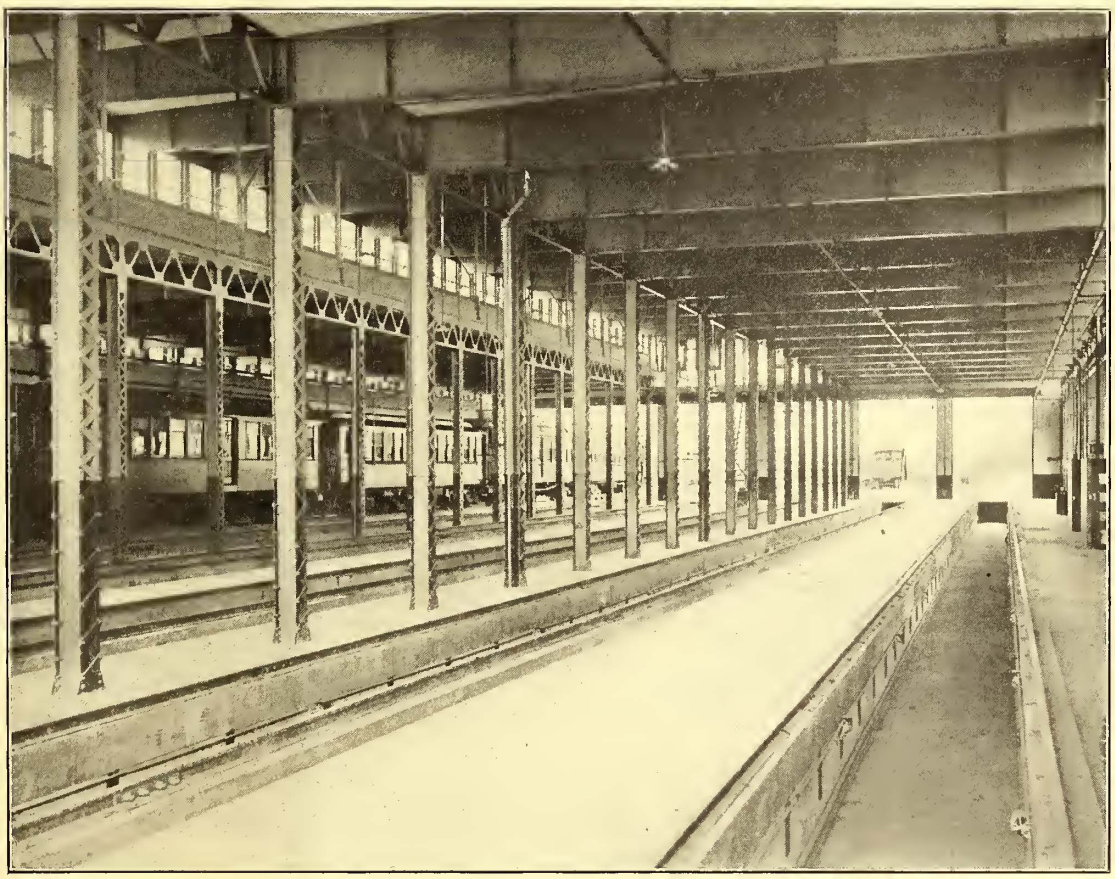


FIG. 29.—INTERIOR OF DUNTON INSPECTION SHED

ORGANIZATION

The equipment of the steel passenger cars, the auxiliary rolling stock, and the building of inspection sheds were carried out by Westinghouse, Church, Kerr & Co., who, as in the other portions of the complete equipment, acted as constructing engineers.

The entire work of design and construction was in charge of George Gibbs, chief engineer of electric traction of the Long Island Railroad.

CONCLUSION

With the preceding account of the electric car equipment, the description of the newly installed system for operating the Long Island Railroad trains with electric power is brought to a close. The car equipment has proved itself in every way equal to the demands made upon it both for regular and emergency conditions of travel. The electro-pneumatic multiple-unit control system has worked perfectly from the start, and throughout the entire installation, including the power station, transmission system, sub-stations and cars, the endeavor was made not only to take advantage of the most recent progress, but, as opportunity offered, to establish new precedents in the art. In achieving the distinction of being the first one of the main steam railroad lines to initiate and make effective the change of motive power for its suburban service to meet the needs of its territory, the Long Island Railroad Company has set an example of foresight, thoroughness and sufficiency in the execution of the undertaking.

The contract with the American Car & Foundry Company for the steel car bodies was let on Jan. 20, 1905. The first car body was received at the Locust Avenue shops for equipment early in April, 1905, and another one was exhibited at the International Railway Congress in Washington early in May. By Aug. 16 the entire number of steel cars had been delivered at the shops, where they were mounted upon trucks and all parts of the electrical equipment assembled. During the summer the cars were equipped at the rate of ten per week. The first test of a completely equipped car was made on May 13, 1905. A month later, fully equipped trains were running on the branch between Jamaica and Springfield for testing the equipment and for the instruction of the motormen. Regular electrical operation was first inaugurated between Flatbush Avenue and Rockaway Park on July 26, 1905. Service between Flatbush Avenue and Rockaway Junction was inaugurated on Aug. 30. In October, the heavy excursion traffic to and from the Belmont Park Race Track was successfully handled. On Dec. 11 the electric service was extended to Far Rockaway and Valley Stream, and the use of steam locomotives for hauling passenger trains to and from the Brooklyn terminal of the Long Island Railroad was discontinued.

On April 27, 1896, the act creating the Atlantic Avenue

Commission passed the New York State Legislature, this being the formal beginning of the working out of a transportation problem that was of immediate and far-reaching importance to the citizens of Brooklyn and the Long Island Railroad. Several years elapsed before the results of the work, first of the Commission and then of the Board of the Atlantic Avenue Improvement, began to be noticeable, but it progressed year by year until finally consummated on the above date, a little less than ten years from its inception.

The respective parts taken, first, by the Atlantic Avenue Commission in formulating a concrete plan of improvement of such far-reaching importance; and later by the Board of the Atlantic Avenue Improvement in planning and executing the work; and by the Long Island Railroad in co-operating with all the duly constituted authorities for the advancement of a plan so conducive to the welfare of the community served by it, have not been enlarged upon in the foregoing technical description of the work, but they are now matters of history,

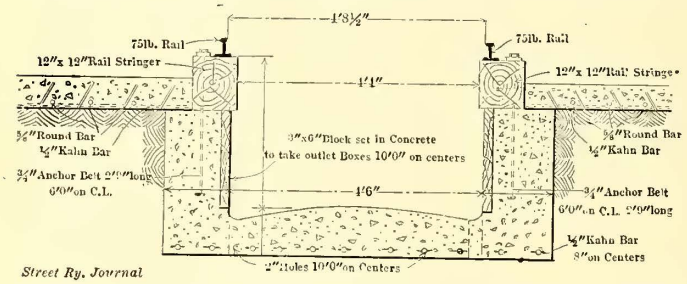


FIG. 30.—DETAILS OF PIT IN SIX-TRACK INSPECTION SHED AT DUNTON

a full knowledge of which is available for other municipalities and corporations which may be confronted by similar problems.

But the record will be incomplete without an acknowledgment of the credit due to the late William H. Baldwin, Jr., president of the Long Island Railroad from 1896 to 1905, whose foresight, public spirit and initiative played such a leading part in the solution of a difficult rapid-transit problem. Could he have lived but one year longer, he would have witnessed the consummation of his labors, which have conferred a lasting benefit on the community.

DATA REQUESTED BY THE AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION'S COMMITTEE ON A STANDARD CODE OF RULES

The American Street & Interurban Railway Association's committee on a standard code of rules is sending out a circular letter to the general managers of the street and interurban electric railway properties of America, referring to the fact that the committee on standard rules submitted a report to the association at the St. Louis convenion in 1904, in which report was embraced a code of general rules for the government of trainmen of electric roads and also some additional rules, applicable to interurban roads, to be used in connection with those contained in the standard code of rules. The complete report of the committee is contained in the twenty-third (1904-1905) annual report of the association. These rules have also been issued in pamphlet form and sent to the various street railway companies of the country. The committee states that those who have no copy of the rules can secure the same by application to the secretary of the association.

In this letter it is stated that before proceeding further, the committee desires to know if the rules contained in the report which was submitted at St. Louis have been universally adopted, and if not, to ascertain the reasons for their non-use.

Replies to this query should be sent to B. V. Swenson, secretary of the American Street & Interurban Railway Association, 60 Wall Street, New York City. If the rules have not been adopted, the respondents are requested to give the reasons why, and also any other suggestions that will assist the committee in further considering the revision of the report of 1904.

The following is a copy of the data sheet to be used in replying to this inquiry. The results of this investigation will form part of the committee's report to be presented at the Columbus convention in October. As the time is becoming very limited, prompt replies are desired.

American Street & Interurban Railway Association
60 Wall Street, New York
Office of the Secretary
Committee on Standard Rules

Data Sheet No. 11. August, 1906.

(1) Company .....
(2) City.....(3) State .....
(4) Urban or interurban system.....
(5) Have you adopted the Standard Code of Rules as submitted by the committee at the annual meeting of the association at St. Louis in 1904? .....
(6) If not, please state your reasons for not adopting these rules.....
.....
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.....
(7) Please offer suggestions applicable to the rules (seriatim).....
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.....
(8) High-speed interurban service. (a) Do you consider it desirable that the committee formulate a special code of rules for high-speed interurban service? .....
(b) If so, kindly offer suggestions on a separate sheet.
Rule Book. If you are using a Rule Book other than that of the association, will you kindly send us a copy?
Remarks. Kindly put additional data and suggestions on a separate sheet and attach it to the data sheet.

Signed .....
Title .....

Notice.—This information blank is sent you in duplicate form. Please fill in the information asked for at your earliest convenience and return one copy to Bernard V. Swenson, secretary American Street & Interurban Railway Association, 60 Wall Street, New York City. The results of this investigation will form a part of the convention report of the committee on standard rules.

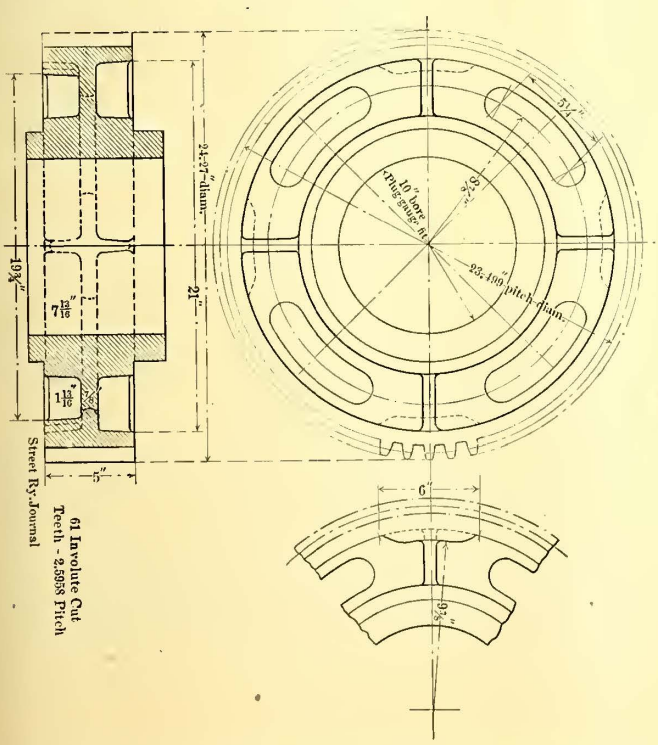
The above-mentioned letter is signed by the following members of the committee on standard code of rules: E. G. Connette, chairman; E. C. Faber and E. J. Ryon.

The seven interurban roads radiating from Toledo have arranged for a joint baggage room, located in a building directly opposite the present Union passenger station on Superior Street. All baggage intended to be transferred or for local delivery will be handled from this station. Baggage will be checked to all points to which interline tickets are sold, including Indianapolis, Ft. Wayne, Dayton, Mt. Clemens and Port Huron. Heretofore, baggage has gone to the interurban freight station on Huron Street, which is some distance from the passenger station, and, as there were no arrangements for transferring baggage, passengers lost connections by having to attend to this matter themselves. The joint baggage room is under the supervision of J. S. Young, representing the Maumee Valley Railway & Light Company, which will be responsible for the baggage department and will pro rate the expense among the various lines. The Toledo Transfer Company has opened an office in the same building.

GEAR PRACTICE ON THE INTERBOROUGH SYSTEM

In the direction of perfecting the various details pertaining to car equipment, the Interborough Rapid Transit Company, of New York City, has been giving considerable attention to the subject of gears. The company has been using extensively a solid cast-steel gear, but it is about to experiment with gears made of other metals. It is the intention to equip several hundred cars with gears of various types, namely, solid manganese steel gears having ground teeth, furnished by Benjamin Atha, of Newark, N. J.; Krupp steel gears with case-hardened rims imported from Germany; gears having cast-steel centers, with wrought-steel rims shrunk on to the centers, and high-grade cast-steel gears. These equipments will be operated under exactly similar conditions for a long enough period to determine the relative life of the different metals.

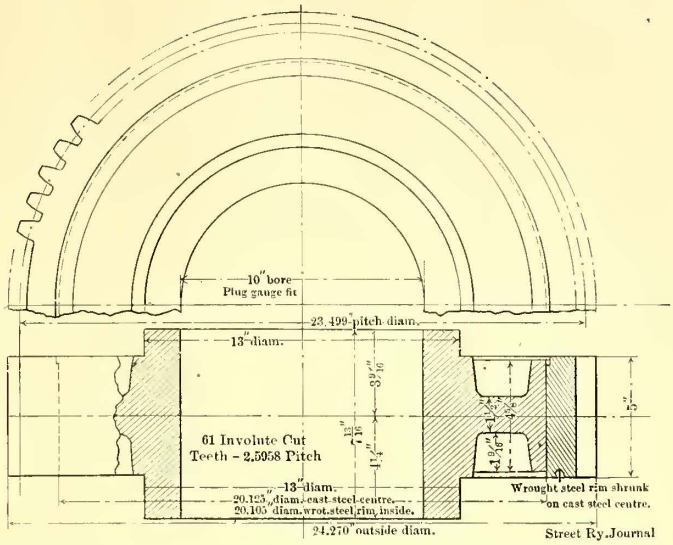
It is interesting to note that, for the purpose of making these and other comparisons, the Interborough is arranging a system with thousand ton-miles as the basis of reference. The present method is to use the straight-mile basis for determining the life of parts, but it is believed the ton-mile basis offers many attractive possibilities in the direction of arriving at conclusions that will be more nearly correct theoretically. The point is made that the ton-mile will provide for the important factor of weight of car and that this method will, therefore, give a much fairer basis of comparison between roads having extremely heavy service, similar to the New York elevated and subway lines. It is also believed this same system of comparison can be applied to lighter conditions, such as are found on the average interurban road, and will give means whereby the results on roads of this class can be studied and compared with far greater satisfaction than with the straight-mileage basis. It will also give a better basis



CAST-STEEL GEAR FOR GE 66 MOTOR, INTERBOROUGH RAPID TRANSIT COMPANY

upon which to compare results with various classes of equipment on the same road. In arriving at the ton-mile unit, it will, of course, be necessary to take the weight of the equipment without passenger load, and while this will not include the passenger-load factor, it will give a better basis for comparison than the car-mile alone.

The accompanying drawings show the solid cast-steel gear now in use and also the proposed cast-steel center gear with



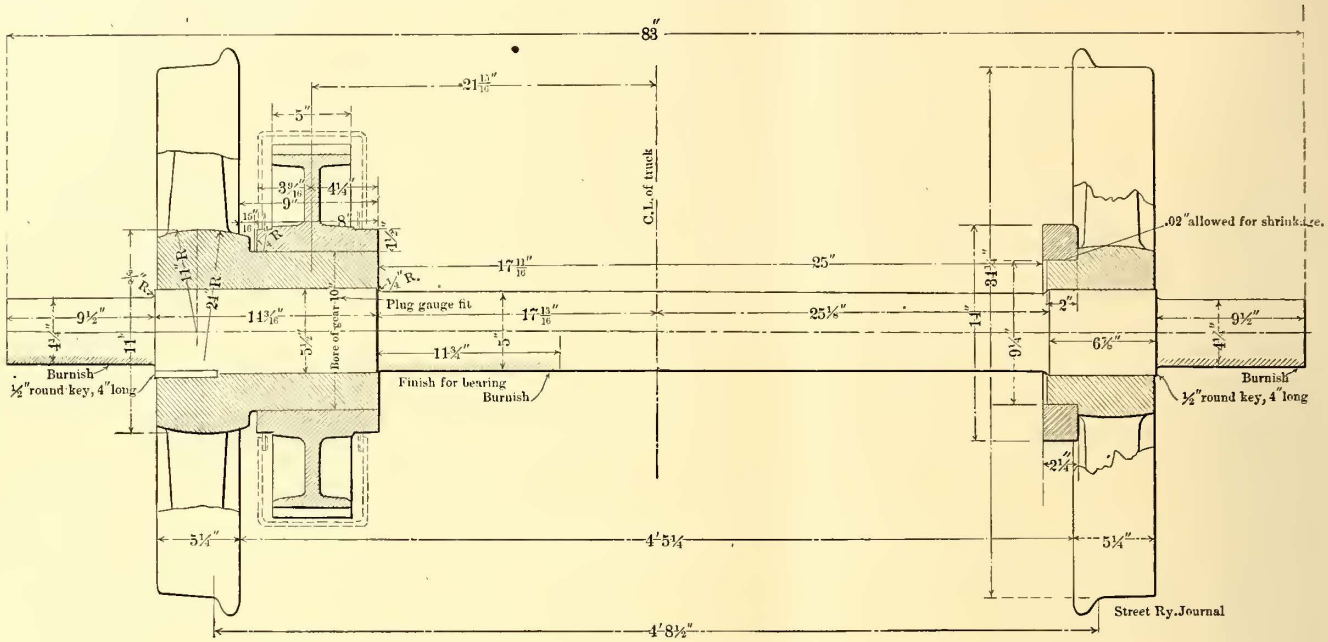
GEAR WITH WROUGHT-STEEL RIM SHRUNK ON CAST-STEEL CENTER FOR GE 66 MOTOR, INTERBOROUGH RAPID TRANSIT COMPANY

wrought-steel rim. The latter form will, of course, be more expensive in first cost, but it is believed that many of the same arguments can be urged in favor of a gear with a shrunk rim that have been advanced in favor of the steel-tired wheel. For instance, the steel center of a gear of this type can, with entire justification, be considered as a permanent part of the truck investment, and the cost of maintaining gears will be virtually confined to the cost of renewing the rim. The results that will be secured with the solid manganese and the Krupp case-hardened gear are still problematical, but confidence is expressed that these harder metals will give a good account of themselves in the application to the making of gears for extra heavy service. The company has had in use samples of gears made of solid cast manganese steel, with ground teeth, and these have already run 20,000 miles on the Manhattan Elevated division without showing perceptible signs of wear. It is evident that the justification for the material increase in first investment for gears made of these harder metals must be found in the saving in cost per thousand miles, or per thousand ton-miles, and in the reduced accident hazard, but whether the results will bear out the expectations is a matter that can be demonstrated only by actual trial.

In this connection it is in order to describe the method of applying the gear. The system followed is not new, as it was suggested originally by Messrs. Doyle and Brinkerhoff for use on the Metropolitan West Side Elevated Railway of Chicago as early as 1897, and it was also described in the Street Railway Journal for Dec. 6, 1902. But the results that are being secured with the method on the Manhattan elevated railway are worthy of comment. Briefly described, the idea is to provide the wheel on the gear end of the axle with an elongated hub, for the purpose of furnishing a seat for the gear. The extended hub is an integral part of the wheel, and in the Interborough standard measures 14 3-16 ins., finished, from end to end. The gear is shrunk on to the seat provided by the extended hub, according to the M. C. B. specifications for shrinking operations of this nature. That is, the inside bore of the gear is one one-thousandth of an inch smaller for each inch of diameter than the seat to which it is shrunk. This practice of shrinking the gear into place on the hub of the wheel not only eliminates all bolts

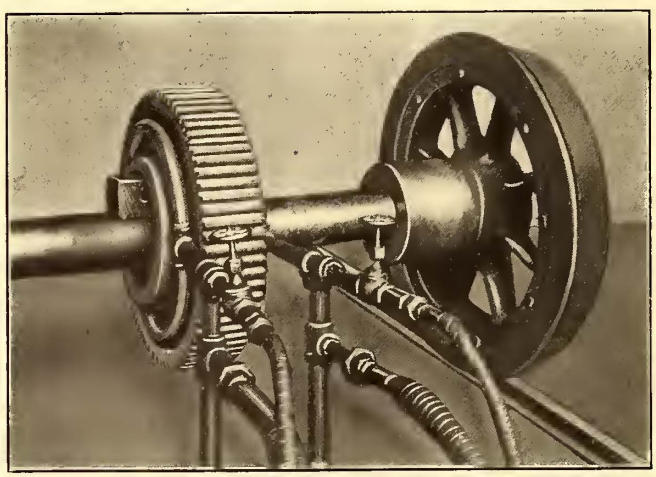
and danger of the gear becoming loose, but also gives the very great advantages of strengthening the axle at the point of greatest strain, and insuring an absolute fit between the wheel and the axle. As a matter of fact, the statement is made that where the practice has been followed on the Interborough equipment there has never been an instance of a wheel becoming loose in service. This statement is all the more forcible when it is considered that the same results are secured with wheels that have been pressed off and on several times. The M. C. B. rules do not permit, under usual conditions, the practice of pressing the wheel back on to the same axle seat more than twice. But by shrinking the gear on to the hub, as outlined, the objections of the M. C. B. authorities are entirely overcome, because it has been found that by shrinking the gear over the hub, a tighter fit is secured between the wheel and the axle than is obtained when a wheel is pressed on in the first instance under the M. C. B. requirements. During a recent test it was demonstrated that a wheel that could be pressed off the axle with 25-tons pressure without the reinforcing gear could not be moved on the axle seat with 85-tons pressure after the gear had been shrunk in place.

As will be noted from the engraving, this practice has eliminated the necessity for cutting a long key-way in the axle, and thus avoids introducing what is commonly a serious weakness in the axle at this point. The method followed on the Interborough, where the extended wheel hub is used with the shrunk gear, is to key the wheel to the axle by means of a single round key, ½ in. in diameter and 4 ins. long. After the wheel is in place on the axle seat, the key hole is drilled from the outside to the proper depth, and the round steel key is then driven to a tight fit.

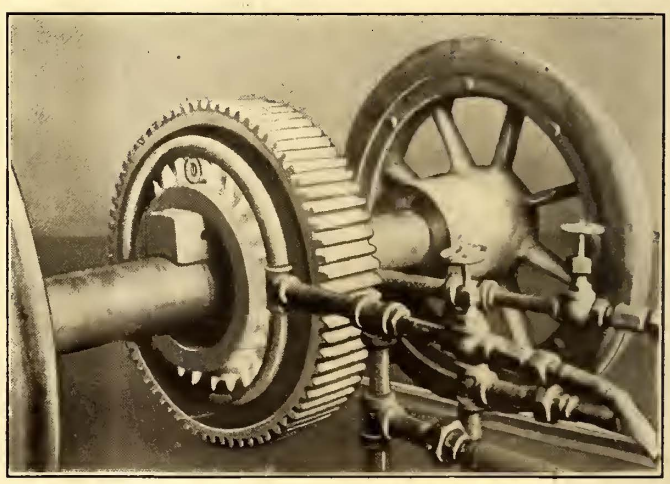


AXLE AND WHEELS ON MOTOR TRUCKS, MANHATTAN DIVISION, INTERBOROUGH RAPID TRANSIT COMPANY, SHOWING METHOD OF SECURING GOOD WHEEL FIT BY SHRINKING GEAR ONTO EXTENDED WHEEL HUB ON ONE WHEEL, AND BY SHRINKING STEEL RING AROUND HUB OF OTHER WHEEL

The operation of heating the gear in order to shrink it on to the hub is as follows: The gear is slipped onto the axle before the wheel is pressed on, and during the heating process is held loosely and clear of the axle by means of a special shaped metal block designed to fit between the inside of the gear hub and the top of the axle. Two rings of 1-in. gas pipe, which are supported on standards from the car-house floor, are then arranged around and a short distance from the gear hub, one on each side of the gear. The rings of gas pipe have a series of perforations around their inner sides, and are connected to both gas and air supply to give a blow pipe effect. The air

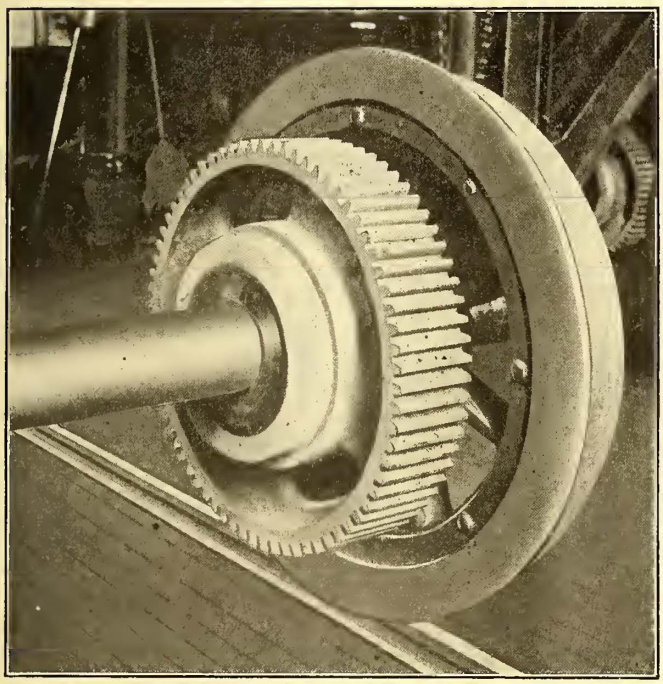


ARRANGEMENT FOR HEATING GEAR PRIOR TO SHRINKING ONTO WHEEL HUB



PROCESS OF HEATING GEAR PRIOR TO SHRINKING ONTO EXTENDED WHEEL HUB

supply pipe to the rings is ¾ in. in diameter, and air is furnished at about 80-lbs. pressure. When all is in readiness, the mixture of gas and air is admitted to the rings in proper proportions to give a clean, intense flame, a torch is applied and the blow flame from the perforations in the rings is directed against all sides of the gear hub. As soon as the hub begins to show a faint sign of color, which it does in from 9 minutes to 10 minutes, the heating rings are removed and the gear is shifted over to its seat on the extended wheel hub. It is allowed to air cool, and in cooling the gear hub contracts to a tight fit upon its seat. The pair of wheels are then ready for service, no machine work or other operation being necessary. In removing the gear the process is similar. A shield is interposed between the gear and the wheel to protect the wheel from the heat, and the flames from gas rings are applied to the hub of the gear, causing the hub to expand, and the gear then can be slipped easily from its seat. The accompanying half-tone engravings illustrate the steps in the process.



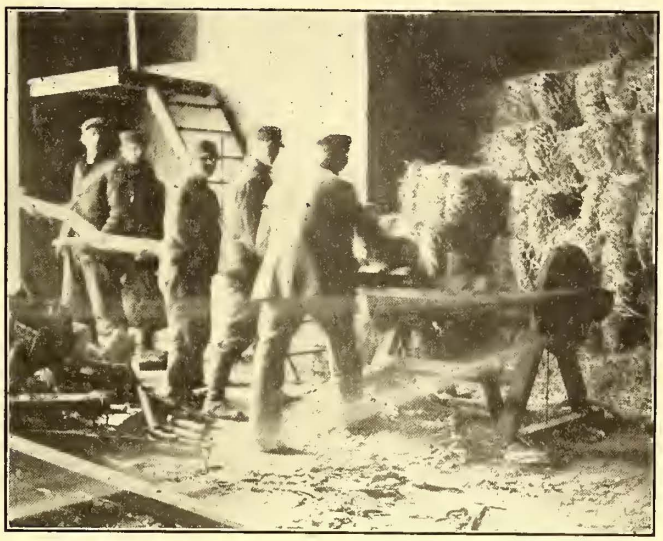
GEAR SHRUNK ONTO SEAT ON EXTENDED WHEEL HUB

Based upon the remarkably satisfactory results secured in binding the wheel to the axle as an incident to shrinking the gear over the wheel hub, the principle is now being applied to the wheel at the opposite end of the axle. As will be noted from the drawing, this is accomplished by finishing off the hub on the inside of the wheel, to give a bearing surface for a cast-steel ring which is shrunk around the hub in about the same manner as the gear is shrunk on to the extended hub on the opposite wheel. The collar is about 2¼ ins. thick and is 9¼ ins. inside diameter, and about two one-hundredths of an inch is allowed for shrinkage between the inside diameter of the ring and the bearing seat on the hub. This ring will perform the service of binding the wheel to the axle and, it is believed, will entirely eliminate the possibility of the wheel working loose.

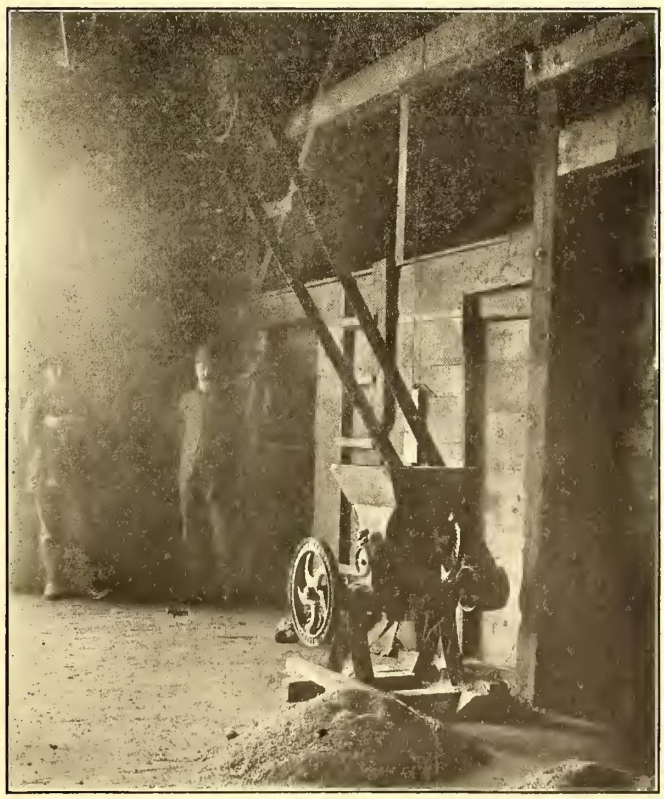
The Strangen-Wick Railway Company, which operates a suburban line near the city of Stockholm, the capital of Sweden, has contracted with the Westinghouse Electric & Manufacturing Company for the electrical equipment of the cars to operate this road with the single-phase system.

MOTORS FOR DRIVING FARM MACHINERY

It frequently happens that the capacity of the generating station of an interurban railroad is large enough to permit of the disposal of a great deal of power if purchasers could be found. Some companies have pushed the sale of power for lighting towns along the right-of-way and for operating motors in these towns, but in a very few instances have attempts been made to supply power to farmers along the line. There is, however, quite a field for the sale of current for this purpose. Windmills are too unreliable for the average farmer and gasoline engines require time in starting them, and considerable care to maintain them. The electric motor is, in fact, the ideal power for the farmer. It is always ready for service, and if not abused or overloaded, there is very little likelihood of it getting out of order. Moreover, the installa-



SAWING WOOD ON A FARM WITH A MOTOR-DRIVEN SAW



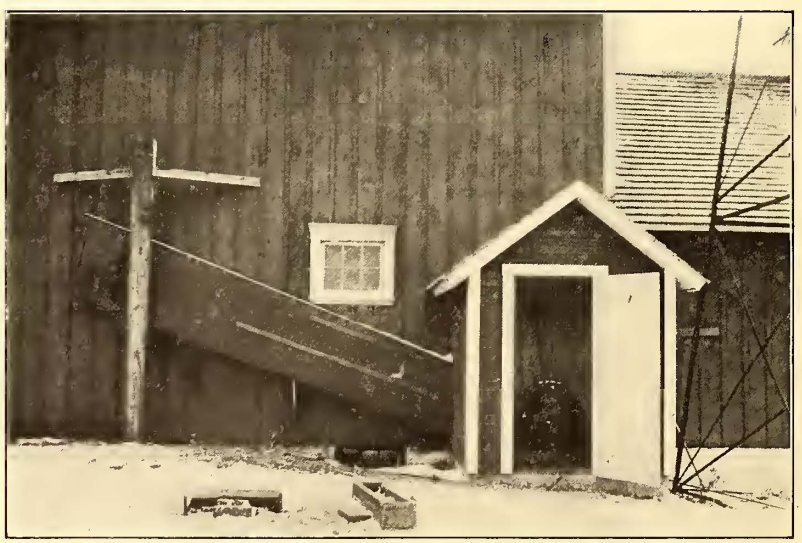
A MOTOR-DRIVEN CORN CRUSHER ON A FARM NEAR ELGIN, ILL.

tion of a motor does not increase the fire risk, and the cost of operation is not excessive.

The accompanying reproductions show some of the installations on farms along the line of the Aurora, Elgin & Chicago Electric Railway. In this instance, the railway simply furnishes the power. The work of installation was done by local electrical contractors. Within five or six miles of Elgin there are about fifteen installations, and others are found scattered along the line. The district around Elgin is noted for its dairy products, and the motors are in most cases employed to drive feed-crushing and grirding machinery. In almost every instance the motor is installed in a detached building, and a chute is provided for protection to the belt, which drives the line shaft in the building in which the machinery is installed. In installing the motors every precaution has been taken to protect them from the weather, and to prevent possible damage to the wiring. The houses covering them are built tight, to avoid the possible entrance of water, and are lined inside with sheet asbestos. A meter is installed in the house with each motor, which is usually of 15-hp capacity. The total cost of installation of a motor is about $600. This includes the cost of erection of the building, the cost of the motor, the expenses of running the line from the tracks of the railway, and the work of installing the wiring and connecting up. The rate charged by the railway company is usually 4 cents per kilowatt. In one instance, the cost of the current used in grinding corn for fifty cows, and sawing wood, etc., was $2 per month. The cost was about one-half cent per bushel for grinding corn.

A CORN SHREDDER AND CRUSHER DRIVEN BY A 15-HP MOTOR

The farmers are all highly pleased with the performance of the motors, as practically no trouble has been experienced with any of them. All the care that the motors have required has been that of oiling them at frequent intervals and renewing the brushes once or twice a year. Power for the motors is taken direct from the trolley and carried on pole lines to the motor house. The advantage to a railway company, having surplus power, of supplying such service can readily be seen, as local firms can be induced to make the installations, and then all the company is required to do is to read the meter and collect the bills.



MOTOR HOUSE IN WHICH A 15-HP MOTOR IS INSTALLED FOR OPERATING FARM MACHINERY

DETACHED MOTOR HOUSE, SHOWING CHUTE IN WHICH THE BELT IS CARRIED TO THE LINE SHAFT IN THE BARN

NEW LIMITED SERVICE BETWEEN TOLEDO AND DETROIT

The Detroit, Monroe & Toledo Short Line has started its new limited service between Toledo and Detroit. There will be four limited trains each way daily making the 60 miles between the interurban station in Toledo and the city hall in Detroit in two hours. The company had built for this service two very fine parlor chair cars, but a trial trip last week demonstrated that the cars were too wide to pass other cars on the city tracks in Toledo. If possible the cars will be altered, and until this is done other cars will be used in the service.

REINFORCED CONCRETE BRIDGES

BY DANIEL B. LUTEN

Bridges of reinforced concrete have many advantages for interurban railways. They compete readily with steel in first cost, and are absolutely permanent, while steel bridges at best endure but twenty or thirty years; concrete bridges, moreover, grow stronger with age, and at a much more rapid rate than the ordinary increase in weight of traffic. Steel and wooden bridges begin to deteriorate from the very day of erection, and railroads have been forced again and again to replace good steel bridges because they have become too light for the heavily increased traffic.

The concrete bridge provides a continuous solid roadbed, so that all conditions of sub-grade, ballast and ties are the same as for the rest of the roadway, and no adjustments of ties to girders, placing of guard rails, etc., are necessary. The steel bridge and wooden bridge, if provided with ballast floor, have these same advantages, but at much greater cost than the reinforced concrete bridge; and the passage of trains over the latter is practically noiseless, while the roar and vibration of the former can not be successfully eliminated.

No delays, such as are exasperatingly frequent in ordinary steel members, are to be met with in the erection of reinforced concrete bridges, and the concrete bridge offers a better solution than wood for the engineer who has prepared his steel plans too late to secure the steel from mills that are often several months behind their orders. Nearly everything required for the reinforced concrete bridge is procurable in the immediate vicinity of the proposed structure; such a bridge can even be constructed by the railway company's own construction gangs when contractors fail to erect promptly. Concrete bridges are readily made floodproof, and they provide greater discharge capacity for the same waterway area than bridges having a separate superstructure. They are, moreover, less likely to become clogged by debris, are much more readily adapted to skew locations, and can be designed to fit any location for which a steel girder is feasible.

The reinforced concrete bridge is much the safer structure, for it never collapses suddenly, but in case of failure gives abundant warning by cracks and distortion at the reinforced edges long before final failure. The steel bridge almost invariably falls with a crash, with no signal of danger. A slight oversight in the inspection of the steel, the omission or burning of a rivet seriously endangers the steel structure, and the wonder is with so complicated a bridge, requiring such careful workmanship and such close following of the drawings, that more of them have not failed disastrously. One need only inspect a few of our steel highway bridges, which are not usually erected under careful supervision, to learn that eternal vigilance is the price of safety in steel bridges. Numerous instances can be shown where bridges have been erected with rivets that could be turned loosely in their holes, with wind bracing omitted, and even with the counters in the wrong panels. In short, numerous details of a steel bridge may be overlooked and can never be detected save by an expert, until finally the critical load or high wind carries the structure down with no warning of danger to the uninitiated. The average engineer must rely almost entirely on the steel bridge builder for security of erection.

FIG. 1.—A 22-FT. HORSESHOE ARCH ON THE INDIANAPOLIS & WESTERN RAILWAY

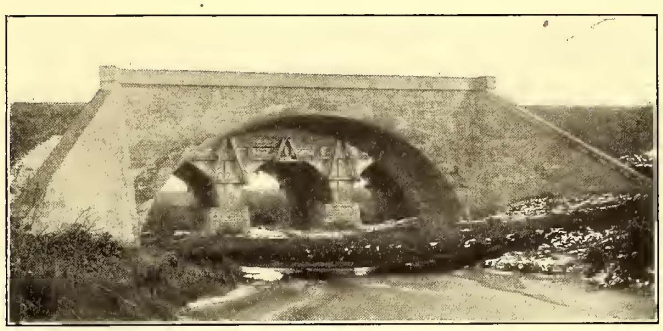


FIG. 5.—A 50-FT. CONCRETE ARCH ON THE LIMA & TOLEDO RAILWAY

FIG. 3.—HORSESHOE ARCH ON THE INDIANAPOLIS & NORTHWESTERN RAILWAY

FIG. 4.—A 20-FT. SPAN ON THE INDIANAPOLIS & NORTHERN LINE

With concrete bridges, cement may be omitted, to be sure, and the reinforcement may be wrongly placed, but if the bridge stands the first test while comparatively new with no signs of failure, the structure will then prove safe for subsequent loadings on account of its rapid increase of strength. Probably the most severe test to which concrete bridges are subjected are when the centers are removed after earth filling has been completed, and usually within thirty days after erection. Even the solidifying of the earth filling over the structure after a few months makes the bridge many times stronger than when first covered with loose earth. The strength of the concrete structure is thus put to the test even before the final payments are due the builder, so that oversights in construction and inspection may be checked before final acceptance. With the steel bridge, on the contrary, only the most careful examination by an expert will disclose these defects, and even then it would require a laboratory test with microscope for each and every member to determine the quality of the steel. In steel bridge construction the reputation of the builder is all important; with concrete bridges, if the efforts of a reputable builder are added to the other safeguards above mentioned, the bridge can hardly prove defective. The concrete bridge shows even to the layman on the removal of the forms whether or not it is to be a success.

One objection is sometimes made to the reinforced concrete bridge, in that most of the methods of reinforcing are patented. But consideration will show that this is an advantage, for it usually gives and should give to the patentee some control over the design, thus insuring expert technical advice, which in any one of the patented systems will work a saving of materials and labor far above its cost.

In appearance the concrete bridge has every advantage over steel and wooden bridges. The latter can not be made beautiful without additional cost. The concrete bridge is inherently beautiful without any additional cost, and every detail may by skillful design be made to add to its beauty without any corresponding increase in cost. The concrete bridge never requires painting or repairs, while steel and wooden bridges always do.

Fig. 1 is a view of a "horse-shoe" concrete arch of which numbers have been erected on Indiana interurban railways. The end is designed of the "horse-shoe" type for economy of

FIG. 7.—OVERHEAD CROSSING ON THE LIMA & TOLEDO RAILWAY

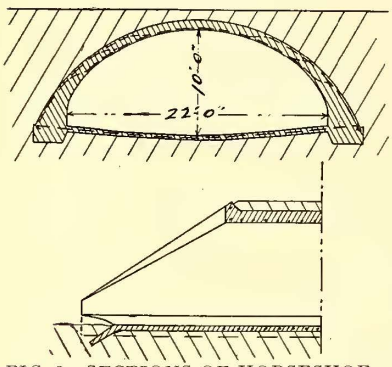


FIG. 2.—SECTIONS OF HORSESHOE ARCH

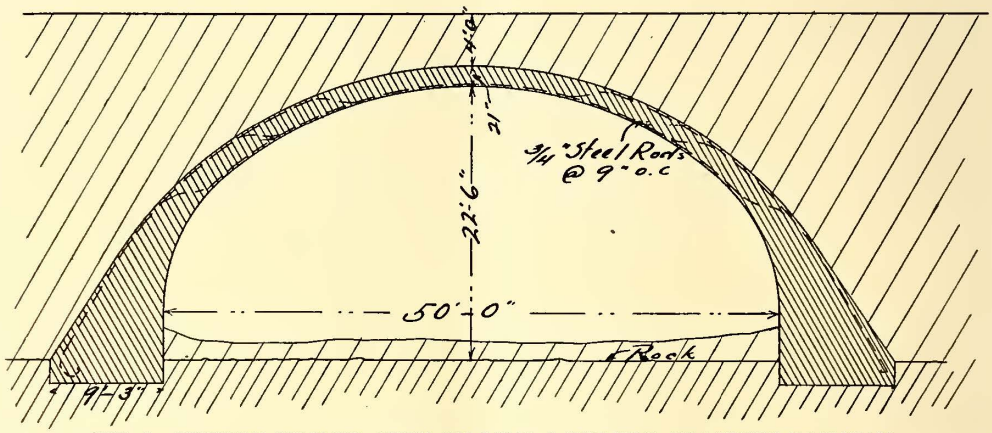


FIG. 6.—SECTION OF 50-FT. ARCH ON LIMA & TOLEDO TRACTION RAILWAY

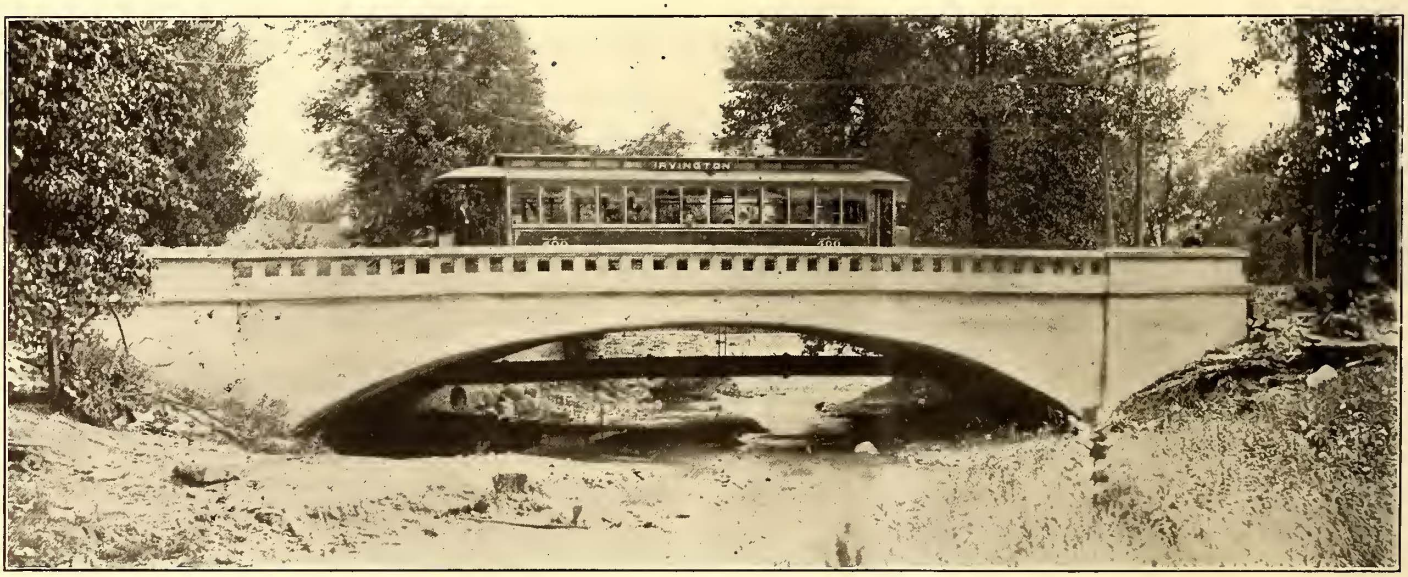


FIG. 8.—A 65-FT. CONCRETE ARCH ON EAST WASHINGTON STREET, INDIANAPOLIS

material, and represents the most efficient type of concrete arch devised. This arch is located on the Indianapolis & Western Railway, three miles west of Danville, Ind., and is of 22 ft. span. The contract price was $1,120. The transverse and longitudinal sections are shown to scale in Fig. 2. Fig. 3 shows a diagonal view of a similar arch, of 6-ft. span, which was built for $385 on the Indianapolis & Northwestern Traction Railway near Zionsville, Ind. This view shows the fit of the "horseshoe" end to the earth slope. These ends are built without any forms other than the drum of the arch, the concrete of the ends being troweled to place, with a guide line stretched at each side of the arch at the slope of the earth filling. Such an arch is from 20 per cent to 30 per cent cheaper than the type with wings and spandrels shown in Fig. 4, a 20-ft. span on the Indianapolis Northern Traction Railway near Noblesville, Ind. The contract price was $1,260. All of the bridges shown in this article were designed for the same loading of 100-ton cars on two trucks, besides the dead weight of earth and concrete.

In all of the above bridges the cross-section of the arch is of the same design, reinforced with rods of smooth, soft steel, embedded near the inner surface at the crown and near the outer surface at the haunches, and crossing the arch ring at alternate points between. By arranging these points of crossing at the middle and third points of the half arch, all possible positions of concentrated loads are provided for, as well as all shearing stresses. The bridges are made floodproof by a reinforced concrete pavement across the bed of the stream, tying the abutments together to resist the thrust of the arch.

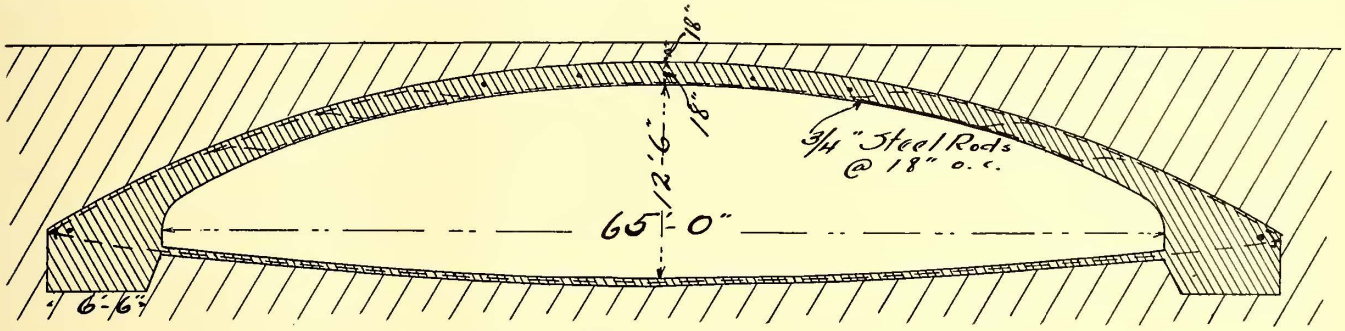


FIG. 9.—SECTION OF EAST WASHINGTON BRIDGE, INDIANAPOLIS

Fig. 5 is a view of a 50-ft. span arch of the same type on the Lima & Toledo Traction Railway three miles north of Lima, Ohio. This arch rests on rock foundation, and the floodproof pavement is consequently omitted. The section is shown in Fig. 6. The contract price was $7,085. In the background is seen a stone arch of three spans on the C. H. & D. Ry., that has proved too weak in the spandrels and has required bracing with transverse tie-rods and timbers, as well as buttressing of the piers.

Fig. 7 is a 24-ft. span on the Lima & Toledo Traction Railway, within a few hundred feet of the 50-ft. span described above. This structure spans a highway with a small stream at the side. The height of opening is 16 ft., and length of arch from face to face 33 ft., carrying a fill over the crown of 8 ft. The contract price was $3,250.

Fig. 8 is the East Washington Street Bridge in the city of Indianapolis, which carries the interurban cars of the Indianapolis & Eastern Traction Railway, running from Indianapolis to Dayton, Ohio, as well as the city cars of the Indianapolis system on its Irvington extension. This bridge is of 65 ft. span and 60 ft. clear roadway. The street is paved with brick, with cement sidewalks and curbs at each side. The railings are of concrete. The contract price was $10,885.

All of these bridges, except the first, were designed and erected by the National Bridge Company, of Indianapolis. The 22-ft. "horseshoe" arch was built by the National Concrete Company on designs and working drawings furnished by the National Bridge Company.

THE CAR WHEEL INDUSTRY

Few persons, even among railroad men, realize the large demands made upon the iron and steel industry of the country by the manufacturer of cast iron and steel wheels. It is estimated by a competent authority in the wheel business that the car wheels at present in use aggregate about 5,000,000 tons in weight. This figure is based upon the following statistics: There are about 1,750,000 freight cars, 40,000 steam passenger cars, 45,000 steam locomotives and 80,000 electric cars in the United States. The freight cars would average eight cast-iron wheels each. The steam passenger cars could be credited with an average of ten wheels each, owing to the extended use of six-wheel trucks. These wheels are probably about equally divided between steel-tired or solid steel and cast iron. The 45,000 locomotives ought to be credited with an average of four small wheels and six drivers each and with eight tank wheels each. The drivers are steel. The small wheels may again be considered as equally divided between cast iron and steel. The electric cars can be said to average seven wheels each, 90 per cent iron and 10 per cent steel. Totalizing these figures, and omitting from consideration hand cars, dump and construction cars, etc., the following table is obtained:

	Drivers	Steel and Steel-Tired Wheels	Cast-Iron Wheels
1,750,000 freight cars.....	.....	.....	14,000,000
40,000 steam passenger cars.	.....	200,000	200,000
45,000 locomotives.....	270,000	90,000	90,000
45,000 locomotive tanks....	.....	180,000	180,000
80,000 street cars.....	.....	60,000	500,000
Total	270,000	530,000	14,970,000

The average weight of drivers is about 1½ tons, that of the steel-tired wheels is about ½ ton, and the average weight of the cast-iron wheel is about 600 lbs., making a total of 5,061,000 tons.

This figure gives about what is in use at the present time. If anything, the total is probably greater than that quoted rather than less. A more important question, however, is how many are made each year. To determine this, it may be assumed that the cast-iron wheels used under freight cars are renewed on an average of once in five years, while those under the other rolling stock are renewed annually. The renewals and new cast-iron wheels manufactured would then

be as follows, according to the authority whose estimates are being quoted in this article:

14,000,000 wheels under freight cars, one-fifth renewed, or	2,800,000
Cast-iron wheels under passenger cars, all renewed, or	200,000
Cast-iron wheels under locomotives, all renewed, or	90,000
Same under tank cars, all renewed, or	180,000
Same under street cars, all renewed, or	500,000
Total for present year	3,770,000
The natural increase in use is about 5 per cent each year, or	188,500
For new cars the present rate is about 150,000 to 200,000, 150,000 cars, eight wheels to the car, would equal	1,200,000
Grand total, or average for next year	5,158,500
This will average an increase yearly of from 150,000 to 200,000 wheels, say	150,000
	5,308,000

These wheels, as before stated, average about 600 lbs. each, which means a yearly consumption of 1,591,350 tons.

The steel wheel consumption for last year, according to a large manufacturer of steel tires, was about as follows:

	Drivers	Steel and Steel-Tired Wheels
In passenger service the steel wheels last about five years, or to replace those under the present equipment the yearly demand is about		50,000
Under locomotives, about once in four years	67,500	22,500
Under locomotive tanks, once in four years.		45,000
Under street cars, about once in five years.		12,000
Under new equipment the average increase is about:		
Steam cars		25,000
Locomotives	12,000	8,000
Street cars		5,000
Total for present year	79,500	167,500
Average yearly increase of about 5 per cent equals	4,000	8,000
Or total for next year	83,500	175,500
		Tons
The drivers weigh about 1½ tons, or		125,250
The others about ½ ton		87,750
Total tonnage		213,000
Total tonnage of cast-iron wheels is		1,591,350
Grand total of tons		1,804,350

To produce this, fully 50 per cent of the tonnage, considering new cars, must be new iron. The balance is made up of scrap wheels or other scrap iron. The new iron required, therefore, equals about 900,000 tons, or one-thirtieth of all the new iron that is made in the United States in twelve months.

The figures quoted above are intended to be approximate only, but serve to show the magnitude of this particular part of the railroad business.

The Canton-Akron Railway Company, acting with the Northern Ohio Traction & Light Company, will shortly institute limited service between Canton and Cleveland. The new cars will make the 55 miles in 2 hours and will be an additional to the limited now operating between Akron and Cleveland over the lines of the Northern Ohio Traction & Light Company. Two 50-ft. cars have been secured by the Canton-Akron Company for this service, as it was found impractical to operate its heavy 60-ft. cars on the severe grade of the Akron-Cleveland line.

SHOP KINKS AT SIOUX CITY, IOWA

Several novel devices which either facilitate work or reduce waste have been put into use in the shops of the Sioux City Traction Company at Sioux City, Ia., by C. M. Feist, master mechanic of the system. In these shops all the cars are constructed and all the car repair work is done for the system, which embraces about 43 miles of track in and about Sioux City.

A little device that has effected quite a saving in register rope is a triangle of bell crank which was substituted for the usual pulley at the bulkhead of the car where the register rope turns to pass to the register. The substitutes of the bell crank on all the cars resulted in a saving of $45 worth of register rope in one year.

With an ordinary wrench it is rather an awkward undertaking to tighten the nuts on split gears. Their position is such as to allow the wrench to turn through but a very small angle, and moreover the nut is usually greasy and it is hard to get a firm hold on it with the wrench. To facilitate the work of tightening these nuts, J. A. Rubel, pit foreman, devised the wrench shown in Fig. 1. This is in fact an offset socket wrench. The T-handle turns a cog which meshes with another of equal size containing a hexagonal opening for the nut. The two cogs are carried in a frame provided with an angular extension which when pressure is put on the wrench strikes the gear and prevents the frame turning further.

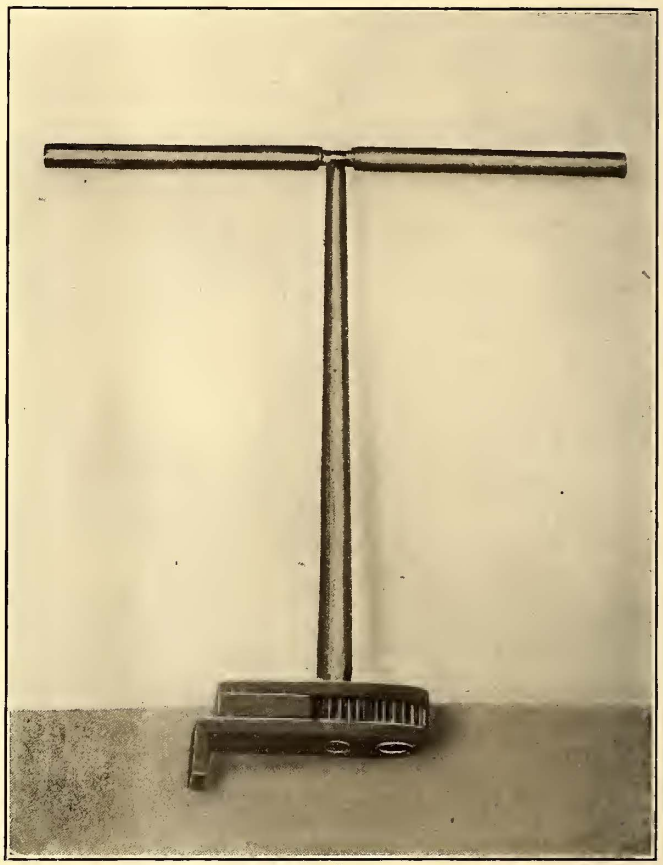


FIG. 1.—EXTENSION SOCKET WRENCH FOR TIGHTENING NUTS ON SPLIT GEARS

A device used for babbiting split bearings is shown in Fig. 2. The mandrel and the base block are in one piece. After the bearing shells have been placed in position on the base block the two half shells shown are clamped around them. The illustration shows the fillets on the mandrel which cast the oilways in the babbit. All the axle bearings are cast full size, and are used without being machined. The controllers

of several of the cars of the system are equipped with hand-wheels illustrated in Fig. 3. These wheels, which have a shorter radius than the regular handles, permit the controller to be placed about 4½ ins. nearer the inside finish of the platform. The controller may be turned either by means of the pear-shaped handle or by grasping the rim of the wheel.

A careful record has been kept of the life and the cost of trolley wheels. For one year the total cost per car of the copper consumed in trolley wheels was $1.92. This cost was

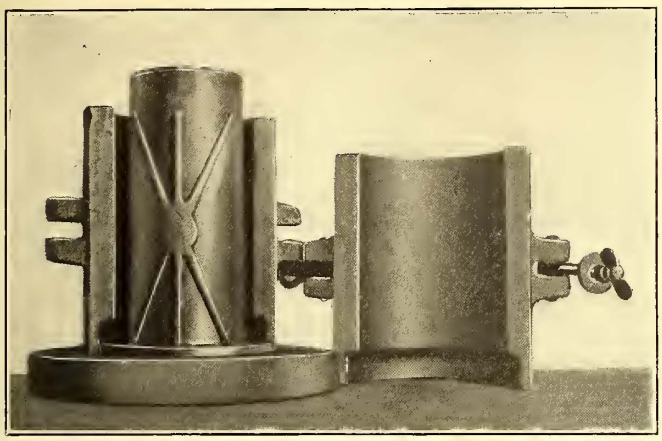


FIG. 2.—DEVICE FOR BABBITTING SPLIT BEARINGS

obtained by deducting from the purchase price the price received for the copper in the scrapped wheel. The style of wheel and harp used is a special one, and was devised by and has been patented by Mr. Feist. Its construction may be gathered from the accompanying illustration. The axle is unusually large, and contains recesses for three radially projecting carbon pencils. The harp proper is made in two halves, each of which is screwed on the axle. Where the wheel is in position the radial pencils, which are forced out-

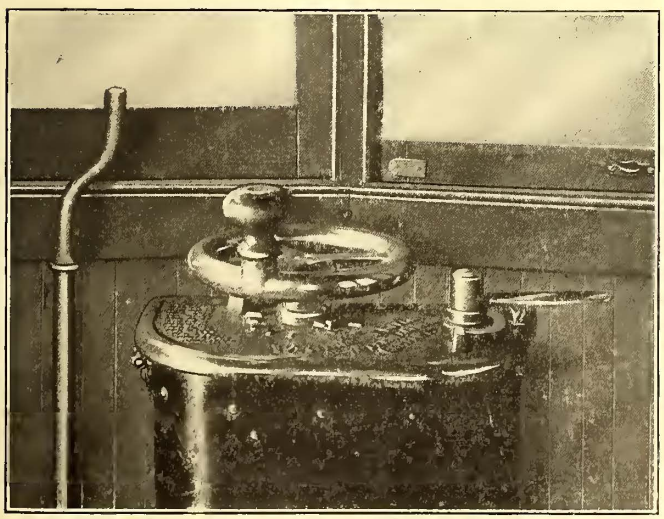


FIG. 3.—HAND-WHEEL USED ON CONTROLLERS

ward by springs behind them, keep the wheel well lubricated. The pencils are of such a length that they last about one year. No oil whatever is used, and the trolleys are said to require practically no attention until the groove is worn out. The life of the wheel is from 18,000 to 20,000 miles.

Oil lubrication has been adopted for the motors originally built for grease by placing a tin cup in the grease boxes. At first considerable trouble was experienced, due to the rattling of the cup in the box and the consequent wearing of holes in the cup, but this trouble has been eliminated by pouring melted sulphur around the cup so as to fasten it securely in place.

The armature shafts of all the motors have their commutator ends covered by a small cap which prevents a great deal of dirt getting into the bearing. This practice, however,

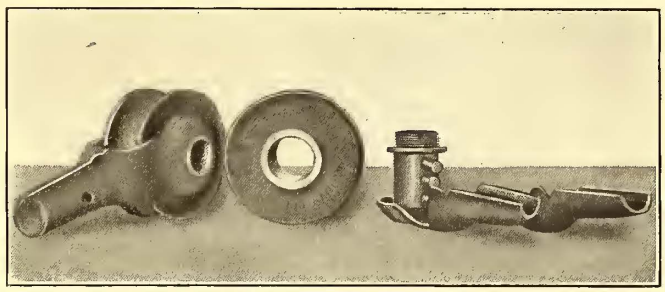


FIG. 4.—TROLLEY-WHEEL AND HARP ASSEMBLED AND TAKEN APART TO SHOW THE LUBRICATING PENCILS

is followed in many other shops, and some motors are supplied with such caps by manufacturers. While it is a minor point, it is one which no doubt prevents a great many bearing troubles.

The type of fender used on the cars is that which is built in the shops, and is shown in one of the reproductions. The

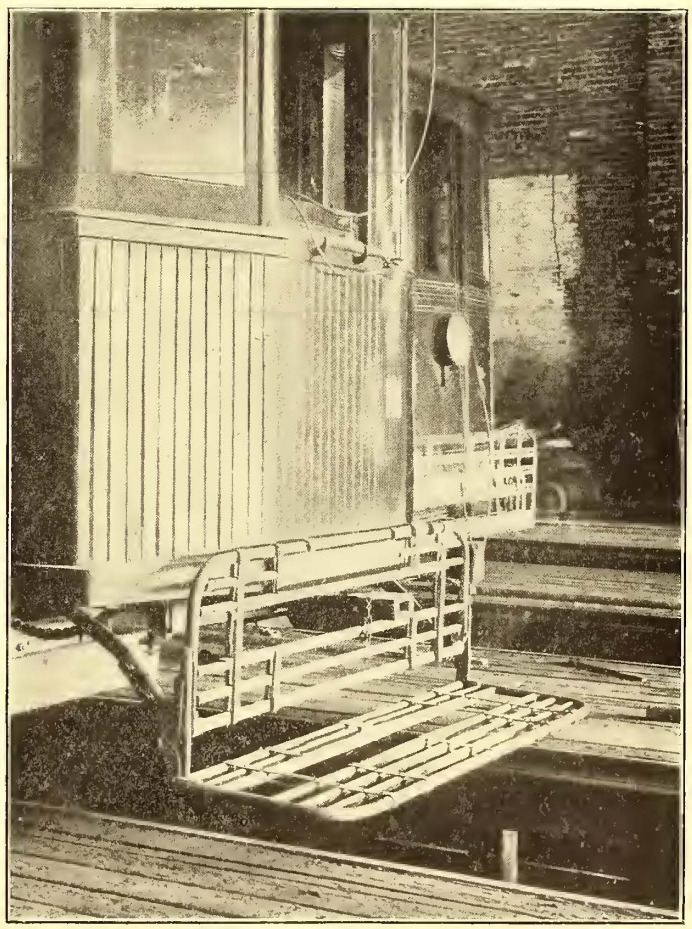


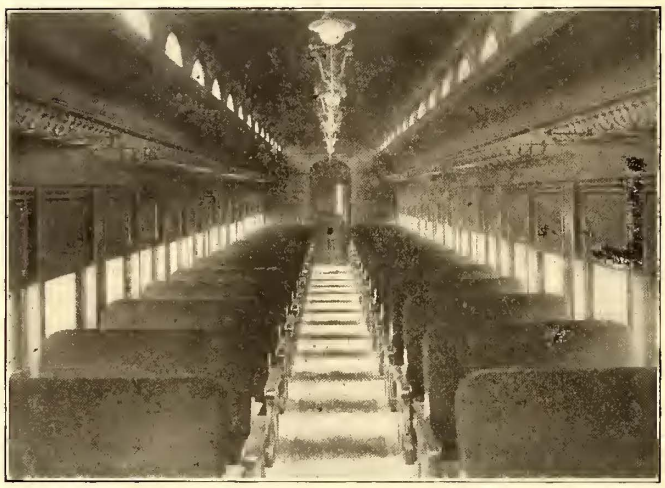
FIG. 5.—TYPE OF FENDER USED ON SIOUX CITY CARS

lower portion is hinged and arranged to fold up against the upper part. When so raised the fender is close up against the bumper of the car, so that it does not interfere with the coupling together of two cars equipped with fenders.

The Indiana, Columbus & Eastern Railway Company has instituted a limited service between Dayton and Springfield. The cars will cover the 28 miles in 55 minutes.

NEW ALL-STEEL PASSENGER CAR FOR THE PENNSYLVANIA RAILROAD

The Pennsylvania Railroad has recently completed at its Altoona shops an interesting type of all-steel passenger car, which is intended for its tunnel service into New York and involves a number of important departures from previous constructional methods. Throughout the whole design of the car the aim has been to obtain a greater amount of strength than could be obtained with wooden construction; a complete steel framing, which could not be affected by fire, and



INTERIOR OF PENNSYLVANIA RAILROAD STEEL CAR

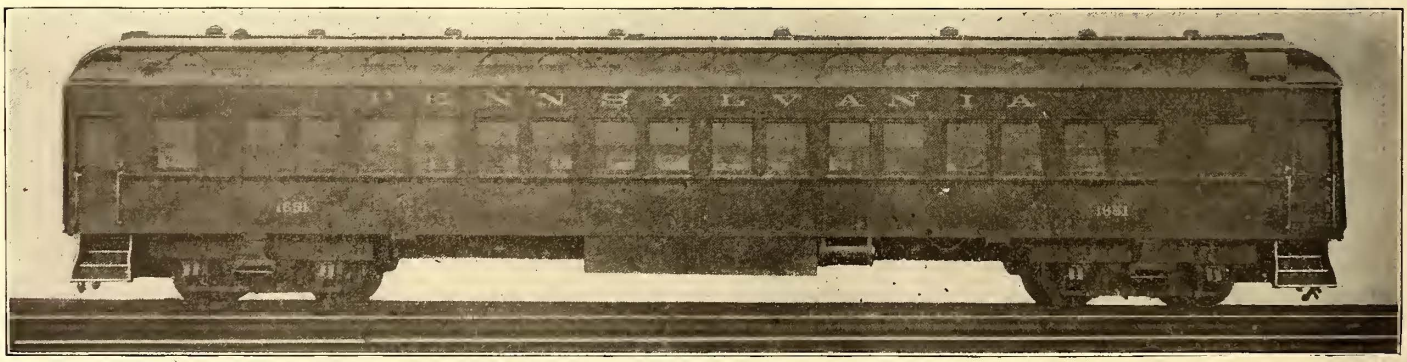
an inside lining which is non-inflammable, and at the same time one which will not conduct heat or sound.

The principal feature of the construction of the body of the car is a center sill member in the form of a central box girder 24 ins. wide by 19 ins. deep, extending throughout the length of the car, including platforms. This girder forms a backbone which supports the rest of the car and at the same time gives such great strength to the body structure that there will be less possible danger to passengers, due to breaking up of the car in case of collision. The sides of the car are composed of deep steel girders of very great strength and strongly reinforced, The platform is composed of steel plates attached to the center sill construction, and covered with a cement finish imitation of stone, which is spread over the steel plates while in a plastic state.

The vestibule end and corner posts are designed to furnish a maximum of strength for the amount of material used and are securely riveted to the center sills and end rail. The end door posts are of rolled material of very deep section, securely riveted to the center girder construction at the bottom and to a horizontal strengthening plate at the top, presenting a feature of strength which is absent from present passenger car construction. This great strength in the door and vestibule end posts will, in case of collision, and the body of one car rising above the body of the next car, tend to prevent the tendency for the underframe of the first car to sweep the superstructure of the second car from its underframe. The vestibule ceiling consists of a wide horizontal steel plate, reinforced in such a manner that it forms a girder braced to the side and roof framing of the car and prevents the collapse of the roof end.

The side framing is supported by cantilevers—four on each side, extending on either side from and supported by the center girder construction. Riveted to and rising from the side girders are steel posts of the strongest available section, spaced about 6 ft. apart, which support the roof and parts depending from the roof. Opposite side posts are connected by steel carlines of similar section, and the ends of the posts are tied together throughout the full length of the car by angles extending continuously throughout the length of the car and attached to the vestibule roof sheets at the ends. Further longitudinal bracing consisting of six angles, located between the angles connecting the ends of the posts, form a substantial connection for the carlines and roof, and are attached at the ends of the car to the vestibule roof sheets.

The inside lining consists principally of steel plates except directly under the roof, where the usual composite board is retained. The outside sheathing of the roof also consists of steel, so that the whole outside of the car presents one unbroken expanse of steel plate with openings for the windows. The doors are composed of steel plates pressed into a shape imitating wooden doors used in other cars with a cork filling to deaden the sound. The seats are composed of steel frames throughout, covered with fireproof plush. The foot-rests are of steel; in fact, no wood or inflammable material whatever has been used, except the top of the seat arm, which was made of wood for comfort of passengers, as steel was considered cold to the touch. Experiments will be made with seat arms made of metal, to determine the amount of discomfort and also whether it would be advisable to substitute metal. The inside flooring of the car consists also of a cement composition in imitation of stone, which in its plastic state has been spread over the foundation sheets, consisting of corrugated iron, which in turn is riveted to the center sills and side framing of car.



THE FIRST ALL-STEEL CAR FOR THE PENNSYLVANIA RAILROAD'S NEW YORK TUNNEL SERVICE

In order to obtain the best possible results from steel construction, it was necessary to consider a redesign of the trucks to provide for a main central body frame of twice the depth that is used in wooden passenger car construction. The trucks consist of a frame work made entirely of steel

and considerably stronger than truck frames now in general use; a bolster passing underneath the frames and provided with side bearings placed directly under the sides of the car to promote easy riding; a location of helical and elliptical springs which, from long experience, has been found to be most advantageous; axles of a large diameter, and rolled steel wheels.

The car is equipped for electric lighting only, the current supply for which is furnished by storage batteries. The wiring has been carefully insulated and is carried in metal conduits. The storage batteries are carried in steel boxes, which are hung from the underframe of the car. The Pennsylvania Railroad standard ventilating system is used and also the four-type heating system. The paint used on this car is fireproof throughout. General dimensions of the steel passenger cars follows:

	Ft.	Ins.
Length over buffers	67	5¾
Length over body corner posts	58	11¾
Length between bulkheads	47	4
Width over upper deck eaves	7	7
Width over lower deck eaves	10	1
Width over letter board	9	10½
Width over sheathing	9	9¾
Width inside of finish	8	11½
Height to top of car from rail	14	0½
Height to top of belt rail from rail	6	7½
Height to top of floor from rail	4	4
Height to bottom of car from rail	3	7½
Distance between truck centers	45	3
Diameter of wheels	3	0
Distances between centers of windows	2	11½

THE AUTOMOTONEER IN ITS LATEST FORM

The automotoneer, which is made by the Garton-Daniels department of the Electric Service Supplies Company, although a very simple device in itself, has required a remarkable amount of ingenuity and experimental work to perfect it. For the benefit of readers who may not be familiar with the history of this retarding device for controller handles which is now in use upon many hundreds of cars in the United States, it may be well to explain that it was invented and the original patent application filed about nine years ago by M. K. Bowen, general manager, and George W. Knox, electrical engineer of the Chicago City Railway Company. The original device as constructed by Mr. Knox and tried upon some of the cars of the Chicago City Railway differed considerably from the present automotoneer. In fact, although the device apparently is one which would be easy to construct, many years of inventive skill and experiment had to be spent upon it to make a device which would stand commercial service. The first automotoneers were placed inside the controller with the idea that they would be more out of the way and less likely to be tampered with. The difficulties of crowding them into most controllers and the greater ease of application caused the designers later to adopt a type which is placed on top of the controller. Dozens of designs and mechanical movements were tried during the experimental period. The latest type of this device is shown by the accompanying illustrations. The object of the automotoneer is, of course, to make it possible for the motorman to move his controller handle but one notch at a time. After he has advanced one notch, he cannot go to the next until a

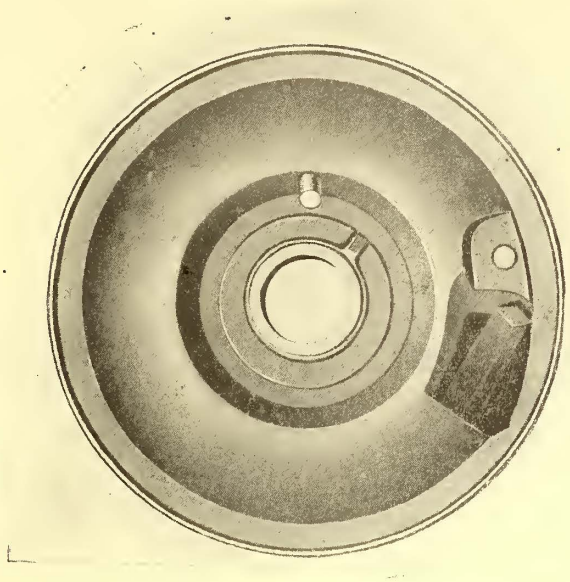


FIG. 2.—INSIDE OF UPPER CASING OF AUTOMOTONEER

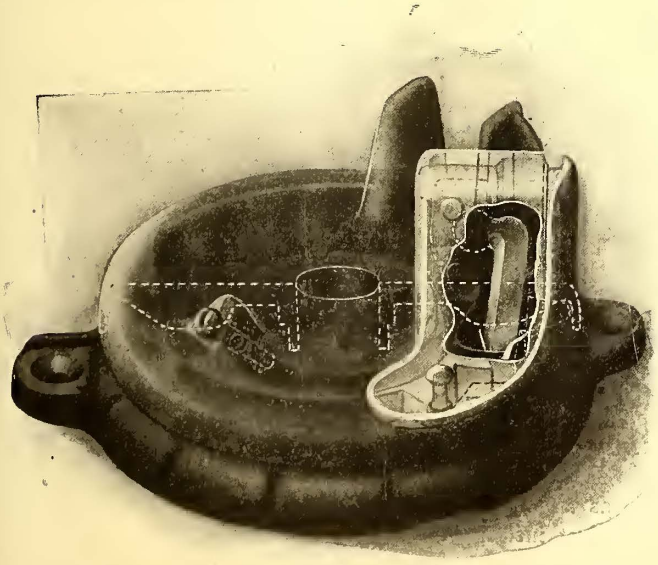


FIG. 1.—AUTOMOTONEER, SHOWING ARRANGEMENT OF DOG

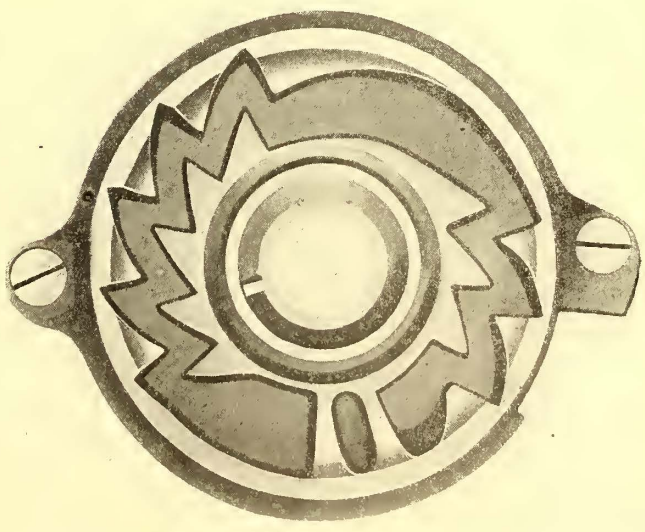


FIG. 3.—LOWER PART OF AUTOMOTONEER, SHOWING ZIG-ZAG GROOVE

certain time has elapsed. No restriction is placed on the turning-off movement of the controller.

Referring to the illustrations, an engaging dog hung from a ball and socket joint is so formed that of its own weight it rests against the inside rim of the zig-zag groove shown in Fig. 3. The movement of the controller handle causes the dog to follow the cam surface of the inner rim which directs it toward the first stop point of the outer rim. This throws the dog into the angle formed by the first projection or stop of

FIG. 4.—THE AUTOMOTONEER INSTALLED

the outer rim, forcing it against the upper casing. This stops the movement of the controller handle. By this simple construction all springs, pivots, hinges, etc., are done away with, except the sturdy ball and socket joint. This is made so free and loose that there is nothing to stock, rust, or get out of order. No oiling is needed.

The automotoneer is so adjusted on the controller that when the dog is in the locked position, the star-wheel roller inside the controller is just ready to go over the next point. This exerts a slight pressure that tends to throw the controller handle back a fraction of an inch as soon as the pressure of the motorman's hand on the controller handle is released. This releases the automotoneer dog and permits it to drop into the inner groove ready for work on the next point. This continues throughout the entire course of the controller handle in turning on current, and on most controllers for city cars forces a sufficient pause at each point to allow the motors to accelerate properly before more current is turned on.

The upper casing of the automotoneer is so made that there is a sufficient space left to allow the dog to swing back out of engagement with cams and stops, when the current is being turned off. The position of the dog is shown in Fig. 1. In turning off current it presents no opposition whatever, and instead of engaging each stop as it does in the forward movement, it simply slides along.

The upper casing of the automotoneer is provided with a sliding bolt shown in Fig. 2 covered on the surface by a short screw shown in Fig. 1. When the casing is in place upon the lower part of the automotoneer, this bolt drops in the groove shown in Fig. 3, fastening the upper and lower parts together, so that they cannot be separated without removing the automotoneer from the controller and turning it upside-down. Fig. 2 shows this bolt in its proper position when the upper casing is placed upon the lower. This arrangement prevents any tampering on the motorman's part. The head of the small screw, shown to cover the sliding bolt, may be cut off flush. This absolutely prevents removing the bolt, although it may be pushed out of engagement when the automotoneer is removed from the controller for inspection.

The advantages of the automotoneer in smoother acceleration, less jerking of passengers, less wear and tear on the equipment, and saving in power, have been thoroughly discussed in past issues. Experience with the device, now that it is in use on a large number of cars, seems to have shown that while the power-saving feature may have been overestimated, the reduction in repairs to motors and other parts of the rolling stock by the use of this device have been very much underestimated.

NEW ROLLING STOCK FOR THE STRANG GASOLINE ELECTRIC RAILWAY CAR SYSTEM

In the Street Railway Journal of March 3, 1906, there appeared an article describing a new gasoline-electric car built for the Strang Electric Car Company, of New York City, by the J. G. Brill Company. Numerous trial trips had been taken over the main line of the Baltimore & Ohio Railroad between Philadelphia and Wilmington, and prominent officials of that road and also of the Pennsylvania Railroad had participated in these trips. As the article above referred to was going to press, the "Ogerita," that being the name of this gasoline-electric car, was about to set on a journey to Kansas City from Philadelphia, via the Pennsylvania, West Shore, Lake Shore, Alton and Rock Island railroads, stops being made at principal points en route to enable railway officials to come aboard and inspect the system and journey on with the

THE NEW GASOLINE-ELECTRIC CAR "MARGUERITE"

car as far as was desirable. No changes in equipment from that first installed were required, the engine behaving perfectly under the most adverse conditions. The average speed for most of the distance averaged about 45 miles per hour. Snow storms retarded the progress of the "Ogerita" on several occasions, and in some instances it was necessary to run behind freight trains, which reduced the average for the entire trip to about 33 miles per hour. Arriving at Kansas City, another trip was taken over the Santa Fe Railroad to Topeka and return. On the return journey the "Ogerita" ran into a heavy snow storm, the drifts being unusually deep. Regular trains on the road were brought to a standstill, but the

"Ogerita" is said to have acted like a snow plow and completed her journey on schedule time. Another trial trip through the Southern part of Kansas covered about 550 miles, the car averaging about 40 miles per hour, despite grades of 3½ per cent and curves as high as 16 degrees.

Last April the "Ogerita" commenced making regular trips on a line built by Mr. Strang, known as the Santa Fe Trail Route, and running between Kansas City and Olathe, Kansas, about 22 miles. The car is now operating between Kansas City and Lenexa, the latter place being about 15 miles distant from Kansas City. Four round trips are made daily, and one and two trail cars are used. Not a single trip has been missed for any cause whatsoever since its initial run on this line.

To hasten the completion of this new line and no locomotive being available for handling steel and ties, the "Ogerita" assumed the role of a freight engine. The present equipment for the road is entirely inadequate to meet the heavy traffic conditions, but will be relieved when the two handsome new cars, one of which appears in the illustration, are placed in commission, to take their regular turns with the "Ogerita." The cars for the line are being built by the J. G. Brill Company, and are mounted on that company's high-speed trucks. The car illustrated is the standard type of combination passenger and smoker used. The "Marguerite" has already had some trial trips and will be at once sent West to join the "Ogerita" and the "Geraldine."

The new cars measure 48 ft. over the end panels and 52 ft. 9 ins. over the crown pieces; width over the sills, including sheathing, 9 ft. 6 ins.; sweep of the posts, 2 ft. 8 ins.; size of the side and end sills, 5¼ ins. x 8⅞ ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 2¼ ins. x 4½ ins. The length of the passenger compartment is 27 ft. 5 ins.; the smoking compartment measures 10 ft. 8 ins.; while the engine room is 14 ft. 8 ins. The seats are covered with red leather and harmonize with the green tint of the interior woodwork, and comfortable armrests are provided on the aisle side of the car. At the forward end of the passenger compartment and on the left-hand side of the car is a saloon with water cooler in alcove and a small folding lavatory with the usual adjuncts; the small oval window of opalescent glass will mark the position of the saloon in the picture. The engine room has a double window on the one side and a double sliding door on the other with a 5 ft. 6-in. opening. A removable partition is placed at the rear of the engine room, 2 ft. 8 ins. from the partition, separating the engine room from the smoking compartment; the space between these partitions to be used for a tank room. The engine is a four-cylinder vertical type, with 10-in. x 10-in. cylinders; the engine requires no attention while running, as the regulating apparatus is automatic; therefore one man can operate both car and engine.

NEW YORK STATISTICS FOR THE LAST QUARTER

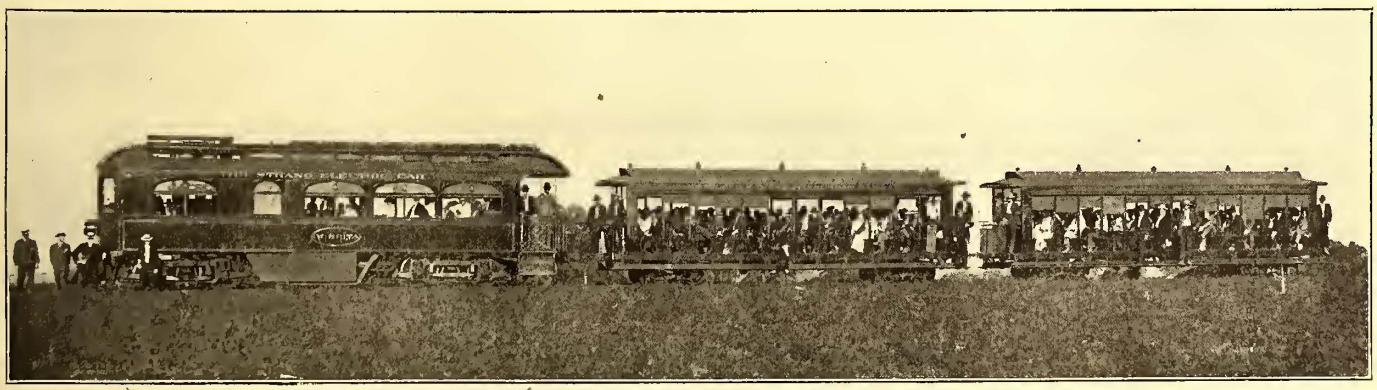
The quarterly statement of passengers carried, car-miles run, etc., by the roads in New York City during the three months ending June 30, 1906, has just been published by of transportation of the West Penn Railway Company, of Railroad Commissioners of New York State. The statistics for the principal lines, as well as for the city at large, are presented in the accompanying table.

TABLE SHOWING STATISTICS OF RAILWAYS IN NEW YORK CITY FOR QUARTER ENDING JUNE 30, 1906

	Cash Fares	Increase	Transfers	Increase	Car Miles	Increase	Passengers per Car Mile *	Increase
Interborough elevated	64,164,266	4,612,563	.....	.....	15,412,542	‡ 460,871	4.16	.09
" subway	37,161,607	10,219,312	.....	.....	8,656,535	961,413	4.21	.71
New York City (surface cars)	101,971,283	2,911,928	46,844,211	5,693,687	14,897,170	‡ 787,561	9.99	.73
Brooklyn R. T. (all lines)	96,275,361	7,700,572	33,114,345	12,756,595	16,070,757	965,913	7.62	.82
Coney Island & Brooklyn	9,462,173	517,083	1,660,242	‡ 46,871	1,813,041	‡ 25,876	6.13	.17
Union Railway †	8,829,084	2,809,223	4,299,266	151,967	1,988,283	331,767	6.60	.46
New York & Queens County	4,949,173	467,732	1,212,174	188,094	956,972	74,776	6.44	.20
All roads in New York	332,384,850	29,925,163	87,519,273	18,903,364	61,757,448	1,252,881	6.79	.66

* Including transfers. † Including Southern Boulevard. ‡ Decrease.

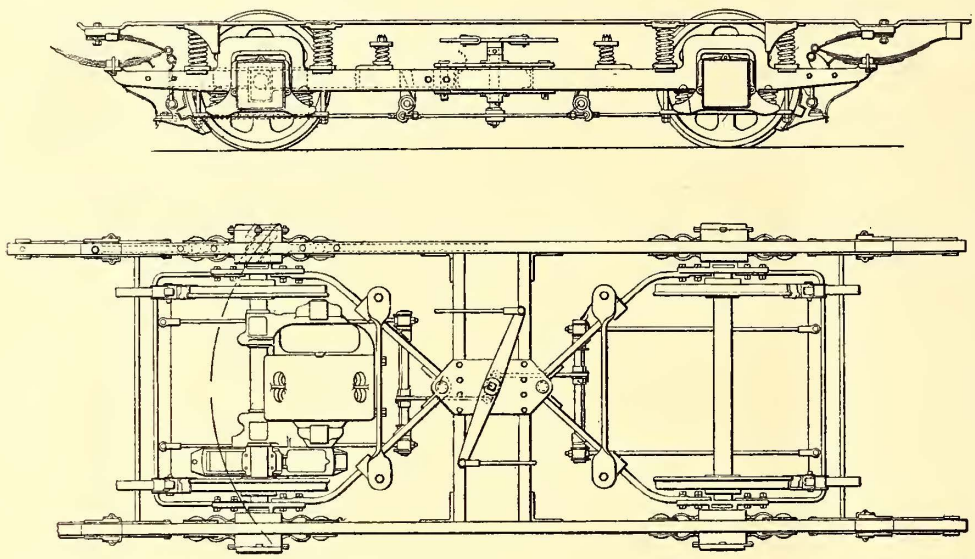
Originality in advertising counts for as much in the street railway business as in almost any other line. The man who gets up unique and attractive advertising is certain to improve the business of his road. W. K. Brown, superintendent Connellsville, has recently invented several ingenious little schemes for promoting business for his road. At all the hotels in the district, the traveling man, after eating his meal, picks up a quill toothpick bearing the words "Pick the West Penn Railways, the road that runs on time." Mr. Brown has taken advantage of the souvenir postal card fad by placing racks of cards illustrating many views on this system in all of the waiting rooms and at many news stands in the towns in near districts. The cards are sold at about cost and have spread the fame of the West Penn system all over that section.



GASOLINE-ELECTRIC HAULING TWO TRAILERS IN SERVICE BETWEEN KANSAS CITY AND LENEXA

THE COOK RADIAL TRUCK

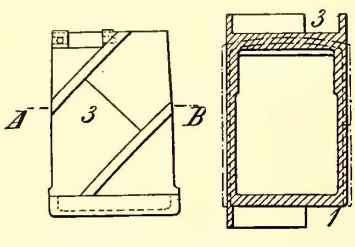
One marked difference between European and American practice in rolling stock is the extended use abroad of radial trucks. Not only are many electric cars in Europe fitted with radial trucks, but a considerable proportion of the steam carriages are equipped with running gear which allows the axles to assume a radial position while passing around curves. In electric railway practice, particularly in England, it is not uncommon to see cars with a 9½-ft. wheel base passing around short radius by the use of this radiating principle. In the city of Birmingham alone there are about 300 cars mounted on radial trucks, and the latest orders from this city have been for trucks of this description. The advocates of radial trucks claim a large reduction of power, not only on curves but also on straight track, due to the decreased tendency to "hunt" and the consequent less flange friction. The larger wheel base also gives a better riding car, and it is claimed that many cars with 30-ft. body or shorter in this country, now mounted on double trucks, could be carried on a single 4-wheel radial truck to advantage.



FIGS. 1 AND 2.—SIDE ELEVATION AND PLAN OF RADIAL TRUCK

The accompanying engravings illustrate the Cook radial truck, of which more than 1000 have been built by the Brush Electrical Engineering Company, of Loughborough, England, and which was invented by E. E. Cook, formerly of the McGuire Manufacturing Company, of Chicago.

This truck combines with a rigid frame two radial axles which swivel from points near the center of the truck frame, as shown in Figs. 1 and 2. The radial action takes place in the journal boxes, Figs. 3, 4 and 5, which are of ingenious construction. Each consists of an outer box, Fig. 4, and an inner box, Fig. 3, in which the axle revolves. The four sketches in Fig. 3 illustrate respectively a plan, section on the line *AB*, a longitudinal section and a front elevation of the inner axle box. This inner box moves vertically with the outer box, but is also capable of a sliding or lateral movement therein. This is accomplished by making the outer box considerably wider than the inner box and providing it with curved guides at the top and bottom. These guides are shown in Figs. 5 and 6. They are in the form of ribs and engage with correspondingly formed grooves 3 and 1 at the top and bottom, respectively, of the inner box. The guides are not made in one with the outer box but have bosses, 2, which allow them to swivel in the outer box. The top guide, Fig. 5, as shown, is made to slope slightly from its outer ends to the center, and the upper groove 3 of the inner box is curved to correspond with this slope. The result is that when the axle swivels away from the center it must slightly lift the car body by means of an inclined plane of slight pitch; that is, when the car strikes a curve, the greater the speed the greater is the swiveling effect. This is, of course, as it should be. The effect of the radial action consequently is to cushion the shock of the car body at the entrance of curves and switches, and also to reduce the wear and tear of the track and car wheels at these points. With the narrow grooved rails, common in England, this saving in wear on special work is of considerable importance. Tests made on current consumption by the British Electric Traction Company on cars equipped with a 6-ft. rigid wheel base truck as compared to radial trucks of 9½-ft. wheel base show much less current consumption both on curves and straight work with the radial trucks than with the rigid wheel base trucks.



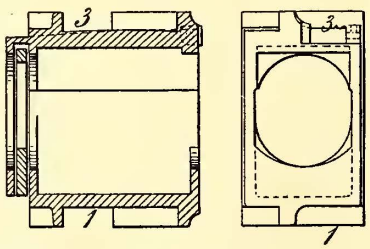


FIG. 3.—PLAN, SECTION ON *A B*, LONGITUDINAL SECTION AND FRONT ELEVATION OF INNER AXLE-BOX

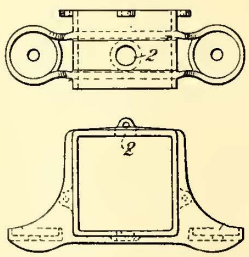
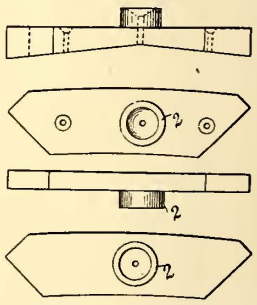


FIG. 4.—OUTER BOX, IN WHICH INNER BOX SLIDES



FIGS. 5 AND 6.—CURVED GUIDES PROVIDED FOR THE OUTER BOX

The traction lines of Central and Western Ohio, acting in conjunction with the Nickle Plate and another steam railroad, last week made a bid for the cheap excursion business to Chicago. The Indiana, Columbus & Eastern Traction Company had 125 passengers from Springfield, Ohio, to Chicago, and a number from Columbus. The Dayton & Troy and Western Ohio lines handled a number of people out of Dayton and other points, while the Ft. Wayne, Van Wert & Lima handled a good party out of Lima and other towns on its line. The Erie, Hocking Valley, Ohio Central steam railroads attempted to thwart these excursions by offering low rates direct, but the novelty of a long trolley trip brought the electric traction lines a very creditable portion of the business.

FINANCIAL INTELLIGENCE

Wall Street, Aug. 15, 1906.

The Money Market

Money market conditions have not changed materially during the past week. Lenders generally continue to hold the market for over-the-year maturities at 5¾ per cent, and while there is not a great deal of business reported at that rate, still there is no disposition on the part of the banks and other institutions to press their funds upon the market, the belief being pretty generally entertained that higher rates will prevail in the near future. There has been a decided falling off in the offerings of out-of-town money in the local market, due to the fact that arrangements are being made at inland cities to finance the crops. Rates of exchange on New York at Chicago are somewhat harder, indicating an increasing demand for money at those points. The outward movement of money from New York may be said to have begun, a small amount having been shipped direct to St. Louis this week. It is not expected, however, that the movement will assume large proportions for several weeks to come. In the meantime New York banks will probably strengthen their reserves, and be in a position to meet any demand for crop-moving purposes that may be made upon them. The banks lost a considerable amount of cash last week, due in part to the heavy custom collections, and the payment for the Panama Canal bonds, which now aggregate $14,000,000. It is expected, however, that during the current week, the New York City banks will gain cash considerably. A feature of the week has been the weakness in sterling exchange, the rate for demand bills dropping 65 points to 4.8465. The decline was due to the unusually heavy offerings of cotton bills at Southern ports. At the low level of exchange it was expected that local bankers would obtain the greater part of the £500,000 gold arriving in London from South Africa on Monday last. The bulk of the gold, however, went to a German institution. However, local bankers are of the opinion that they will be able to obtain all the gold required in the European markets when needed. It is expected that the offerings of cotton and grain bills will be extremely heavy in the near future, and will be sufficient to depress the rates of exchange to a point where gold can be readily secured. The European money markets have been somewhat easier, this being particularly so at Paris, owing to the improvement in the Russian situation. The bank statement published on Saturday last was decidedly unfavorable, the clearing house banks reporting a decrease in cash of $9,274,900, and a decrease in the surplus reserve of $5,851,150. The surplus now stands at $8,271,525, as compared with $12,846,800 in the corresponding week of last year, $57,751,475 in 1904, $21,563,575 in 1903, $7,126,600 in 1902, $18,421,900 in 1901, and $28,125,950 in 1900.

Money on call has loaned at 5 and at 2½ per cent, the average rate for the week being about 3¼ per cent. Time loan rates are about ¼ higher than those prevailing at the close of last week. Quotations are 4¼ and 4½ per cent for sixty days, 4¾ per cent for ninety days, 5¼ per cent for four months, and 5¾ and 6 per cent for five and six months. Mercantile paper remains quiet at 5¼ per cent, the minimum for prime names.

The Stock Market

The stock market has shown rather decided strength during the week, and prices are higher all along the line, and in some instances new high records for this movement. Sentiment is more friendly to the upward movement, and developments have been of a character to encourage a better feeling. Much attention is being paid to prospective dividend increases, especially on the Harriman stocks, on which action is likely later in the week. There has been much talk of an increase in the Union Pacific rate to 7 per cent, with the probability that an initial dividend will be declared on Southern Pacific at the rate of 4 per cent. The Atchison directors, and also the Louisville, the Norfolk & Western and the Chesapeake & Ohio are counted upon to increase the distribution to their stockholders, and the large increase in the earnings of all these roads certainly warrants such action. The money market has worked somewhat firmer, as a result of demands from the interior for crop purposes, and this demand will now increase, but the Treasury Department can be depended upon to furnish relief whenever the situation calls for such action. The engagement of $2,000,000 gold in Europe had a favorable influence, but our bankers are not likely to get much of the yellow metal from the other side until cotton begins to move out in a more liberal manner. This movement promises to be earlier than usual, and cotton bills are coming in more freely. The heavy and rather aggressive buying of Pennsylvania gave rise to a rumor that the dividend might be increased to a 7 per cent basis, but there does not appear to be any good ground for this. The general market situation is more encouraging, and the only drawback to a bull market of importance is the possibility of firmer money during the crop-moving period. If the dividend on Union Pacific is increased and Southern Pacific is placed in the dividend list it will have a good effect upon the entire market, and will stimulate speculative interest. The indications point to further improvement in prices, and the banking and other large interests are doing what they can to encourage confidence in the situation. The crops are making good progress, and barring accident the harvest returns will be of record volume.

Brooklyn Rapid Transit was an exception to the general strength, and was sold freely, on the decision that the 10-cent fare to Coney Island is illegal, and on the action of the company in suspending its summer schedule to the seaside as a result of the disturbances which have followed. The earnings of all the traction companies show a large increase, and it is announced that the Brooklyn Rapid Transit will carry the 10-cent fare fight to the higher court.

Philadelphia

Although a very small volume of business was transacted in the local traction issues during the past week, prices generally held firm in sympathy with the improvement in the general securities market. American Railways was a prominent feature of the week's trading, the price advancing nearly 2 points to 54 on the purchase of nearly 1500 shares. There was no news to explain the marked strength in these stocks. Otherwise the price movements were confined to narrow limits. Philadelphia Rapid Transit was dealt in to the extent of about 1500 shares, at prices ranging from 30½ to 30 and back to 30¼. Philadelphia Company common sold at 51 and 50½ for odd lots, and transactions in the preferred stock were made at 51. Philadelphia Traction was strong, sales of about 200 shares being reported at 98½ and 99. Other transactions included Rochester Railway & Light at 100 and 101, United Companies of New Jersey at 255, Lehigh Valley Traction preferred at 22¾, and Union Traction at 63¾.

Baltimore

Trading in the Baltimore traction issues was not heavy, and prices were inclined to sag. The greatest activity developed in United Railway income bonds, of which about $130,000 changed hands at prices ranging from 71¾ to 70⅝. The refunding 5 per cents were fairly active, about $68,000 selling from 90⅜ to 88¼. Certificates representing income bonds deposited brought 69 for $5,000, and upwards of $55,000 of the 4 per cent bonds brought 92⅛ and 91¾. The free stock sold at 15¼ and 15 for 200 shares, and 150 shares of the deposited stock sold at 15½.

Other Traction Securities

A feature of the Boston market has been the wide fluctuations in Boston Elevated on rather light transactions. Opening at 150, the price dropped to 147, but at the close there was a full recovery to 150. Only odd lots were traded in. Boston & Suburban brought 20 for a small lot. Boston & Worcester common advanced from 28½ to 29, while 475 shares of the preferred changed hands at from 80 to 79 and back to 79¼. Massachusetts Electric common sold at 19½ and 20, and the preferred rose from 68½ to 69½. West End sold at 95 and 94½, and the preferred at 110½ and 110. Trading in the tractions at Chicago was practically at a standstill. West Chicago sold at 30 and 29¼ for small amounts. South Side Elevated was strong with sales at 98. Chicago & Oak Park sold at 6 and 5⅞, and the preferred at 20¼ and 20.

Tractions were comparatively inactive at Cincinnati last week.

Cincinnati Street Railway sold at 143 even with the previous sale. Detroit United gained a point to 96. Cincinnati, Newport & Covington preferred was stationary at 97½. Cincinnati, Dayton & Toledo declined fractionally to 26⅝, a block of the 5s of this company sold at 93. Toledo Railways & Light suffered a fractional decline to 32⅜. Cleveland Electric sold unchanged in Cleveland the latter part of the week. In spite of the court decision, which Mayor Johnson claims favors the city, the stock did not slump below 70, where it has stood for several weeks. About a thousand shares changed hands. Lake Shore Electric declined a point on news of the terrible accident referred to in this paper last week. It has been pointed out, however, that there was no good reason for this, as it is claimed that the company is protected by an accident fund which will cover the loss. The approaching consummation of the purchase of the Canton-Akron by the Northern Ohio Traction & Light caused a slight decline in the stock of the latter company, because it is probable that many of the Canton-Akron holders who received the Northern Ohio stock will place it on the market. Several lots of Northern Ohio sold at 28¾, lower than it was sold for several months. Cleveland & Southwestern Traction sold at 16, a fractional advance on news of a fine statement for last month. A block of this company's 5s sold at 93½, a jump of 3½ points from the last sale. Bidding for Aurora, Elgin & Chicago preferred was strong, and the price jumped three-fourths of a point to 78¼. The earnings of the company are responsible for the increased price.

Security Quotations

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

	Aug. 8	Aug. 15
American Railways	52⅛	54
Boston Elevated	*147	149
Brooklyn Rapid Transit	80⅛	76⅜
Chicago City	160	160
Chicago Union Traction (common)	4¾	4¾
Chicago Union Traction (preferred)	15	15
Cleveland Electric	81	81
Consolidated Traction of New Jersey	78	78
Consolidated Traction of New Jersey	78	78
Detroit United	94¾	92
Interborough-Metropolitan, W. I.	36½	36½
Interborough-Metropolitan (preferred), W. I.	77⅛	78¼
International Traction (common)	a55	a55
International Traction (preferred), 4s	78	78
Manhattan Railway	147	—
Massachusetts Electric Cos. (common)	19¾	19½
Massachusetts Elec. Cos. (preferred)	69½	69
Metropolitan Elevated, Chicago (common)	28	28
Metropolitan Elevated, Chicago (preferred)	66½	68
Metropolitan Street	—	106
North American	95½	95¼
North Jersey Street Railway	27	27
Philadelphia Company (common)	50¾	50¼
Philadelphia Rapid Transit	30⅜	30
Philadelphia Traction	98¾	98¾
Public Service Corporation certificates	68	68
Public Service Corporation 5 per cent notes	95½	95½
South Side Elevated (Chicago)	96	96
Third Avenue	124	126
Twin City, Minneapolis (common)	113	112½
Union Traction (Philadelphia)	63⅝	63½
West End (common)	—	—
West End (preferred)	—	—

a Asked. * Ex dividend.

Metals

Great activity continues in all branches of the iron and steel markets. Producers report an extremely heavy demand for steel for next year delivery, and it is said that some of the independent mills have withdrawn from the market for this year's deliveries. Iron remains unchanged, but in some quarters higher prices are predicted for finished products. Pig iron continues in enormous demand at full prices. No. 2 Southern Foundry at Birmingham is quoted at 15 and 15.25, and No. 2 Northern is quoted at 18.25 and 18.75.

Copper metal ruled firm, but unchanged as to price. Quotations are 18⅝ and 18¾c. for lake, 18⅜c. asked for electrolytic, and 18 and 18¼c. for castings.

INTERBOROUGH-METROPOLITAN STATEMENT FOR QUARTER ENDED JUNE 30.

The statement of the Interborough-Metropolitan Company for the quarter ended June 30, issued Aug. 14, with a similar statement for the New York City Railway Company and its allied companies, shows a surplus of $56,125, or approximately one-sixteenth of 1 per cent on its $100,000,000 of common stock. This is at the rate of one-quarter of 1 per cent a year. Compared with last year's figures at this time, which, though the Interborough-Metropolitan Company was not yet organized, may be computed from the earnings of the constituent companies, the surplus shows an increase above the then deficit of $584,517. The showing made by the merged company is largely due to an increase in gross earnings from operation of $939,867, and a decrease in operating expenses of $18,908. The decrease in operating expenses is to be chiefly credited to the surface lines.

The consolidated statement of the New York City Street Railway Company shows a decrease of $62,648 in expense of operation and an increase in gross returns from operation of $198,546. The statements of the two companies follow:

INTERBOROUGH-METROPOLITAN COMPANY

Statement showing combined operations of the Interborough Rapid Transit and New York City Railway systems for the quarter ended June 30, 1906, and 1905:

	1906	1905
Earnings from operation	$11,030,377	$10,090,510
Operating expenses	5,280,646	5,299,554
Net earnings	$5,749,731	$4,790,956
Other income	240,670	275,853
Gross income	$5,990,401	$5,066,809
Interest and rentals, including 7 per cent per annum on unexchanged Metropolitan Street Railway Company stock and 5 per cent per annum on Interborough-Metropolitan Company preferred stock	$4,486,268	$4,319,619
Taxes, excluding special franchise taxes of New York City Railway system in litigation	660,508	575,582
Total interest, rentals and taxes	$5,146,776	$4,895,201
Balance	$843,625	$171,608
Dividends on Interborough Rapid Transit Company stock	787,500	700,000
Surplus	$56,125	.....

NEW YORK CITY RAILWAY COMPANY AND ITS ALLIED COMPANIES

Consolidated statement of income for the three months ended June 30, 1906, and June 30, 1905:

	1906	1905
Gross earnings from operation	$5,740,213	$5,541,667
Operating expenses	3,156,020	3,218,668
Net earnings from operation	$2,584,194	$2,322,999
Income from other sources	117,586	119,301
Gross income from all sources	$2,701,780	$2,442,300
Deductions from income	3,019,051	2,972,635
Net income	*$317,271	*$530,335

* Deficit.

LIMA & EASTERN FINANCED

The Lima-Eastern Electric Railway, which proposes to build a line connecting Lima, Kenton and Marion, a distance of 55 miles, will be financed by a syndicate of Cleveland and New York people. The negotiations on the part of the company have been in the hands of W. H. Wyke, general manager, and C. B. Shode, treasurer of the company. At a meeting held in Mansfield last week, the contract was entered into for the sale of the company's property, consisting of right of way, franchises, profiles, maps, etc. A meeting of the stockholders has been called to authorize the sale at the earliest possible moment. The F. S. Pease Engineering Company, of Cleveland, representing the Cleveland people, will have charge of the engineering work for the line.

STREET RAILWAY RIOTS IN BROOKLYN

On Saturday, Aug. 11, a decision was handed down by Justice Gaynor, of the Supreme Court, sitting in Brooklyn, in the case of a passenger from Coney Island who refused to pay a double fare, to the effect that the passenger was not "guilty of a breach of the peace in simply disputing the right of the conductor to make him pay a second fare. He had the right to refuse to pay it and is discharged." As a result of this decision many of the passengers to the Island on Sunday over the Brooklyn Rapid Transit and Coney Island & Brooklyn lines took it upon themselves to interpret the finding to mean that they would be justified in not paying the additional fare, which is collected in the outlying districts of the city, about 2½ miles from the Island, and a number did refuse to pay. These passengers were requested to leave the cars by the companies' special officers, and not complying complacently, were ejected. In a number of instances the passengers became unruly, and the aid of the police had to be secured to suppress the hoodlum element. These skirmishes with passengers interfered with traffic, and in the evening, when the 250,000 or more pleasure-seekers were returning home, a block resulted on the Brooklyn Rapid Transit lines which tied up traffic for more than 2 hours, and stalled the cars from Kensington to Coney Island, a distance of about 4 miles. Messrs. Smith, Dutton, Wood, Davis and Cooley, of the Brooklyn Rapid Transit, were all at the Kensington station in the evening, and Secretary and Treasurer Cannon, of the Coney Island & Brooklyn Company, was at Coney Island Avenue and Twenty-Second Avenue to direct the handling of traffic. The police seemed to be entirely at sea as to their authority in the matter, and when they did act complicated matters. This was instanced in their arrest of several Brooklyn Rapid Transit motormen, who refused to move their cars until the conductors had secured all the fares. Bird S. Coler, who was elected president of the borough of Brooklyn on the Municipal Ownership ticket, and who has been avowedly hostile to the Brooklyn Rapid Transit Company, was present at one of the points of disturbance, and urged the rioters not to pay the second fare. He has since given out several interviews in which he has stigmatized any one who paid a second nickel as only "half a man." The routes of the lines are all within the city limits, but the companies operate over leased lines organized and formerly run as steam railroads. On this it is that they base their right to the extra fare.

Col. Timothy S. Williams, vice-president of the Brooklyn City Railway Company, said in relation to the matter:

"We believe that we are fully within our rights in the matter. If there are persons who think that we are not entitled to the 10-cent fare, all that any one of these persons has to do is to take a train to Coney Island, go to the point where the extra fare is collected and there refuse to pay it. If that person then leaves the car and commences suit for the penalty of $50 prescribed by law, in addition to the fare lost, he then can test the law to his satisfaction—and to ours. We would welcome a suit of this kind in order to make the fact known that we are within the law absolutely clear to all.

"The persons who go down to the point where the second fare is collected, and there go about making a fuss do not proceed in the right way. They show that they are merely looking for trouble. That is not the way to accomplish a public good, which I am given to understand was the underlying object of Judge Gaynor's decision, rendered at 3:30 o'clock on Saturday afternoon, at about the time when the heaviest traffic to Coney Island is beginning.

"Under the law we are not limited to a charge of 10 cents for a ride to Coney Island. Where one railroad company takes a lease of another and runs the second road as a part of its complete system, it is entitled to charge what was the legal rate for a male adult passenger on that road. The steam railroads which we took over and converted to form a union with the electric system were entitled to charge 3 cents a mile. That would make the fare to Coney Island by steam road 18 cents. Add to that 5 cents for the electric part of the road in operation before the junction was effected with the steam road, and the total cost is 23 cents. Instead, we charge 10 cents, which is a little over half of what the steam roads used to charge.

"We could not possibly charge less than 10 cents and support the expenses of the road. However, as I have said, we would be only too glad to have a test case made of the charge, so as to set forth our charge as legal until such time as the law is changed."

The dispute between the Brooklyn Rapid Transit Company and those riding over its lines to Coney Island, who regard the 10-cent fare illegal, was cleared somewhat Wednesday by the company's promise to give rebate checks to those who pay the second fare. A test case will be taken to the Court of Appeals, and if the court decides that the railway company has no right to charge the 10-cent fare now demanded, each check will be redeemable by the company for a nickel. In case the court decides for the company's contention the checks will be valueless.

The sanest expression of editorial opinion that appeared in the Metropolitan press while the relations between the company and its patrons were strained, probably appeared in the New York "Times" on Wednesday morning. The gist of this opinion follows:

"Acting Mayor McGowan correctly describes President Coler as 'a great poser' and as a man who 'is inciting riot.' The course pursued by Sheriff Flaherty is entirely consistent with the policy adopted by the President of the Borough. With much propriety Judge Gaynor's remarks upon the double fare to Coney Island, delivered as an unnecessary addendum to a decision discharging a prisoner, have been criticised as untimely, superfluous, and ill-judged. His Honor's observations precipitated disgraceful and continued public disorder because of his failure, whether by intention or oversight, to say what he should have said, that the opinions he expressed were merely individual views and not an authoritative declaration of the law binding upon the company. He issued no order, the company was not concerned in the matter, and hence was powerless to appeal. No course was open to it but to continue the collection of its lawful fares, and to eject from its cars as disorderly persons those who refused to pay."

JOSEPH RAMSEY IN NEW YORK-CHICAGO PROJECT

The announcement was made on Wednesday that Joseph Ramsey, Jr., former president of the Wabash Railroad, and foreign capitalists are planning to build an electric railroad from New York to Chicago by way of Pittsburg. As a preliminary step in the furtherance of the project papers of consolidation are to be filed in Harrisburg within a few days of the Indiana, Clearfield & Eastern, the Allentown, Tamaqua & Ashland, and the Brush Creek & Crow's Run Railroads. It is intended to use the Lorain, Ashtabula & Southern, which is now approaching completion in Ohio, as a feeder for the new line. The Indiana, Clearfield & Eastern and Allentown, Tamaqua & Ashland Railroads form the main system in Pennsylvania. The Indiana, Clearfield & Eastern begins at Pittsburg and follows the Allegheny River up to a junction of that stream with the Kiskiminetas, opposite Freeport, and traces the Kiskiminetas up several miles to a point near Leechburg, where it crosses Crooked Creek, running up that stream through South Bend, Shelocta and Creekside. Thence it crosses the Black Lick Creek and crosses the Divide to the west branch of the Susquehanna River, which stream it spans at Cherry Tree. From there it passes through Westover, near Irvona, on the Bells Gap division of the Pennsylvania, through Beccaria, crossing the main Allegheny Mountains near Sandy Ridge. It is near this point that the Pennsylvania lines to Tyrone and Clearfield cross the Allegheny Mountains. The main line continues by way of Selins Grove, crossing the valley of the Susquehanna at that point. It thence strikes into the valley of Mahanoy Creek, and follows that stream through Ashland and Mahanoy, and tunnels Buck Mountain for a distance of 3000 ft. It then reaches Lizard Creek by way of Tamaqua, and the Blue Ridge is pierced by a tunnel 5000 ft. long to Jordan's Valley, which is traced on to Allentown on the Lehigh River. The road continues to Easton on the Delaware, the extreme Eastern point in the State. Several very short lines have been located through New Jersey, where the low ground makes easily possible a line into Jersey City. The total distance from Pittsburg to New York by the new line is 380 miles.

Joseph Ramsey is credited with the following signed statement relative to the new project:

"We expect to make a start this fall and begin work next spring, hoping to complete the line between Pittsburg and New York within three years. The cost of the line between Pittsburg and New York is estimated to be between $75,000,000 and $100,000,000, all of which has been pledged, the bulk of it by foreign capitalists. It would not be wise for me to give details or names now.

"The line is not merely a preliminary survey, but a final location that has been revised three times. Three corps have been busy for three years. It is the best possible short low-grade line to be secured through Pennsylvania between Pittsburg and New York. The extension of the road west to Chicago from Pittsburg will be taken up when the line east to New York is completed."

BOSTON ELEVATED PETITION TO BE CONSIDERED AUG. 20

The plans of the Boston Elevated Railway for the proposed extension through the West End have been formally filed with the city, and the petition of the company will come up before the Board of Aldermen at a public meeting on Aug. 20, and at some subsequent date will go to the Railroad Commissioner. The new route, as laid out in the plans, will traverse the city from the North Station to the Charles River dam, taking in entire blocks of brick tenements, crossing seven streets, but avoiding Leverett Street, the main highway of the West End. The plans show three interesting features, namely, a new elevated station in Causeway Street, where the new line will pass in front of the passenger terminal of the Boston & Maine Railroad; a two-way connection with the existing elevated railway at the corner of Canal and Causeway Streets, and an entire absence of curves except at the place where connection is made with the existing structure and at the place where the proposed line swings out of Causeway Street to make the long diagonal in the direction of the dam. What the plans are with reference to the present North Station stop on the elevated does not appear. Possibly the present station between Canal and Haverhill Streets will be left as it is, and the new one at the end of Friend Street used in connection with it. This new location is asked for by the railway company under authority given by the Cambridge Subway Act, passed last May. But that act did not name specifically any such route as has been proposed. The act said that the new line might go by way of Causeway, Lowell, Brighton and Leverett Streets, locations existing under the provisions of Chapter 548 of the Acts of 1894," the original elevated railway act; but it said further, that "for the curves" the extension might be made "in and over such other intervening public or private ways or lands" as the Mayor and Aldermen might approve.

ANNUAL REPORT CENTRAL PENNSYLVANIA TRACTION COMPANY

The annual report of President Musser, read at the recent annual stockholders' meeting of the Central Pennsylvania Traction Company, shows among other things an increase in gross receipts of $100,789 over the year previous. The gross receipts during the year ending June 30, 1906, were $640,356.14, and operating expenses $309,856.73, leaving the net earnings $330,999.41. Taxes and rentals amounted to $214,836.67, leaving surplus earnings of $116,162.73. The company carried 15,967,412 passengers during the year, and the company's mileage was 2,222,765, as compared with 2,021,976 the year previous. During the year just closed the company put in operation the line between this city and Hummelstown, and put down considerable double track, and now have 63.92 miles of single-track road in operation daily. The company expects to have the new power plant in South Harrisburg in operation by Oct. 15, 1906, when both the old Harrisburg and Steelton plants will be dismantled and the old machinery sold. The improvements at Paxtang Park include a swimming pool 50 ft. x 100 ft., and a boating lake, also a subway at the park entrance, which will be completed by Aug. 15, 1906. During the coming year the company will lay track on Cameron Street from Forster to the northern city limits; on Thirteenth Street to the eastern city limits; on North Street from Third to Capitol; and on Third Street from Walnut to North, the latter being a second track. These directors were elected to serve for three years: E. W. S. Parthemore, James Russ, Jr., William H. Seibert, F. Eugene Wolz and E. Z. Wallower. At a subsequent directors' meeting the present officers of the company were all re-elected.

IMPORTANT ILLINOIS ROAD FINANCED

A syndicate of leading bankers in Cleveland has undertaken the financing of the Chicago, Lake Shore & South Bend Railway Company, which was originally promoted by J. B. Hanna, F. B. McMillen, F. B. Wagner and others of Cleveland. The road will be one of the most important links in the chain of lines between New York and Chicago. The eastern terminus of the road will be South Bend, Ind. From there to Michigan City it will parallel the Lake Shore & Michigan Southern. Then it will run due west to the new town of Gary, which promises to become the most important steel producing center in the country, enormous plants being erected there by the Steel Corporation. From that point it will go to Indiana Harbor and thence to Kensington, on the outskirts of Chicago, from which point it is stated that the center of the city will be reached under an arrangement to utilize the tracks of the Illinois Central. The new line will serve a population of 250,000 outside of Chicago. The road will be built entirely on private right of way, except through cities where fifty-year franchises have been obtained. The construction will be of the highest order, with heavy rails and approved grade crossings, and with practically no grades or curves. It is expected that the road will be completed by Sept. 1, 1908.

ST. LOUIS CAR COMPANY TO BUILD AUTOS

The Kobusch Automobile Company, of St. Louis, will be absorbed by the St. Louis Car Company, and will be operated as a part of the car plant. Arrangements are now being made to merge the automobile company in the car company, and the management will soon be in a position to make an announcement that the absorption has been effected. As the St. Louis Car Company controls the stock of the Kobusch Automobile Company, George J. Kobusch being the dominant officer in both institutions, the merger will be accomplished without any difficulty. The automobile company was originally operated in connection with the car company, and the new arrangements practically will be to return to the initial organization. The automobile company manufactures the American Mors machine, for which it holds the American rights.

ST. LOUIS MERGER RATIFIED

The proposition of the management of the United Railways Company to merge the St. Louis & Suburban system, on the basis of an exchange of United Railways preferred stock for the stock of the St. Louis & Suburban Company, was ratified Wednesday, Aug. 8, by vote of the stockholders of the United Railways Company. The stockholders of the Suburban system met at the same hour, and voted to accept the offer of the United Railways Company. Most of the stockholders were represented by proxy. President Begg, of the United Railways Company, said that the amalgamation of the new system and the consequent issuance of transfers from one line to another may not be brought about for some time, perhaps for six months. The total stock issue of the United Railways Company, including common and preferred stock, is 378,970. Out of this number 321,705 shares were voted in favor of the consolidation, and 2650 shares against it. The Suburban stockholders cast 35,678 votes for the proposition. This represents 90 per cent of the entire stock issue of the Suburban Company.

INTERURBAN SERVICE FOR NEW HAVEN, MERIDEN AND MIDDLETOWN

The statement is made in New Haven that the city of Hartford will be given additional time in which to consider the application of the New York, New Haven & Hartford Railroad to lay T-rails in that city preparatory to the inauguration of an interurban service over its steam lines into the city, and that the company will devote its energies to perfecting arrangements for giving New Haven, Meriden and Middletown such a service, as none of these cities object to the use of the T-rail to a limited extent within corporate limits. Commenting on this situation the Hartford "Courant" says: "The opposition to this project has been incomprehensible to us from the start. It is utterly unlike Hartford. This is not a community that ordinarily wants to raise hay in Main Street, or that bases the value of real estate on the quiet of the locality. Looping New Haven, Meriden and Middletown will develop a large trade, and it will go away from instead of to Hartford. Our loss is their gain, as the tombstone poets sing; and we still have the dinky engine, the grooved rail and the satisfaction of turning down a great railroad's president. The other fellows get the business."

FOUR-TRACK LINE FROM BUFFALO TO NIAGARA

The Frontier Electric Railway Company has been organized as a subsidiary company of the International Railway Company, of Buffalo, to build a modern high-speed, double-track electric railway, mainly on its own right of way, from Buffalo to the entrance of the new bridge at Niagara, for which charters have already been obtained form the State of New York and the Dominion of Canada. Of the project President Pierce, of the International Company, is quoted as stating:

"It is proposed to double track the existing line between Lockport and Tonawanda, not only to take care of the ever-increasing traffic from Lockport to Buffalo and Niagara Falls, but also to provide for the very large increase in traffic which will immediately follow the completion of the electric railway now being constructed between Rochester, Brockport, Medina, Albion, Middleport and Lockport. The new railway company will also make connection at the new bridge at Niagara Falls with the fast electric railroad owned by the MacKenzie-Mann-Nicholls syndicate running from Toronto through Hamilton to Niagara Falls, the rights of way for which have been acquired and the contracts for the construction of which are now about to be let."

PROGRAM OF THE INTERNATIONAL STREET RAILWAY CONVENTION AT MILAN

The program of the convention at Milan of the Union Internationale de Tramways et de Chemins de fer d'inérêt local (Internationaler Strassenbahn und Kleinbahn-Verein) has just been published. It is as follows:

Sunday, Sept. 16, Evening.—Reception to delegates and ladies at the Bourse Salon, distribution of badges, etc.

Monday, Sept. 17, Morning.—Opening of convention by his honor the Minister of Public Works of Italy. Afternoon—Visit to various manufacturing establishments in Milan. Evening—Banquet to delegates, extended by the Italian Government.

Tuesday, Sept. 18, Morning.—Second session of the convention. Afternoon—Visit to the Exposition, with luncheon at the Belgian section, extended by the Belgian Commissioner General. Evening—Reception by the Italian Edison Electric Company and visit to its power station. At this meeting a paper will be presented on "Steam Turbines and Their Application to Electric Traction," by G. Semenza, of the Italian Edison Electric Company.

Wednesday, Sept. 19.—Excursion to Lake Maggiore and to Varese.

Thursday, Sept. 20, Morning.—Third session of the convention. Afternoon—Excursion to Pavia.

Friday, Sept. 21, Morning.—Fourth session of the convention. Afternoon—Excursion to Monza, stopping at Sesto S. Giovanni, to visit the manufacturing works at that place.

Saturday, Sept. 22.—A choice of two trips is offered, viz.: (1) to Bergamo and the Val Brembana, to inspect the Westinghouse single-phase road, or (2) to Sondrio and the Valtellina, to inspect the Ganz three-phase road. In the evening the delegates will be entertained at a banquet extended by the Municipality of Milan.

THE SITUATION IN CLEVELAND

In deciding the injunction suit over the right of the city to tear up the tracks of the Cleveland Electric Railway on Fulton Road, extended reference to which has been made in previous issues, Judge Lawrence, of the Common Pleas Court, gave a partial victory to the old company by deciding that the city had not acted in a legal manner in that the resolution calling upon the company to remove its tracks and the resolution instructing the Board of Public Service to do the work after ten days, had not been read before the Council on three different days, and that an action thus taken is absolutely void. He gave the company the right to restore its tracks, but added that if the Council later adopted the resolution in a legal way that the tracks would have to be moved, as he denied the contention of the company that it enjoyed vested rights in any particular part of the street, adding that the street was wide enough for two tracks. He denied a mandatory injunction requiring the city to restore the track at this time. The Forest City Company was restrained from laying another track on the street or doing any work whatever until further action had been taken by the Council. Both parties to the fight claim victory in this decision. The Forest City Company is now endeavoring to induce the old company to allow it to lay two tracks on the street for the joint use of both companies at terms most favorable to the old company, and the old company is still considering the matter.

In their advertisements in the daily papers the contending parties are having warm arguments as to the question of whether the old company, in case the new company builds its lines, will be compelled to exchange transfers. Upon this question practically hinges the whole matter of the advantages of the two propositions —3 cents fare or seven tickets for a quarter. President Andrews contends that the proposition is ridiculous; that his company cannot be compelled to exchange transfers under existing franchises. He points to the fact that the old lines owned by Mayor Johnson, both in Detroit and Cleveland, never exchanged transfers with other companies, and referred to the great confusion of systems in Chicago, Dayton and other large cities where there are several companies. Mayor Johnson reiterates that the company's best grants expire in three years, and that self-defense will oblige it to seek a transfer alliance with the so-called Municipal Company. Mr. Andrews has proved to the satisfaction of nearly every one that this is untrue.

A new wrinkle in the advertising compaign of the old company is the erection of large signboards in various parts of the company setting forth its arguments.

An entirely new angle has been created by the announcement, on Monday of this week, by Councilman Hitchens, who fathered the Cleveland Electric ordinance of seven tickets for a quarter, that he is now in favor of the Detroit plan of settlement (referred to in our last issue). In brief he says he will vote to bring before the vote of the people at the November election an ordinance requiring the company to give ten tickets for a quarter during the workingmen's hours of 6:30 to 8:30 a. m. and 4:30 to 6:30 p. m., with six tickets for a quarter and 5-cent cash fare during other hours, with universal transfers at all times. Nothing is said about a proportion of the gross receipts going to the city, which is a feature of the Detroit ordinance agreed upon. Hitchens now stands for a twenty-year franchise in place of the twenty-five-year grant called for in his original proposal.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED AUG. 7, 1906

827,710. Electric Tram Car; George J. Conaty, Smethwick, England. App. filed Oct. 17, 1904. Details of a car in which the axles, after having moved radially in passing around the track or curve are quickly brought back to their normal positions relatively to the car.

827,827. Rail-Bond; Charles R. Sturtevant, Mansfield, Ohio. App. filed Dec. 2, 1904. A terminal is provided on the rail-bond adapted to be applied to a rail or other part to be bonded, the surface of the terminal to be applied to the rail or other part having projections of uniform height whereby a uniform space is provided there between.

827,829. Trolley; George C. Thomas, New York, N. Y. App. filed Aug. 26, 1905. Rigid frames are provided on the trolley comprising casings, each casing having an inwardly projecting bearing lug on its depending lower portion, in connection with a bearing bar having a flat upper surface rigidly secured in said lugs to connect said casing, and forming an axially-located bearing surface, each casing having an angularly disposed ball race with a substantially straight lower portion, a facing for said lower portion, balls in said race, and a yoke having openings at either end to loosely engage said bearing bars.

827,880. Fluid Pressure Brake; Augustus Parker-Smith, New York, N. Y. App. filed Dec. 1, 1905. In a fluid pressure brake system for trolley and other cars there are employed, in connection with the brake levers of a main pressure cylinder and piston connected to said levers, a second cylinder and piston supplied with fluid under pressure from the first cylinder, means for connecting the piston of the second cylinder to the brake levers when said piston moves on its out stroke, a valve controlling the flow of air from the main cylinder to the second cylinder, which valve is set to open at a predetermined pressure and a check valve controlling the return flow of fluid from the second cylinder to the main cylinder.

827,947. Automatic Signal; William A. True, Rulo, Neb. App. filed Nov. 27, 1905. An alarm is located in proximity to the driver of the railway motor. In connection therewith a pivoted latch is

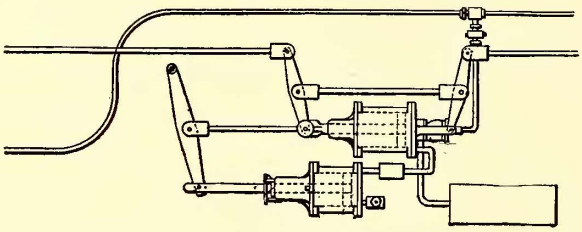
employed adapted to control the alarm, together with a rod mounted upon the motor, an extension projecting from the rod in such a manner as to actuate the latch, an arm pivoted to said rod for contacting with posts located at predetermined points along the roadbed, whereby the alarm may be sounded, and a spring for returning the rod to its normal position.

828,014. Electro-magnetic Railway Switch; Rollin A. Baldwin, South Norwalk, Conn. App. filed July 17, 1903. A railway switchpoint is positively reciprocated in both directions by means of a magnet, thus dispensing with the use of a spring which is commonly employed for moving the switchpoint in one direction.

827,977. Composition of Matter; Louis F. Johnson, Chicago, Ill. App. filed Jan. 10, 1906. The composition of matter covered by this patent is designed for use as a brake-shoe facing or insert, the same consisting of granulated cinder, asbestos pulp, salt, wood pulp, cement, sulphate of magnesia and creosote.

828,054. Track Mechanism for Railroad Crossings; John W. Renner, Cadillac, Mich. App. filed May 29, 1906. The rails terminate short of the points of crossing to provide passageways for the flanges of the car wheels, and a moveable splice bar or bridge element is located at each point of crossing common to two crossing rails, the same being designed to be automatically shifted to bridge the space between the ends of the rail at the time the rails are in service. The patent covers details of the mechanism for automatically shifting the bridge element and for shifting a signal arranged adjacent the crossing.

828,112. Car Replacer; Nicolas F. Hess, Atchison, Kan. App. filed April 18, 1906. The car replacer of this patent has a body portion gradually reduced in thickness in a forward direction, the tread surface of said body portion being provided with a vertically projecting flange adjacent to one edge thereof, and formed with a groove extending at an angle to the side edge of the tread portion and opening at its rear end to one side of the tread portion.



PATENT NO. 827,880

828,184. Railway Brake; Samuel Britton, Twilight, Pa. App. filed May 3, 1906. A friction brake is carried by the car, the same being used in connection with a continuous rack-bar and a toothed wheel arranged between the track rails and a train of gearing, together with a sprocket wheel for revolving a brake shaft and brake wheel carried thereby.

828,159. Brake-Shoe Fastening; Samuel Webb, Glassport, Pa. App. filed Jan. 10, 1906. The brake-shoe is provided with a lug, and has a key passing through said lug, the key having a hooked engagement at its ends with the ends of the brake head.

828,263. Switch Operating and Locking Device; Alfred Anderson, Detroit City, Minn. App. filed Nov. 21, 1905. Two rock shafts are employed, one designed for locking engagement with the switch bar, and the other provided with means for engaging the switch points, with a connection between said rock shafts whereby they will operate simultaneously.

PERSONAL MENTION

MR. W. W. S. BUTLER, of Grand Rapids, Mich., has been appaonted general manager of the Newport News & Old Point Railway & Electric Company, succeeding Mr. H. H. Carr, resigned.

MR. C. V. MILLS, superintendent of the Chester (Pa.) Traction Company, has resigned. Mr. Mills was in charge of the company's interests for two years.

MR. E. J. KOPPITZ, engineer for Westinghouse. Church, Kerr & Company, leaves this week for Rochester to superintend for that corporation the installation of the 11,000-volt single-phase railway being built for the Erie Railway between Rochester and Mt. Morris.

MR. E. B. JOHNS is to be superintendent of transportation of the new Norwich-Westerly Street Railway Company, having in charge the actual operation of the cars of the road and all that pertains to them. Mr. G. W. McClure will be the superintendent of motive power, in charge of the power house, etc. Both of these gentlemen come from the Michigan Union Traction Company, of Lansing, Mich.

MR. H. B. AINSWORTH, manager of the Los Angeles & Redondo Railway, and for twelve years with the company, has resigned, and is succeeded by Mr. C. H. Burnett. Mr. G. J. Kuhrts has been appointed chief engineer. Other appointments are Mr. C. O. Anderson, superintendent of the line department; Mr. L. O. Lieber, electrical engineer; Mr. C. A. Henderson, auditor; Mr. E. T. Cook, auditor of the Huntington-Redondo Company.

MR. ROBT. L. KELLY, chief engineer of the Florence Electric Street Railway, of Florence, Col., well known throughout the West, was struck by lightning near Raton, N. M., July 24, and instantly killed. Mr. Kelly was a native of Lebanon, Ky., and was 41 years old. He went West some time years ago, and did considerable important engineering work for the railroads, more especially the Denver & Rio Grande. At the time of his death he was locating a road eastward through a very mountainous section from Raton.

MR. J. W. HOLLIDAY has been appointed superintendent of the Montgomery Traction Company, to succeed Mr. C. C. Hogshead, resigned, who has gone to Lynchburg, Va., to take the position of superintendent of a gas plant owned by the same syndicate which owns the Montgomery Traction Company. Mr. Holliday, the new superintendent, was superintendent of the traction company when Mr. E. E. Winters was its general manager. In March, 1895, when the property of the traction company passed into the hands of the syndicate of which Mr. R. D. Apperson, of Lynchburg, is president, Mr. Holliday was retained by the syndicate, and has since that time had charge of overhead work of the Montgomery Traction Company.

MR. D. A. HEGARTY has resigned as general superintendent and chief engineer of Railways Company General, and accepted a position as general manager and treasurer of the Little Rock Railway & Electric Company, of Little Rock, Ark. He entered upon his duties Aug. 1. Mr. Hegarty entered the electric railway field after six years service as assistant engineer of construction on the Pennsylvania Railroad, becoming associated with Mr. A. Langstaff Johnston in the construction and installation of various properties throughout the country. After acting as chief engineer of construction of Hestonville, Mantua & Fairmount Railway, of Philadelphia, he became general superintendent and chief engineer of that company, remaining until the consolidation with the Union Traction Company. Then he resigned to become general superintendent of the Norfolk & Ocean View Railway, of Norfolk, Va., and later accepted the position of general superintendent and chief engineer of the Railways Company General, having charge of all operation and construction of different properties owned and controlled by it. No successor to Mr. Hegarty will be appointed, as the Railways Company General is retiring from the operating and constructing field.

MR. NORMAN McD. CRAWFORD, of Hartford, Conn., formerly general manager of the Hartford Street Railway Company, has returned from England, where he has been for the past six months investigating the condition of street railways for the committee on public ownership and operation of the National Civic Federation. The experts employed by the committee were Mr. Norman McD. Crawford, who with Mr. J. G. Woodward, of the engineering firm of Preece & Carew, of London, investigated the street railways; Mr. J. B. Klump, of Philadelphia, and Mr. William Newbigging, of Manchester, England, who investigated the gas companies; Commissioner Albert E. Winchester, of South Norwalk, and Mr. J. B. Klump, electric lighting. Mr. R. C. James, of Philadelphia, and Mr. E. H. Turner, of Manchester, England, expert accountants, examined the financial conditions of the various corporations and companies, and Prof. J. B. Commons, of the University of Wisconsin, and Commissioner J. W. Sullivan, of New York, examined the labor conditions. Mr. Crawford, in company with his English associate, Mr. J. G. Woodward, examined the Dublin United Tramways and the street railways of Glasgow, Liverpool, Manchester, Norwich, the London County Council, and the London United. The Dublin, Norwich and the London United Companies were private concerns, but the others are railways operated by the municipalities.