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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

During 1906 *the Street Railway Journal printed and circulated* 426,950 *copies, an average of* 8210 *copies per week. Of this issue* 8000 *copies are printed.*

Investigation on Useless Weight of Cars

The action of the Central Electric Railway Association at the Indianapolis meeting providing for the appointment of a special committee to look into the matter of reducing the unnecessary weight of cars is certainly a timely one, and the results of the committee's investigation will be looked forward to with expectancy. The question of the weight of electric cars has received very little consideration, and it certainly has not been given the attention that it deserves. That it is important may be comprehended with very little calculation. Assume that a car weighing 50,000 lbs. is operated at a current cost of 2 cents per mile, and that this car is run 50,000 miles a year, or an average of about 140 miles per day. The total cost of power for the year will be $1,000, or it will be 2 cents per pound of weight of the car. Assuming a car to last ten years, every pound saved in the weight of a car without the sacrifice of carrying capacity, strength or any other benefit means 20 cents to the operating company in the cost of power alone.

But some may question whether or not much weight can be saved without sacrificing some valuable feature. In this connection it might be stated that one company operating in a large city has made a reduction of 500 lbs. in the weight of its car by the substitution of pressed steel seat pedestals instead of those of cast iron. According to the assumptions made above this company will save in power during the lifetime of a car about $100 per car. The company will probably order several hundred cars of the type upon which the improvements have been made, and no one will question whether or not this step, which may result in a saving of several thousand dollars, is worthy of attention.

No doubt if an average car were subjected to a close examination and estimates were made on the probable saving in weight of fittings and attachments alone it would be found that in the neighborhood of 2 per cent of the weight of the car could be gotten rid of. The results of the study of the Central Railway Committee on this point will be of value. There are, to be sure, other advantages to be gained by eliminating unnecessary weight in cars aside from the lessening of the power required to operate the cars. The consideration that should be most effective is that decrease in cost will in most instances go hand in hand with decrease in weight.

Inspection of Line Lightning Arresters

The master mechanic's duties as a general rule should be limited to the maintenance of the cars, so that the care of the line lightning arresters logically should be left to the line department. On the other hand, the condition of the lightning arresters usually has so much influence on the expense of maintenance of the cars that from this standpoint it is advisable to put the inspection of these arresters in the charge of the most interested party, the master mechanic. If this were done, the chances are very great that the arresters would be kept in better shape than when they are in charge of the line department. The line department is not inconvenienced in the least when arresters are neglected, but the fear of having a wholesale grounding of armatures as sometimes occurs during serious storms would keep the master mechanic on the alert with regard to the condition of every arrester on the line. If some one else has the care of the arresters the master mechanic can plead the negligence of others whenever cars are put out of service during a storm. The line department may throw part of the blame back from whence it came and scatter the rest so that censure for the neglect loses much of its effect.

One thing is certain: time spent in keeping arresters in working condition is very seldom wasted, whether it be done by the shop or the line department. Some people are too prone to regard lightning as being too mysterious to be controlled and to consider as unavoidable those cases where armatures are lost through this cause. But we have a great deal of evidence that where lightning arresters are properly installed and then properly cared for the cars go through storms repeatedly without damage. An incident on one road shows what can be obtained in the way of effects when proper steps are taken. A small city system had been continually losing armatures through lightning. A few days after a new superintendent assumed charge about half the motors on the system were disabled during a storm. The new superintendent started to inspect the arresters next day, and discovered that practically all of the few he could find were not in working order. He immediately sent in an order for enough lightning arresters to equip the whole system at 500-ft. intervals, and heavy choke coils were gotten on the cars as soon as possible. Since the installation of these only one or two machines have been disabled during storms.

A few instances of this character show that faith must not be lost in the present form of arresters. It is possible that some people who are prone to depreciate them don't give them a chance. They expect them to give perfect protection when installed at possibly one-mile intervals, and to give this protection without any attention or inspection whatever. In the instance cited the arresters were placed ten to the mile. Usually they are spaced from two to five per mile, but it might be a good investment on any line where lightning is especially destructive to approximate more or to follow the practice on the small system.

Difficulties in Terminal Design

For a business which fundamentally consists of the apparently simple task of picking people up at one point and carrying them to another, always along a fixed path and for the exceedingly moderate sum of a nickel apiece, it is at times surprising even to the eye of experience that every act performed in electric railway work carries with it such far-reaching consequences. As the years of urban trolley operation lengthen into decades it becomes more and more apparent that every decision of an active street railway management with respect to design, construction or operation facilitates or impedes traffic, tends to reduce or increase the cost of maintenance, and either makes for better or poorer public service.

The relations between car design and traffic congestion illustrate these points fully, and that the importance of studying the best forms of cars for different conditions is fully appreciated by electric railway men can be doubted by no one who realizes the development which is at present taking place in the fitting of rolling stock to the public's needs. The difficulties of the problem, especially in rapid transit service, are very serious, and they are complicated to no small degree by the influence of station design upon the congestion of travel.

Experience with different types of stations, and particularly rapid transit terminals, has not been lacking in the past ten years, yet the unsettled questions are almost as stubborn as at first. The difficulties encountered in trying to satisfy the wishes of the public, meet the judicial criticisms of municipal and State authorities, and conserve the profitable and economical movement of traffic are most perplexing. One can sit in his office with a pad and pencil and figure by the hour all sorts of smooth running schedules over loops, assuming uniform station stops cut down to fifteen or twenty seconds each by an obliging public, moving the streams of entering and leaving passengers in polite curves past one another over wide platforms to their desired destination, and in general planning for a continuous flow of traffic through proper channels; but let these schemes be put in actual operation, and how quickly assumptions become invalidated! Irregularities develop in the flow of passengers past the ticket offices; people crowd into cars partly filled rather than entering cars practically empty; congestion occurs at doors, stub track berths and newspaper booths; station stops consume twice the estimated time, and finally, the intervals between cars run short and long because of external causes beyond the control of the company. The narrowing of a doorway by 3 ins., the closing of a ticket office at 6:30 p. m. instead of at 6:45, the increasing of the height of the risers in an approaching stairway by ½ in.—these minute architectural and operating features and others which might be named by the score by any one who has ever tried to design a terminal or to oversee the movement of traffic carry a weight in the resulting success of the transportation scheme. The difficulty of foreseeing future conditions makes it doubly hard to know what dimensions and arrangements are best for the long-run good of the service.

One of the most trying of these questions is whether passengers shall be transferred between cars and trains at the same level or whether surface cars shall keep to the surface and elevated or tunnel trains remain above or below ground. Off-hand it would seem to be a clear case that a direct transfer at one level is preferable on all counts, but when one considers the need of future expansion in rapid transit terminals, the question arises whether a double or triple-level arrangement may not finally prove best. The inevitable law of rapid transit facilities that new routes and opportunities to travel create new traffic and soon become inadequate applies as much to a terminal station as to the tracks and rolling stock. It is hard to foresee the conditions, and platform room which looks ample for years to come when a station is built may easily have to be increased 50 to 75 per cent within five years. Such extensions may be almost impossible if the transferring cars are brought to a common level. Again, the cost of operating cars up the 4 or 5 per cent grades common in inclined approaches to one-level terminals is another consideration, while the difficulty of running cars into a ground-level and second-story terminal without complicating the highways below too much for public satisfaction is a troublesome problem in itself, well-nigh impossible of solution.

Problems of this kind cannot all be perfectly solved in any single terminal scheme. Compromises must be inevitable results of attempts to attain an ideal design. Several points are apparently pretty well established, however,—the superiority of loop over stub track layouts, the desirability where possible of avoiding stair climbing in making transfers, the very slight need of much waiting room area in urban terminals with frequent car service, the immense advantage of separating opposing traffic streams even if a double stop at loading and unloading platforms is entailed, the value of wide platforms with straight edges parallel to the tracks, the worth of a simple and effective scheme of visually announcing car and train destinations, and finally, in very congested stations, the need of platform attendance with special police powers to cope with disorder, confusion and bewilderment among passengers. The combination of these features in the most reasonable scheme must be the basis of solution in the modern terminal problem.

Substitutes for Copper

The present enormous price of copper is a rather serious matter for electric roads that are compelled to install it on their feeder systems. Copper has now reached a price so high as to make it necessary to look sharply into the question of substitutes. Whatever may be the cause of the present prices, and information differs with respect to this, they have persisted in a way that has been both disappointing and unexpected to those who are compelled to use the metal. Nothing like it has before been known, and if it be due to actual scarcity it is certainly high time to seek other material for conducting purposes. If, on the other hand, the price is in whole or in part due to artificial causes, then its persistence over a long period argues the probability of a continuance or of the repetition of the same conditions, and leads to the same conclusions.

The two substitutes for copper most available at the present time are aluminum and iron. The former has been within the past few years extensively used as a conductor. In the earlier stages of its employment people were rather afraid of it as of uncertain tensile strength and lack of capacity for making sound joints. Its high coefficient of expansion made it somewhat difficult to string, and many engineers were decidedly afraid of it. At the present time experience has removed most of these fears. Stranded aluminum cables as at present manufactured have proved reliable and they are now being successfully employed in a good many high-voltage systems. The tensile strength of such cables is about equivalent to that of soft-drawn copper, but their relatively small weight enables them to be used with a somewhat greater factor of safety. The question of joints, too, seems to have been satisfactorily settled by the use of aluminum sleeves put on under pressure, and while the joints are more troublesome to make than in copper, we have not heard of late of any material difficulty with them when once in place. In fact, there has been recently a considerable tendency to use aluminum for long spans on account of its relatively small weight. It is also claimed that aluminum conductors are less likely to hold sleet than copper ones, and hence are less exposed to destructive strains.

With respect to cost the current price of aluminum is largely regulated by that of copper, since owing to the patent situation aluminum manufacture is at present a monopoly. Those competent to judge of the cost of producing it practically agree in holding that it can profitably undersell copper at any price reached by the latter metal within recent years. As a matter of fact its market price can be counted upon to keep materially below that of copper, and the chief present difficulty is that of securing reasonably prompt deliveries. A few years hence, when the patent situation clears itself up and foreign producers of aluminum reach the American market, the effect upon the price of copper will be very considerable and a repetition of the present situation will be well nigh impossible.

For all overhead feeder construction aluminum is surely available if it can be secured at suitable price. For working conductors and for underground cables copper has the advantage, but these uses are on the whole of a subsidiary character. With respect to iron or steel the case is different. The conductivity of steel rails, for example, is an eighth or a tenth that of copper. At any high price of copper, however, steel for equal conductivity is and is likely to remain the cheaper, particularly if, as is possible in some instances, old rails can be used for conducting purposes. On elevated structures and in subways the location of such conductors is comparatively an easy matter and they have been used to a limited extent. Of course, old rails are available only in relatively short lengths, generally 30 ft., and the question of joints is a somewhat serious one. Rails can be electrically well united, however, by electric or some other form of welding and even by some forms of bonding, and since a 70-lb. rail has conductivity about equal to a million circular mils of copper, the fundamental economy of its use is evident even at a considerable expense for making suitable joints. It is even possible to use such a conductor underground in a plank conduit filled with an insulating compound at a price probably considerably below that of insulated copper cable installed in a conduit. Of course, the utility of steel as a conductor is greatly limited by the difficulty incurred in attempting to use it with alternating currents, but as a direct-current feeder under favorable circumstances, steel, with copper at anywhere near its present price, deserves to be seriously considered.

Beyond all this consideration of metals lies the possible chance of relief by the use of high-voltage distribution for electric railways, and the last two years have made a prodigious difference in the conditions of economy as between loss of energy and investment in copper. Kelvin's law applied to the present price of copper and the present cost of the electrical energy generated in large stations, leads to results very different from those obtainable a few years ago. The application of alternating current in railway practice may make also a great change in the existing situation. With small working conductors supplying energy over long stretches of track and fed from aluminum cables transmitting high-voltage current, an electric railway within the next few years may be far less at the mercy of the copper market than is now the case. Certainly a continuance of exorbitant price of copper demands earnest consideration of every possible means of relief. Of course, copper is likely to fall in price, but if it has once reached, naturally or artificially, the figures now current, the same causes may again maintain it for long periods at high prices, and one might as well begin at once the investigation of means for avoiding its use in its present large quantities.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—THE INSPECTION AND TRUCK OVERHAULING SHOPS AT EAST NEW YORK

INSPECTION SHOP

The inspection shop is located just west of the main shop building and on a level with the second floor. The construction of a building for inspection pure and simple is another evidence of the care that the Brooklyn Rapid Transit Company is giving to the maintenance of its rolling stock. Where inspection is done in the open the inevitable consequence is that in cold or otherwise disagreeable weather the inspectors cannot perform their duties properly. Hence, slight defects are frequently overlooked and receive no attention until some serious breakdown occurs. Without question, an inspection shop that is comfortable in all kinds of weather more than pays its cost by the reduction it brings in the repair and accident accounts.

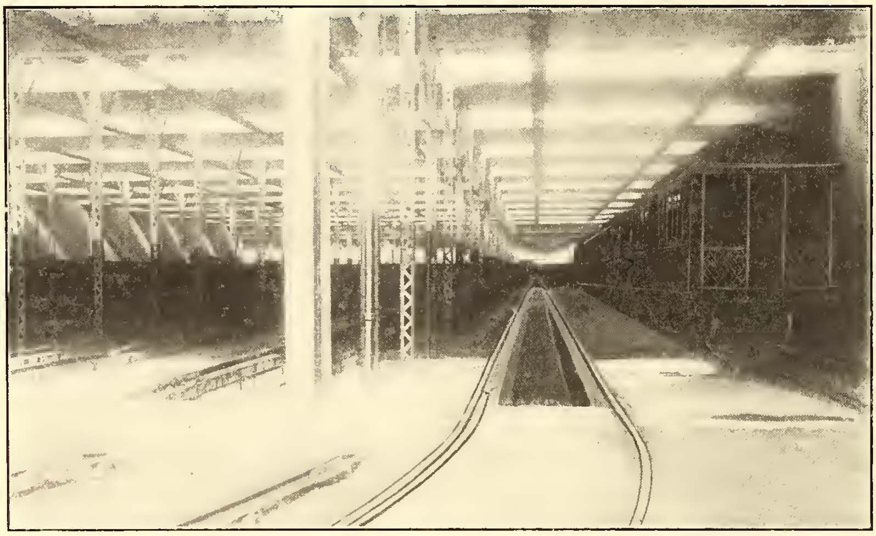


FIG. 14.—PART ENTRANCE VIEW OF THE INSPECTION BUILDING

This shop is really a complete building, as it is open only on the side entered by the eight inspection tracks from the storage yard, and even this side may be closed by lowering the one double and the six single steel rolling doors. The work done here covers almost everything that can be done without the aid of machinery, such as the inspection of the air-brake mechanism, including the compressor and hose connections; of the electrical wiring, motors and controllers throughout the train; brake rods and shoes; third-rail shoes; chipped flanges on wheels, broken axles, gears, etc. This inspection is divided among specialists in each line, so there is no difficulty in finding the man responsible for any particular defect which may later show up in service.

Each inspector is supplied with a pad of the motor and trail car forms shown in Fig. 17, on which he writes the numbers of the cars inspected and then returns the form with any remarks relative to work that requires special attention. It is customary for the man signing these forms to give his time-card number, as the latter indicates at once to the recording clerk what class of labor has been performed on the car. The reports from different men who worked on one car are then transferred to a motor-car record similar to the one for trailers, reproduced in Fig. 18, the classification covering practically every mechanical and

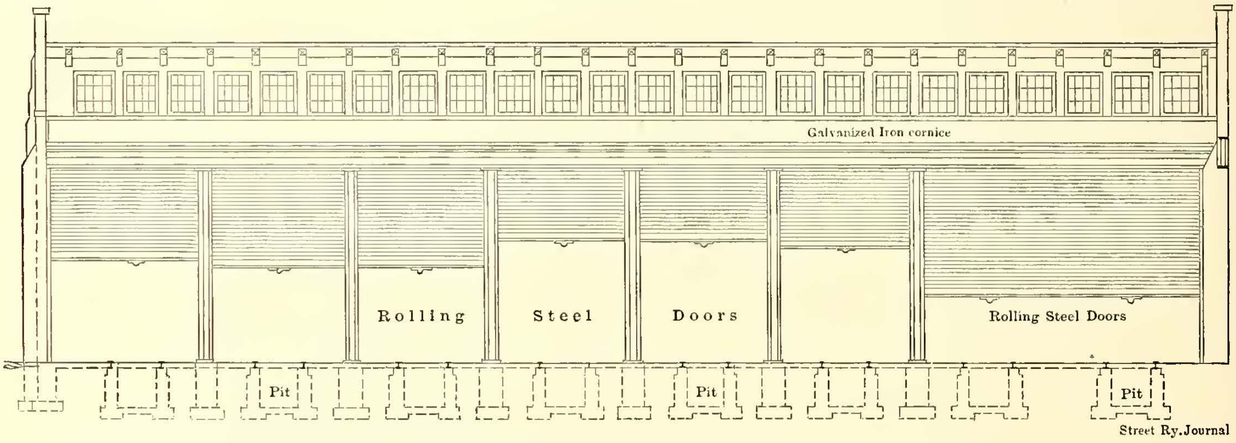


FIG. 15.—FRONT ELEVATION OF THE INSPECTION BUILDING AT THE OPEN END

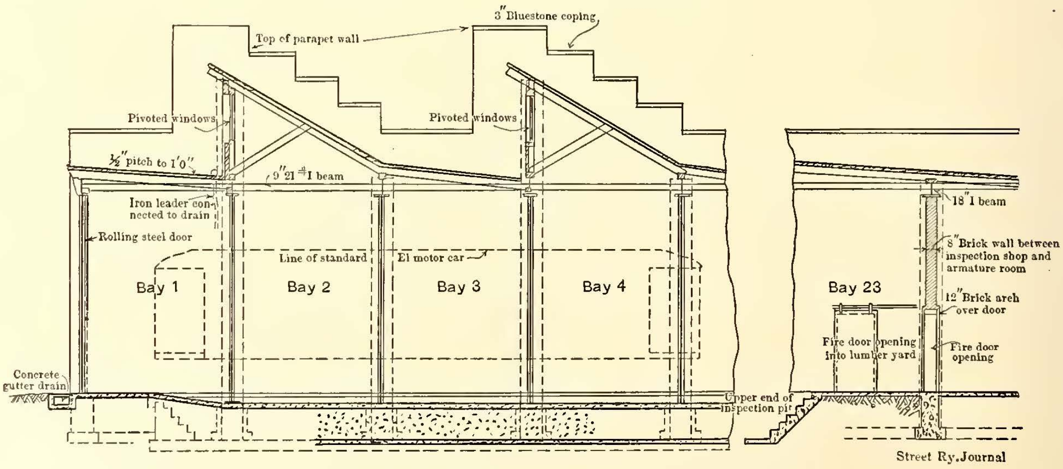


FIG. 16.—PART LONGITUDINAL SECTION OF THE INSPECTION SHOP AND ADJACENT ARMATURE ROOM

Form N. S. 639 — 100 Books 5-13-5 0-62067

THE BROOKLYN HEIGHTS RAILROAD CO.
ELEVATED DIVISION.

30 DAY
MOTOR-CAR OVERHAULING REPORT

..............Shop. Date..............190

CAR NO.	CAR NO.	CAR NO.	CAR NO.	CAR NO.

General Remarks ....

Original (white) to be forwarded DAILY to the Mech. Eng.'s Office.
Duplicate (yellow) to be left in book.

FIG. 19.—REPORT ON MOTOR-CAR OVERHAULING (NOW DONE EVERY SIXTY DAYS)

N. S. 405. — 500 Pads. 10-3-06. 0-85217

The Brooklyn Heights Railroad Company
ELEVATED DIVISION

..............190...

Inspect the following **MOTOR** cars for and put in good condition.

I have inspected and put above in good condition, except the following, which must have special attention

(Sign)..............

FIG. 17.—ORDER COVERING THE INSPECTION OF MOTOR (OR TRAIL) CARS

electrical feature in connection with rolling stock.

At the present time it is customary to overhaul motor cars every sixty days, although the form reproduced in Fig. 19 calls for thirty days. This report is made out in duplicate, the original being forwarded to the office of the superintendent of equipment, where detail records are kept of all shop matters relating to equipment.

An important function of the inspection shop is the help it affords the claim department by giving it a complete account of the condition of a car before a certain accident, what was done to repair it and the probable cause of the trouble, whether due to defects in equipment or crew. This system will be clearly understood by reference to the accompanying reproduction in Fig. 20 of the report made out by the foreman of the eastern elevated division on Aug. 9, 1906, on motor car No. 653. It will be noted that the condition of the car before the accident is determined from the records already given, which show that the car

..............DIVISION — MONTH OF..............

GENERAL INSPECTION OF TRAILER CAR NO..............

..............SHOP — FIRE EXTINGUISHER NO..............

CLASSIFICATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Car Bodies																															
Gates-Railings																															
Trucks Brakes																															
Lights-Wiring																															
Air Brakes																															
Journal Oiling																															
Receptacles																															

FIG. 18.—TRAIL-CAR REPORT ON GENERAL INSPECTION

Form N. S. No. 99. — 25M. 6-24-05. 0-60476

INSPECTION OF CAR.

REPORT.

Car No. 653 Line Canarsie Date of Accident Aug. 19th, 1906.

Date of Inspection August 19th, 1906

Claim Agent:

DEAR SIR:—The following facts are, to the best of my knowledge and belief, a correct and full statement of the condition of Car No. 653 previous to and after the accident of August 19th, 1906

CONDITION OF CAR BEFORE ACCIDENT.

From Motorman's report of car when last turned in. (Give name, date and report.)

Last inspection and repairs previous to accident. (Give date when inspected, night or day, when repairs were made and what they were.)

Motor 653 - In for Gen. Inspection Aug. 14th, 1906
" Overhauling " 10th, "

CAUSE OF ACCIDENT.

(If any part of the mechanism of the car, either electrical or mechanical, is found to have been out of order at the time of the accident, state whether they could or could not cause the accident.)

The 10:46 P.M. train from Canarsie Terminal, consisting of cars Nos. 818, 757, 751 and 653, in charge of Motorman McCann, trolley pole left trolley wire and struck span wire, bending same and in the rebound, cut hole in roof.
Cause of accident - trolley pole leaving trolley wire while train was in motion.

FIG. 20.—FIRST PAGE OF INSPECTION REPORT ON CAR INJURED IN ACCIDENT, SENT TO THE CLAIM DEPARTMENT BY THE SHOP FOREMAN

CONDITION OF CAR AFTER ACCIDENT.

(Examine carefully and report on all parts of car, truck, motors, wiring, etc. Give especial attention to those parts which may have been or are claimed to have been the cause of the accident.)

Motor 653 - Given a general inspection and found O.K. in every respect, with the exception of the foregoing.

(If any part is found to be out of order after the accident, state whether the accident could have been the cause or not.)

Additional information,

Cost to repair Motor 653: Material -- $3.00
Labor ----- 2.00
Total -- $5.00

Respectfully submitted,

..............*Name.*

Foreman East. El. Div. *Occupation.*

II
WGG

FIG. 20—(CONTINUED).—SECOND PAGE, CONTINUING THE REPORT ON CAR INJURED IN AN ACCIDENT

had been inspected on Aug. 14, 1906, and overhauled on Aug. 10, 1906. Under "cause of accident" a summary is given of the operating features in connection with this car, a description of the accident and its cause. Following this, under "condition of car after accident," the report shows that with the exception of the parts injured by the accident, the rest of the car was O K. Hence, in this case no defect in the car itself was responsible for the trouble. It will be

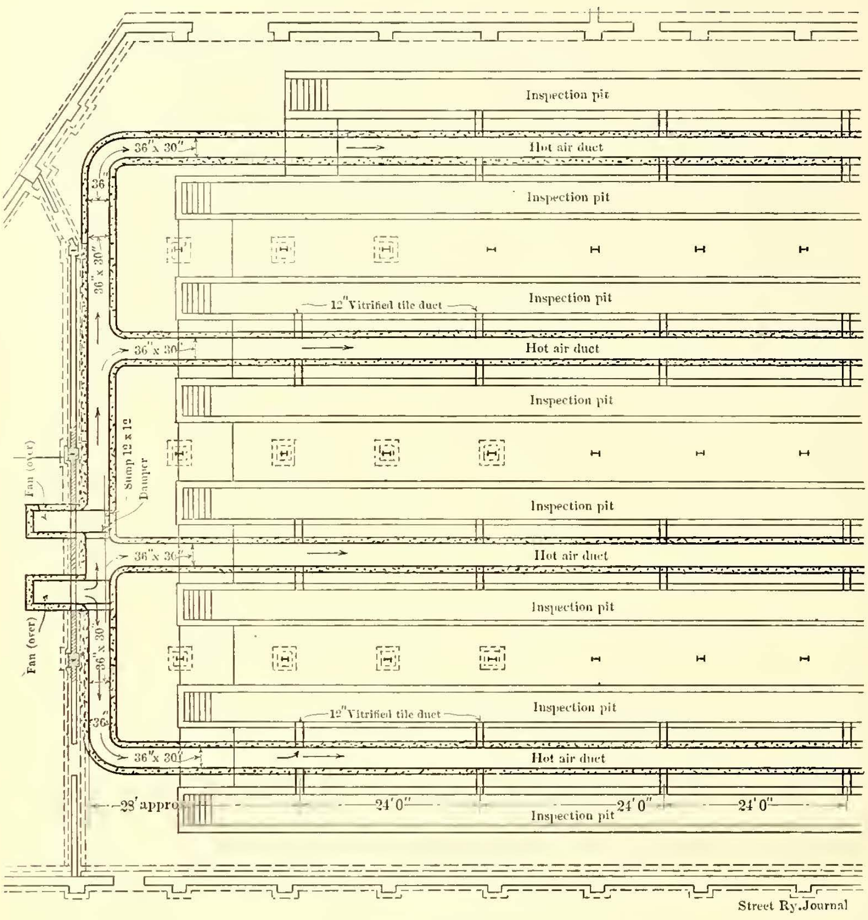


FIG. 21.—PART PLAN OF INSPECTION SHED, SHOWING METHOD OF HEATING THE PITS

noted that the estimated cost of repairing the damage is also given.

Every track in the shop is provided with a concrete pit 4 ft. 3 ins. deep throughout the entire length. The concrete steps at the ends of the pits are reinforced with metal tubes at the edges to prevent chipping by the fall of heavy brake-shoes, etc. These pits are heated by air conveyed from two heaters in the armature room through 12-in. vitrified ducts with openings in the pit walls placed 24 ft. apart, as shown in Fig. 21. When desired, this heat can be cut off by dampers.

The superiority of this method of pit heating over the use of steam pipes is so obvious as hardly to require comment. There are no leaks from bad piping connections, so that the pits are always dry; no projections or narrow gaps between pipes and the pit walls to catch all manner of dirt and other refuse, thus keeping the pits clean; nor is there any hindrance to the free movement of the pit man, as he is in no danger of coming into contact with hot pipes, and the presence of the dampers also enables him to regulate the amount of heat to suit his personal convenience. Of course, in the summer time it is just as easy to convey cold air to the pits, so that this method of distribution is of equal value for the workers' comfort throughout the year. While the first cost of a heating installation of this character is more than the direct steam heating method, the cost of maintenance is far less, and the convenience to the men so much greater that the difference in outlay is easily balanced by the better work secured.

The pits are illuminated by incandescent lamps spaced 10 ft. staggered and grounded on the rails. As shown in Fig. 22, the lamps are set in recesses of the concrete pit walls. This arrangement fully protects the lamps from breakage, besides offering a good reflecting surface. At the head of each inspection track will be found a large can for the deposit of oily waste so that there is no excuse for leaving inflammable material scattered around loose to litter up the pits and cause possible fires.

A valuable kink noted in this department is the novel wall-rack for storing twenty-five trolley poles with their wheels and harps complete. The rack is shown in Fig. 23. It consists of hooks turned in to hold the pole, which can be moved only slightly to the right or left and yet can be lifted out easily by raising it a few inches. When in position on this rack the poles take up very little room, since they are parallel with and almost touch the wall. This method also makes it easier to keep track of the number of poles on hand than if they were stacked up in corners or encumbering the floor.

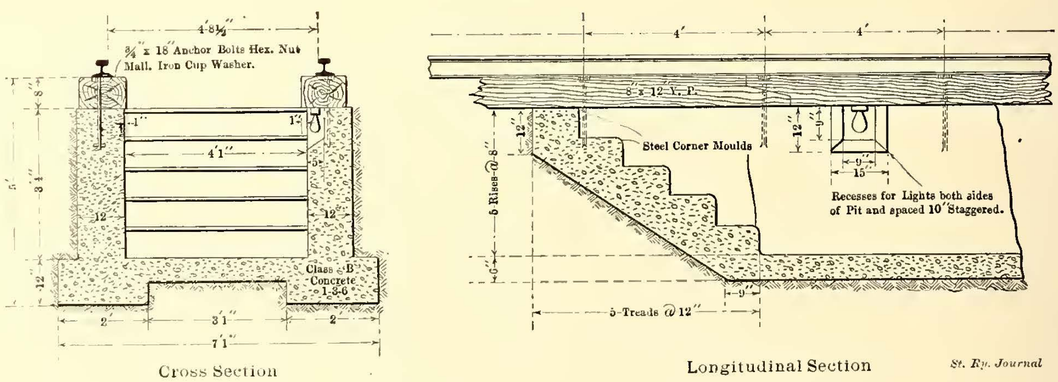


FIG. 22.—DETAIL OF STANDARD INSPECTION PIT FOR ELEVATED CARS, SHOWING THE LIGHTING

THE ARMATURE ROOM

The armature room is placed directly behind the inspection shop, from which it is separated by a brick wall. Owing to the shape of the lot at this point, this room forms a right-angle triangle with the longest side facing Bushwick Avenue. This side is furnished with the same style of windows as the Gillen Place side of the main shop, and as in the latter the work benches are placed along the wall where the light is best.

The heaters which furnish hot air for the inspection pits are installed in this room on the side nearest the inspection shop, so that no light is cut off from the work bench. To economize space, all of the apparatus is mounted on a plat-

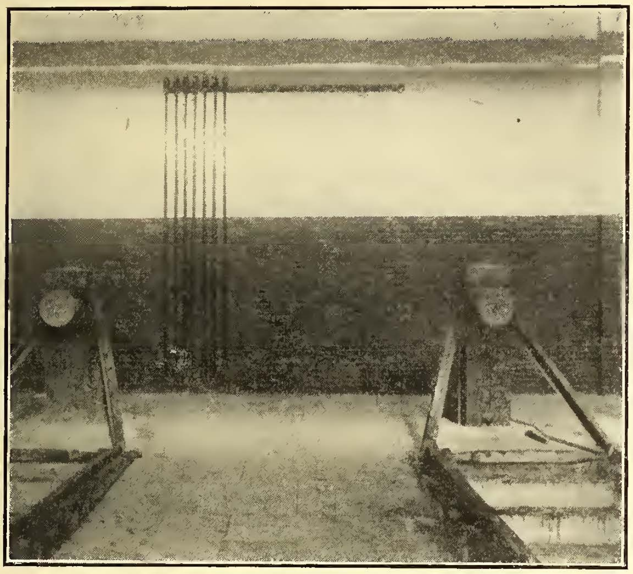


FIG. 23.—VIEW FROM HEAD OF THE PITS, SHOWING STEPS AT THEIR ENDS, BUMPERS, AND ALSO WALL RACK FOR POLES

form supported by steel columns. The heating plant consists of two groups of steam coils, which are supplied from the 3-in. pipe running through the blacksmith shop, and two 48-in. diameter fans which force the heated air into the ducts leading to the pits. The fans are belt-driven from two 12½-hp Northern Electric motors. The latter are of the variable-speed type to enable the fan speeds to be changed as heating conditions demand.

The armature oven in this room is a two-story brick structure placed in the northwest corner, with a stairway leading to the upper level. Both floors are made of iron gratings and are served by I-beam cranes for the transportation of heavy armature coils or fields in and out of the oven. Where the I-beams intersect in the interior, the continuity of either track is obtained by operating a switch to shift in the proper direction the piece common to both beams, forming, as it were, a trolley turntable. This arrangement allows coils to be put in at one door and taken out at the other. Reference should be made to Fig. 26 for the full construction details of this interesting armature oven.

Winding work has not yet been started in this shop, but two armature banding lathes have already been furnished by the American General Engineering Company, of New York. These lathes are driven from a line shaft by a 5-hp Northern Electric motor, which forms a part of motor-group E. At present all rewinding and other armature repairs are made at the Fifty-Second Street shops of the company.

TRUCK-OVERHAULING SHOP

When a car is in need of overhauling it is brought in from the yard on one of the two trucks on the second floor of the main shop. If only work on the car body is needed, the car comes in on the outer track so it will not interfere with cars whose trucks are to be removed. Cars requiring

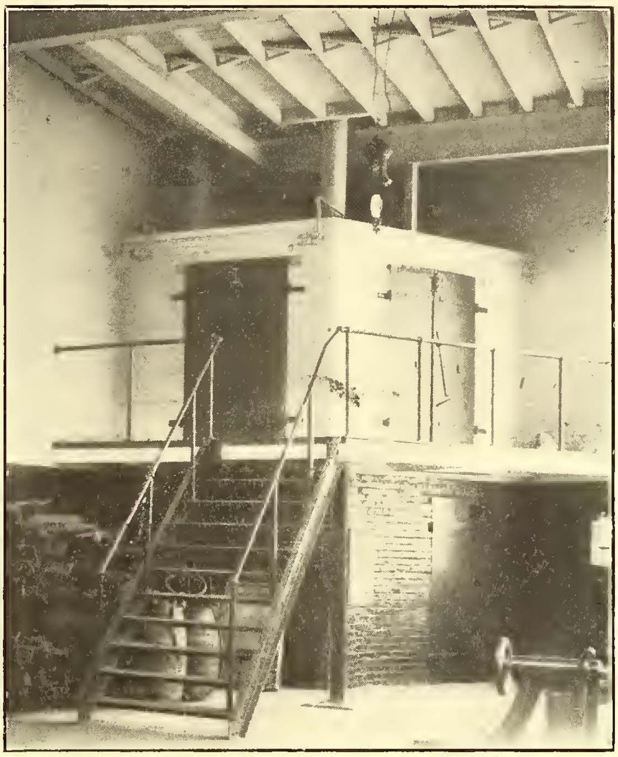


FIG. 25.—THE TWO-STORY ARMATURE OVEN

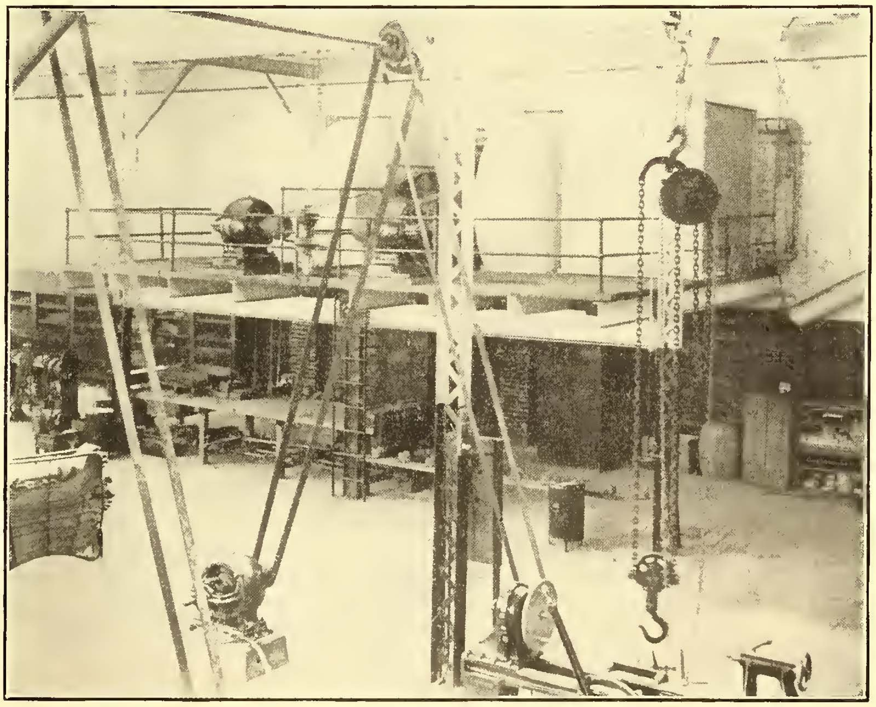


FIG. 24.—A VIEW IN THE ARMATURE ROOM, SHOWING THE PIT-HEATING PLANT MOUNTED ON A PLATFORM, BELTED MOTOR FOR ARMATURE-BANDING LATHES, CHAIN HOIST, FIRE HOSE, ETC.

truck repairs come in on the inner track, which leads to the elevator connecting with the truck-overhauling shop below. Originally there was no intention of installing pits for these tracks, but despite their location, directly over the chief crane runway of the truck-overhauling shop, it was

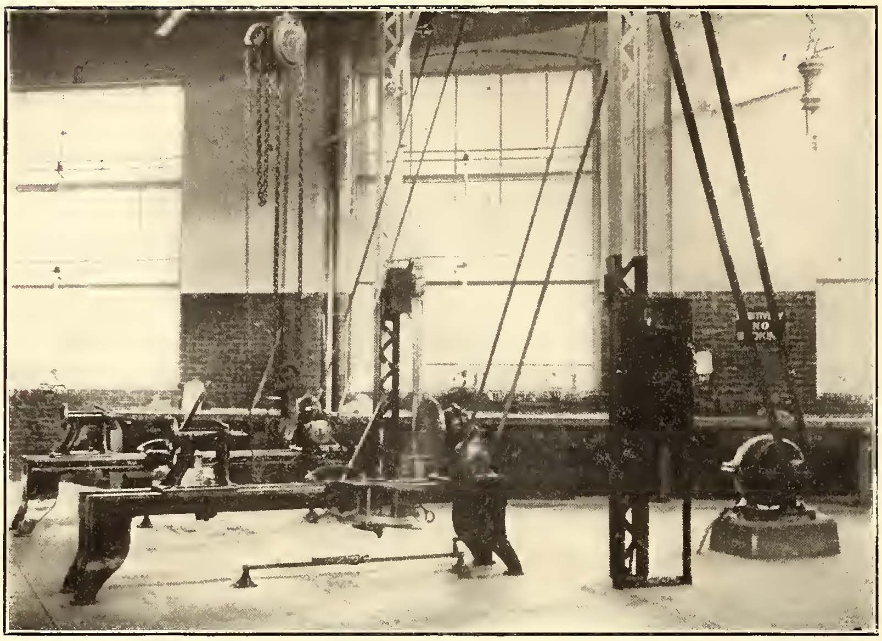


FIG. 27.—ARMATURE-BANDING LATHES AND BELTED MOTOR DRIVE

found that pits could be built to a depth of about 24 ins. These shallow pits are very convenient for connecting or disconnecting brake rigging, examining journal boxes and doing other light work on trucks.

It is customary by 7 a. m. every morning to have four to six trucks lowered to the overhauling shop, thus providing plenty of work for the overhauling men until the full number of trucks is in the hands of the ten truck-repair gangs. The earlier trucks are usually ready to be returned by noon so that the day is occupied by lowering trucks in the forenoon and raising them in the afternoon. Consequently this scheme of handling the work avoids contrary motion of trucks and permits the best exploitation of the elevator throughout the day.

To remove a truck one end of the car is run over far enough to

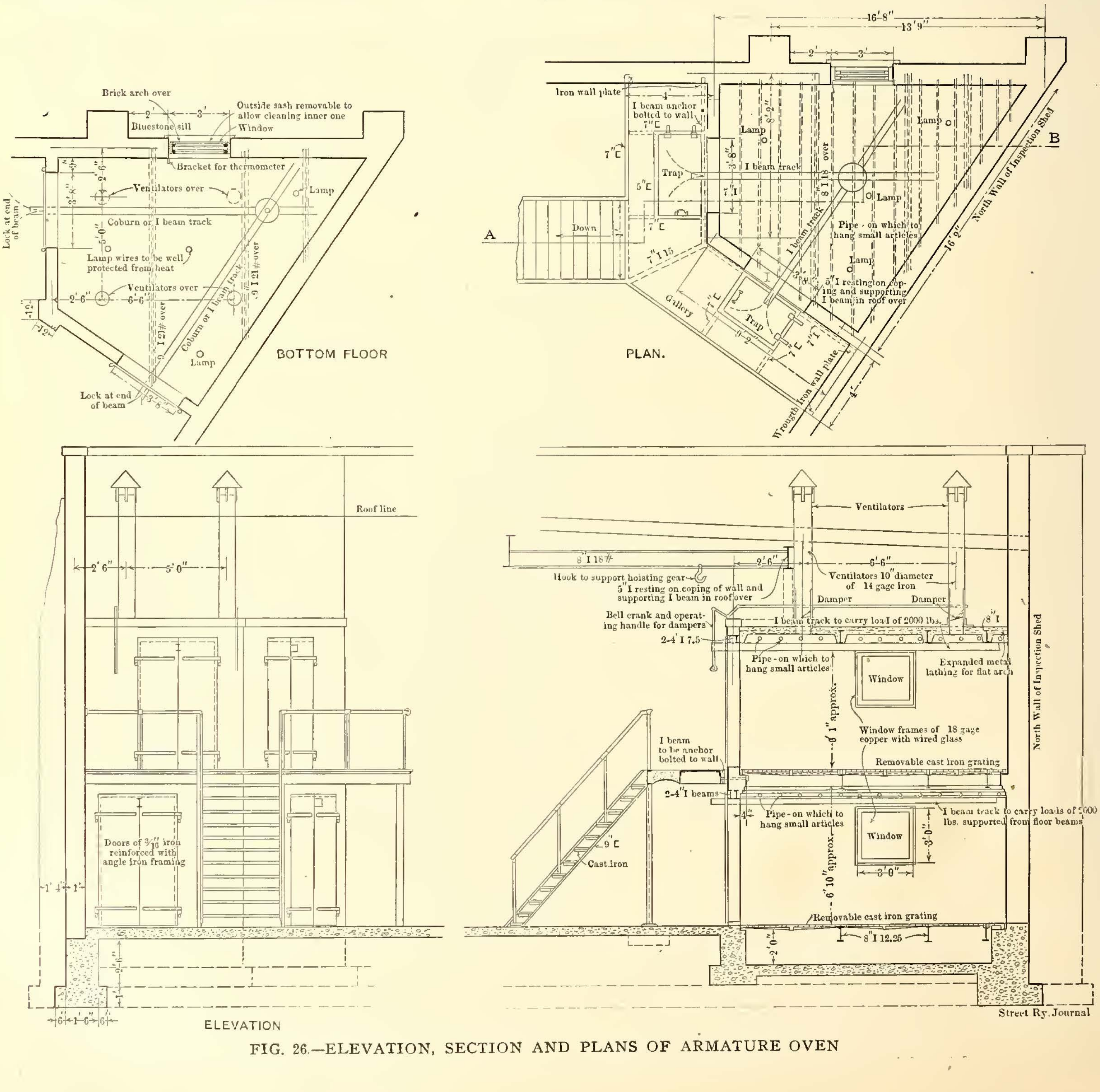


FIG. 26.—ELEVATION, SECTION AND PLANS OF ARMATURE OVEN

have the trucks rest on the elevator. The elevator is raised slightly; the struts shown in Fig. 29 are then swung under the car body to hold the same in position, thus permitting the truck to be lowered to the overhauling shop. A dummy truck is then sent up to enable the car to be run off the elevator. The car is then shifted to a convenient side track and not returned to the elevator until the original truck has been overhauled and returned. The dummy trucks are of iron and steel and are very substantial. Ten of them are in use—enough for easily handling ten to twenty cars in a ten-hour day. The elevator for this work

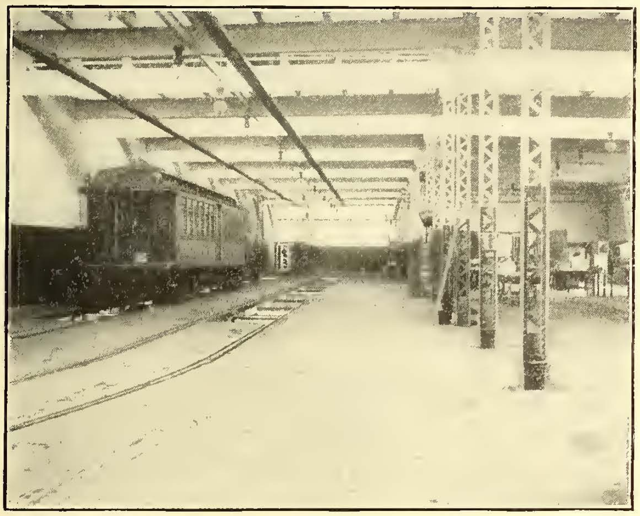


FIG. 28.—THE TWO TRACKS ON THE SECOND FLOOR OF MAIN SHOP BUILDING; THE INNER TRACK LEADS TO THE ELEVATOR

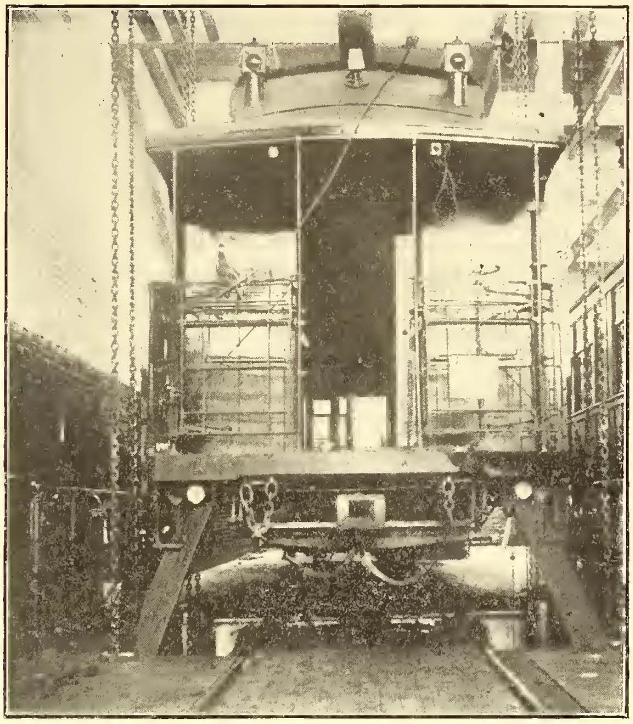


FIG. 29.—WOODEN STRUTS USED IN THE EAST NEW YORK SHOPS TO HOLD UP CAR OVER ELEVATOR WHILE TRUCK IS BEING REPLACED BY A DUMMY

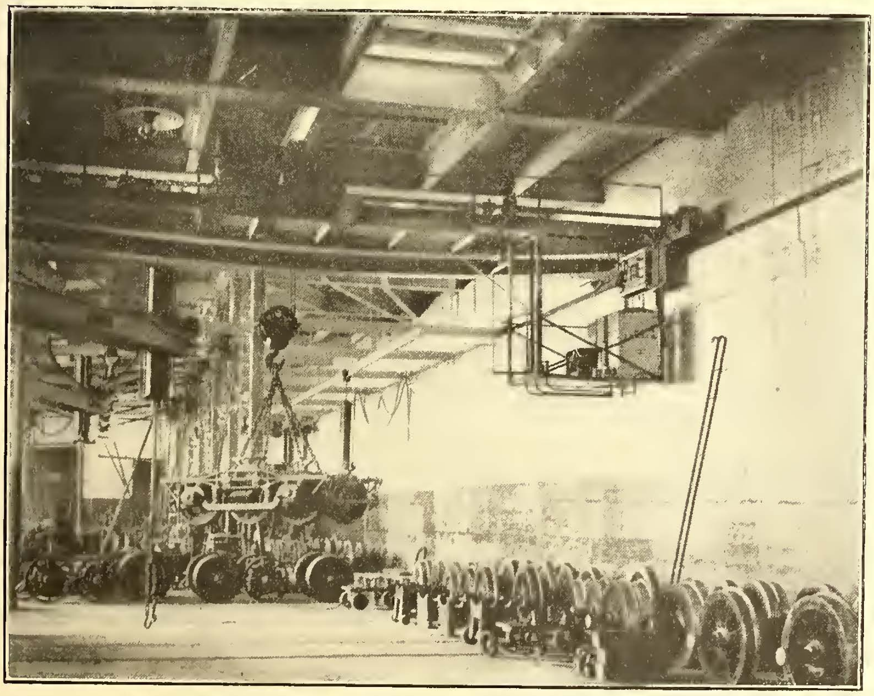


FIG. 30.—PART OF THE TRUCK-OVERHAULING SHOP, SHOWING A TRUCK BEING RAISED OVER THE OVERHAULING TRACKS, THE WHEEL-STORAGE TRACKS, ETC.

is of the Otis plunger type, 24 ins. diameter by 25-ft. lift and is operated by a 60-hp Otis motor and a Quimby rotary pump.

The truck-overhauling shop proper is on the lower floor, extending for a distance of 235 ft. parallel with the machine shop and forming the west bay of the main shop building. Along this side and in line with the elevator there is a double track which runs the entire length of the shop. The outside-inside rails are 22 ins. apart so that almost as many wheels and axles can be stored as on two pairs of rails, each taking up the space required for a standard-gage track. This space is large enough to prevent the flanges of one pair of wheels coming into contact with the axle bearings of another pair.

This double track is served by a Shaw 25,000-lb. electric traveling crane, which handles complete trucks, armatures, wheels and axles as well as other heavy parts. From the southern end of the crane travel, there is a runway about 100 ft. long for a pneumatic hoist to carry wheels to a grinder placed at the end of these wheel storage tracks.

For transmitting power to move motor trucks along the tracks leading to and from the elevator, a K-14 controller furnished with 28 Westinghouse resistance grids is placed on the wall near the elevator shaft. In circuit with this controller there is a flexible cable with three contacts conveniently arranged for connection with the leads of one of the truck motors. By this simple but effective scheme a motor truck can be moved by its own power for a distance of 50 ft. or more from the elevator.

In addition to the wheel storage tracks in the truck overhauling shop there are twelve stub tracks running at right angles to the long double tracks. When a truck is taken off the elevator to be overhauled, the large crane is used to carry it to the most convenient stub-track. This track arrangement is much better than having the trucks repaired on one or two long tracks. Every truck can be overhauled on its own track, and the gang working on it will therefore not be inconvenienced by having trucks or other apparatus moved over their heads while they are at work. Five of these stub-tracks are also valuable in another way as they terminate within 8 ft. to 12 ft. of the be incurred if all heavy parts had to be moved by the single large crane.

One of the interesting features of the overhauling shop in the way of space, economy and equipment protection is the type of armature racks of which the construction details are given in the accompanying Fig. 31. At present

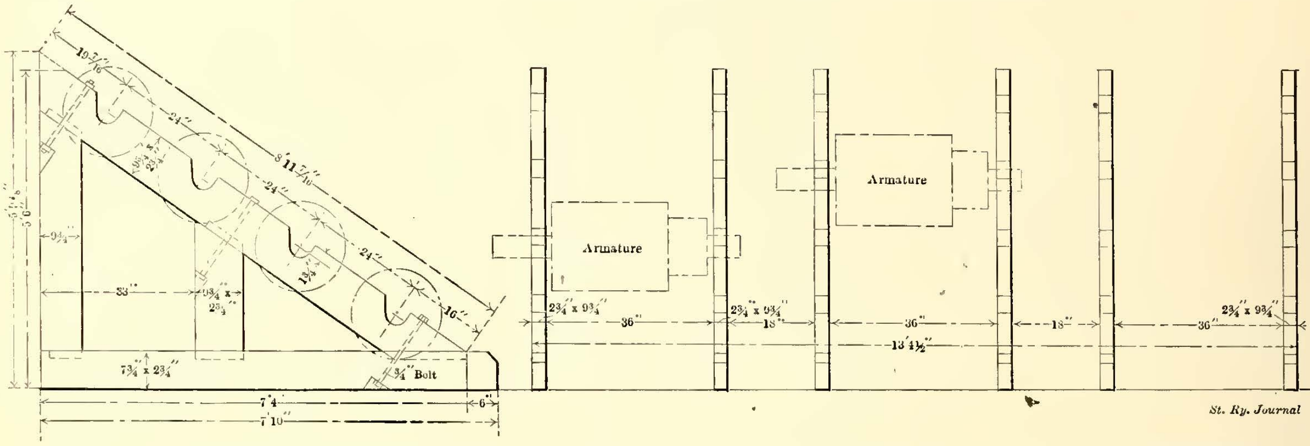


FIG. 31.—TYPE OF ARMATURE RACKS USED IN THE EAST NEW YORK SHOPS, SHOWING HOW THE DIFFERENCE IN THE SPACING OF THE MIDDLE RACK PERMITS CLOSER STORING OF THE ARMATURES

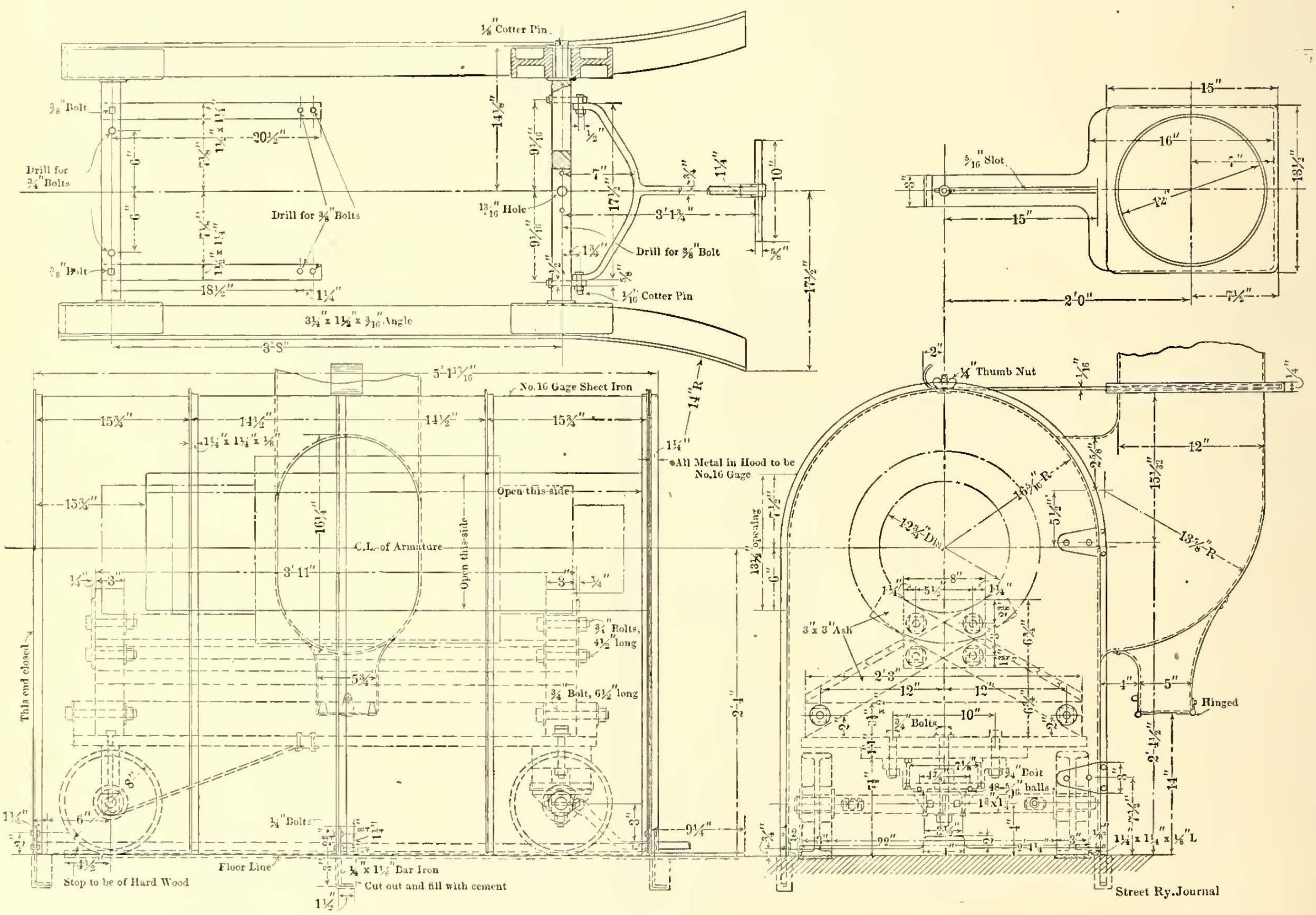


FIG. 32.—CONSTRUCTION DETAILS OF ARMATURE TRUCK AND SECTION SHOWING POSITION OF TRUCK WHEN THE ARMATURE IS IN THE EXHAUSTER

wheel lathes in the machine shop, thereby saving considerable labor in handling wheels and axles.

These stub-tracks are served by five Pedrick-Ayres two-ton jib cranes, fitted with the latest type of safety air hoist, for handling motor shells, armatures, wheels, etc. This auxiliary crane equipment avoids the loss of time that would three racks are in place near the elevator, two holding four Westinghouse No. 50 armatures each and the middle rack three more armatures of the same type. The middle rack is made for three armatures only, so that the projecting shaft of the armature on the other racks will have the necessary clearance, also enabling the racks to be placed closer to each other. The storage of armatures in this manner is also an excellent way to keep them from the injury they would be subjected to if allowed to remain on the floor.

The method used here of driving all dirt and metallic dust out of armatures is a simple but absolutely effective combination of the compressed air and vacuum processes. The armature to be cleaned is placed on a small hand truck with

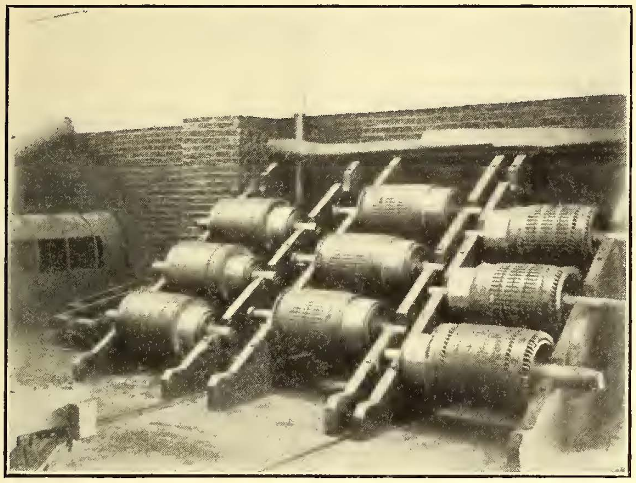


FIG. 33.—ARMATURE RACK AT EAST NEW YORK, SHOWING THE DIFFERENT SPACING OF THE MIDDLE RACK TO ALLOW THE AXLES TO OVERLAP. PART OF THE ARMATURE EXHAUST IS SHOWN AT THE LEFT

wooden saddle and is then carried into a low oval-shaped exhaust chamber near the armature racks. Here every part of the armature is treated with compressed air directed at about 85 lbs. pressure from a hose held by the operator, the exhauster immediately carrying away the released particles through a 12-in. pipe connected to the exhaust system of

Form N. R. 407. EAGLE—83604—9-19.06—10M

THE BROOKLYN HEIGHTS RAILROAD COMPANY. ELEVATED DIVISION ________ SHOP

MOTOR AND TRUCK REPORT.

Motor / Trailing Truck No. ________ Taken from Car No. ________ Date ________ 190

REPAIRS NEEDED:

REPAIRS MADE:

REMOVED.		CAUSE	PUT IN	
No. 1 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 2 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 3 Motor No.	Arm. No.		Motor No.	Arm. No.
No. 4 Motor No.	Arm. No.		Motor No.	Arm. No.
Wheel Nos.			Wheel Nos.	

Put Under Car No. ________ Date ________ 190 Inspected by ________

FIG. 34.—STANDARD MOTOR AND TRUCK REPORT, INCLUDING MOTOR AND ARMATURE DETAILS

the mill room on the floor above. Fig. 32 gives the complete construction details of the armature truck and also its position in the exhausters.

In the shop a covered tank which can hold about 100 gallons of oil and 100 lbs. of waste has been installed for storing packing for the armature axle journal bearings. In this tank there is a screen about 18 ins. from the bottom and covering about one-half the area. Waste is first put into the lower part of this tank and allowed to soak for 24 hours, after which it is placed on the screen long enough to drain sufficiently before it is placed in the different bearings on the truck. By this practice all good waste removed from journals is soaked with new oil and used several times. Consequently the amount of new waste required daily is comparatively little.

Fig. 34 shows the style of motor and truck report sent by the truck-overhauling shop to the office of the superintendent of equipment, covering repairs needed and made. Space is left on this form for similar references to motors and armatures.

CAR DESIGN FOR RAPID TRANSIT SERVICE DISCUSSED IN ENGLAND

The comparative failure of the Metropolitan District Railway, of London, to achieve the results expected by its promoters from its electrification has led to a great deal of speculation in London as to the causes. The facts are that the operating expenses, number of passengers carried and receipts have increased but the two latter items have not grown in the ratio desired or predicted. In an article on this subject which appears in a recent issue of the London "Electrical Review," Phillip Dawson, the prominent electrical engineer, attributes the greater part of the trouble to the design of car used. This car is known in England as the "American" type, that is, it has end platform doors with a single side door, in distinction from the usual side-door compartment car used on the steam lines. Other reasons given for the poor results secured are the competition from the tremendous number of motor omnibuses which have been installed in London during the last few years, and the competition of the tramways. The most important factor, however, according to the writer, is the design of car used, which in his opinion militates very much against rapid filling and entering and encourages strap hanging. Mr. Dawson's preferred design for a car of this class of service is one which he recommended in an article in the STREET RAILWAY JOURNAL for April 7, 1906. It is the same as used on the Prussian state railways for its Hamburg and Berlin service, and is also practically the Illinois Central car with vis-a-vis cross seats on one side of the car and an 18-in. aisle on the door side. The car is not reversible, but must always be run in the same direction. Its multi side doors can be made sliding and be opened and closed by pneumatic pressure if it should seem desirable. Mr. Dawson does not think this necessary, however, with single-phase traction, owing to its comparative slow acceleration. He therefore recommends swinging doors which can be closed by the platform guards as a train pulls out of the station. Such a car, according to the author, should have from eight to ten doors, would seat from 30 to 40 per cent more passengers in the same area than the center-side-door car, and would be very much quicker at stops.

Officers of the Spokane & Inland Empire Railway Company and the Washington Water Power Company have contributed $9,500 to the Spokane Y. M. C. A. building fund. The first company gave $5,000 and the other $4,500.

PAVING BETWEEN STREET RAILWAY TRACKS AND RAILS *

BY B. J. T. JEUP, OF INDIANAPOLIS, CITY ENGINEER

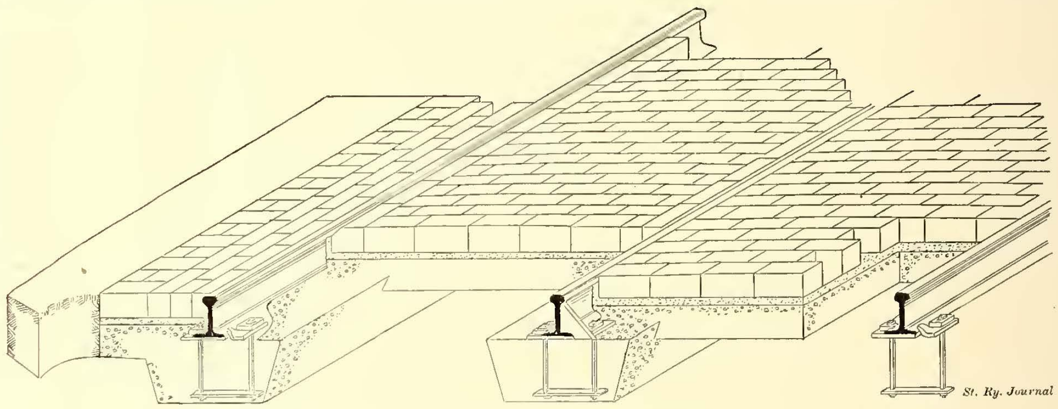
Most franchises granted in recent years to street railway companies contain provisions describing in general terms the kind of rail and the paving between the tracks. By the terms of the franchise granted to the Indianapolis Street Railway Company in 1899, for instance, the company agrees that "The tracks of the said company shall at all times be kept in repair, provided with the most modern and improved rail of sufficient size and weight"; and the same franchise and contract require the company to pave the space between the rail and the space of 18 ins. outside of the outer rails with the same material and in the same manner as the remaining portion of the street, or to improve said space with other materials in accordance with the specifications prepared by the Board of Public Works of the city. Owing to the improvements that are being made in rails and in the methods of track construction and in paving, the provisions in franchises covering the kind of rails are usually and naturally indefinite. This indefiniteness has, however, given rise to clash of opinions between street railway officials and municipal authorities as to the kinds of rail which comply with the terms of the contract and franchise. After years of controversy opinions still differ as to the kind of rail best suited for our streets. To illustrate:

In the STREET RAILWAY JOURNAL of Jan. 5, 1907, an article is printed on "Track Construction and Other Improvements of the Tri-City Railways" (Rock Island, Moline, Ill., and Davenport, Ia.) in which appears the following: "As the city ordinances in all three of the cities did not permit T-rail construction, girder rails were at first employed in the new work. However, permission was obtained from the City Council at Davenport to lay 800 ft. of double track with T-rails in paved streets in order that the advantages and disadvantages of this construction might be observed. The location chosen for this strip of track was a point where it would receive the hardest usage from crossing wagons. It is interesting to note that within three weeks from the time permission was obtained to lay the strip of track the T-rails were ordered, were rolled and were on the ground. After a trial section had been in use for a few months and after frequent inspections had been made by the members of the Council, permission was granted to use T-rails in all the new track work in Davenport. It is expected that permission will be obtained from the city authorities in Rock Island and Moline to use the same rails."

In the same number of the STREET RAILWAY JOURNAL we read an account of a discussion of the rail question by J. L. Adams, general manager of the Western Division of the Indiana, Columbus & Eastern Railway Company on the one hand, who advocated the use of T-rails, and City Engineer of Hartford, Conn., on the other, who appeared for the city, advocating grooved rails. In Columbus the traction company is very firm in its determination to use T-rail on account of the greater safety in running its cars, so that the question of the kind of rails in Columbus will probably have to be settled in the courts. Here we see the municipal authorities of the two cities arriving at diametrically opposite conclusions.

RAILS

Without going into a history of the development of the rails for street railways, it may be said that various modifications in size and shape have been made from time to time, which has resulted in three prevailing types: First, the T-rails, the rail used in steam railroad practice; second, the girder rail; third, the grooved rail, reaching into its state of perfection, it is said, in the Trilby rail used in Philadelphia, and weighing 137 lbs. per yard. This grooved rail is, strictly speaking, a development of the girder rail. All of these three types vary in height and weight according to various practice. With the advent of large interurban cars into cities upon tracks of the street railway companies much track had to be rebuilt, and considerable rail of the girder type became practically useless. I recall that on one of the lines in this city the interurban cars entered the city on the wheel flanges, and I remember seeing the tram of a comparatively new girder rail worn through in a very short time by the grinding action of the flanges of the interurban cars. The old type of grooved rail was found also to be useless for interurban cars with their deep flanged wheels.



ISOMETRIC VIEW OF T-RAIL CONSTRUCTION

Railway companies advocate the use of a T-rail, and the arguments they present in favor of this section over grooved rails are the following: First, less resistance to tractive force; second, ease of and better installation; third, long life of rails; fourth, greater safety of traffic; fifth, minimum track expense. In the above arguments the one that appeals to the city authorities is the safety of traffic. High-speed interurban cars have deep-flanged wheels. The tendency of the times in wheel construction of these cars is for the adoption of the M. C. B. flange of steam railroads. Serious danger has developed on operating these cars on city tracks where these tracks are of the ordinary girder type, or the old standard grooved rail. The railroad companies further object to the grooved rail on account of trouble in keeping the groove clean.

From the standpoint of a city, it makes little difference as to the kind of rail which is used where the streets are wide and where there is no teaming on the space occupied by the street railway tracks. But in cities where the streets

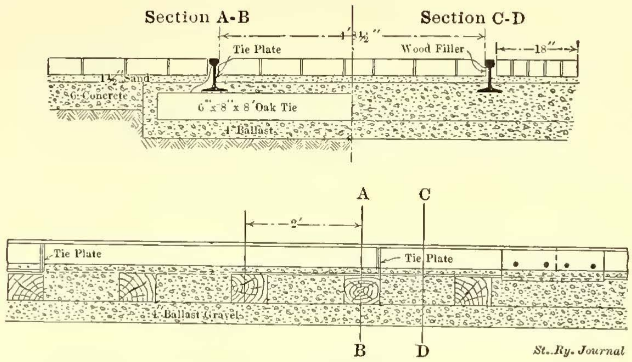
* Paper read at the Indianapolis meeting of the Indiana Engineering Society, Jan. 17, 18 and 19, 1907.

occupied by street railway tracks are narrow, the municipal authorities rightfully demand a rail which offers the minimum obstruction to teaming and which will cause the least derangement and deterioration of pavements along the rail, and at the same time a rail which will be safe for the traveling public.

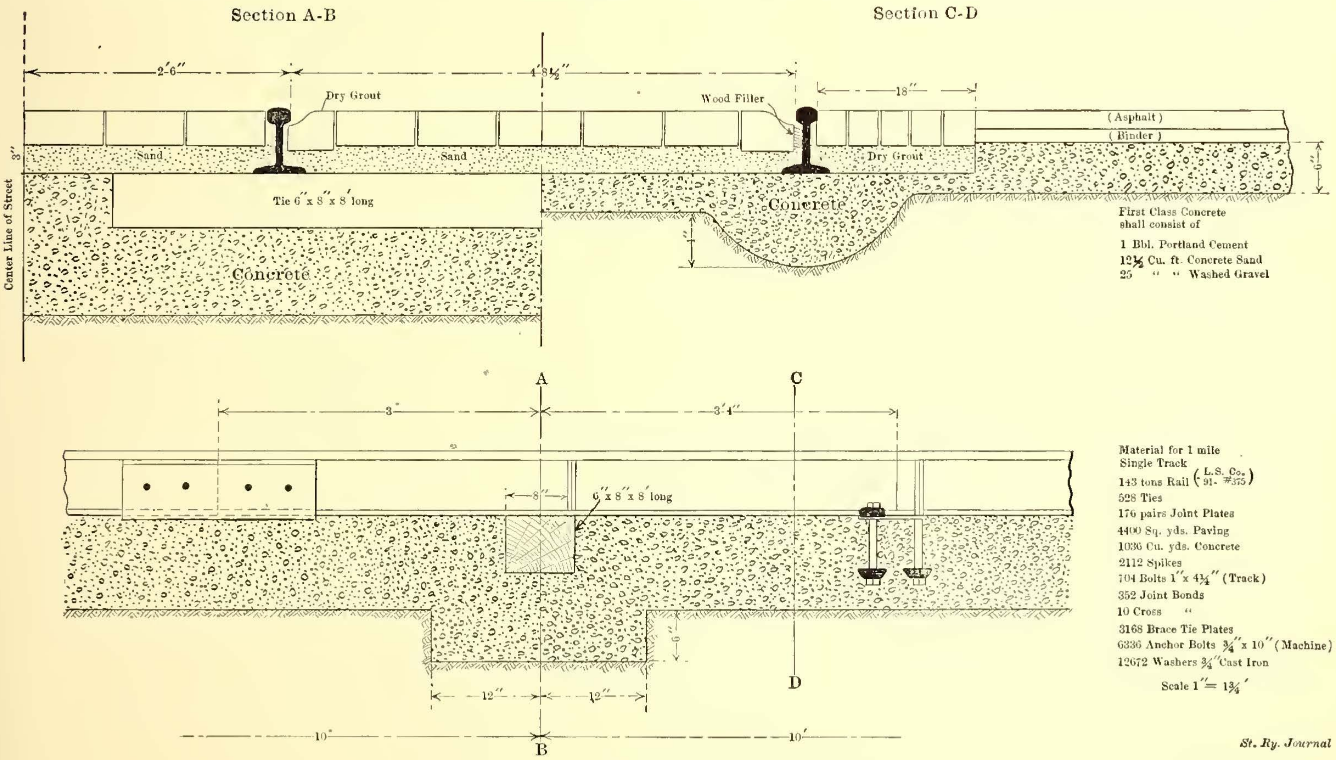
To remove the objection made by this city to the ordinary form of T-rail used by interurban companies, and to combine the advantages of both the T-rail section and the advantages of the grooved rail, a method of construction was agreed on between the city and the railroad companies which I will describe. A heavy T-rail section of special design was rolled weighing 91 lbs. to the yard, heavier than is usually used for many of the steam railroad tracks. The depth of the rail is 7 ins. It, therefore, has the advantage of the rigidity and stability of girder rail. A deep groove is formed by the use of a large nose block placed as a stretcher along the inside of the rail. The space between the nose blocks is paved in the ordinary manner with vitrified paving block in courses at right angles to the nose block. Vehicles turn out of the space between the rails as easily in this form of construction as out of grooved rails. There is some evidence of wear on these nose blocks, and as an improvement I would suggest a form of asphalt block of similar design which would have toughness rather than the brittleness of brick and would wear by matting rather than by chipping. The use of this heavy, deep T-rail with a large nose brick is a construction which has met with the approval of a large number of engineers who have visited the city. It is a form of construction which has all the advantages of a T-rail as ordinarily used, and possesses such features of the grooved rail as are desired by city authorities.

PAVING BETWEEN THE RAILS

For terminal tracks used by interurban cars, the best and heaviest construction is none too good. In this city such rails have been laid on Portland cement base, with concrete stringers, the rail being anchored to the concrete at intervals of 3 ft. 4 ins., and ties being spaced about 10 ft. apart for the purpose of maintaining the track in position during the laying of the concrete. In parts of this city where the tracks are used by the city cars, and by one or two lines of interurban railways, oak ties are used and the concrete is placed between the ties. We have many forms of paving construction in this city: Asphalt between the tracks, with a stretcher of brick or granite on each side of the rail, a header of brick, with two stretchers of brick alternating; asphalt placed against the rail and against a Haydon block on the inside of the girder rail, with brick or stone block pavement. The practice has been in this and other cities to put in nose brick or nose block, or a cast-iron block on the inside of the rail, with the paving between the rails laid in courses at right angles to the rail. The paving of the 18-in. strip on the outside of the rail has been either of brick or stone block, laid in courses at right angles to the rail, or in courses parallel to the rail. Some cities are still using wooden block between the tracks laid in a manner similar to that of construction with paving brick.



T-RAIL CONSTRUCTION ON 4-IN. BALLAST AND 6-IN. CONCRETE



DETAILS OF T-RAIL CONSTRUCTION WITH CONCRETE AND SAND

The experience of this city is opposed to the use of creosoted wooden block, however well they may be treated, as a paving material between tracks. It is only a question of a short time until sufficient oil has exuded from the blocks to enable them to absorb water, when they swell and seriously interfere with the alignment of the track.

Sheet asphalt, in fact any sheet pavement, as a rule, is very unsatisfactory for paving between the tracks, and has only given partial satisfaction with heavy grooved rail construction. It is now the generally accepted opinion that the paving between the track should be some form of block pavement, either brick or stone or asphalt block—a pavement which can be laid by the railroad company and taken up and replaced when joints, ties, bonds, etc., are to be renewed. Such a pavement can be repaired more promptly when so directed by the city, because the company need not await the pleasure or convenience of paving companies to make repairs. In the city brick is now almost universally used for paving the space between the rails.

I am of the opinion that a heavy T-rail construction with a large nose block forming a groove, and modified to remove some minor objections which have developed, together with a brick pavement laid on a well-built Portland cement concrete base, will be entirely satisfactory to city authorities on all streets which are to be permanently improved.

THE TELEPHONE IN TRANSPORTATION

The regular monthly meeting of the New England Street Railway Club was held at the American House, Boston, on the evening of Jan. 31, J. H. Neal presiding. The subject of the evening was "The Application of the Telephone to Transportation Service," and the speakers were Dr. C. J. H. Woodbury and his assistant A. B. Stetson, engineers of the American Telephone & Telegraph Company, of Boston. The lecture was illustrated by stereopticon views showing uses of the telephone in many different branches of railway and general transportation work, and several modern telephone equipments specially designed for railway use were shown to those present at the conclusion of the paper.

Dr. Woodbury emphasized the value of the telephone as practically the only electrical device which can be used without skill, and pointed out that electricity was considered for railway signaling long before the devices for its application were invented. On the whole, the application of electricity for the communication of intelligence in both directions appears to have originated on the Erie Railroad in 1850, as this work included the systematic dispatching of trains by telegraph. Of late years the telephone has taken the place of the telegraph to a very material extent, and its use is rapidly increasing. The facility which it furnishes for the instantaneous reply is of great value in emergencies. Simultaneous telegraphy and telephony is now practiced on the same circuits without interference, this dual use of the same wires for composite systems being accomplished in a simple manner by the insertion of choke coils at the terminals and also bridging condensers around the telegraph relays. These condensers will transmit the attending currents used by the telephone bells and the undulatory speech currents, but they do not conduct the direct currents used in telegraphy.

On the Mexican Central Railroad all the cabooses are equipped with telephones so that all freight trains may be at any time in communication with the superintendent's office, in the same manner that wrecking cars are equipped with telephones which can be attached temporarily to overhead wires by rods carrying suitable hooks. Dr. Woodbury cited the emergency use of the telephone in the accident on the Pennsylvania Railroad in 1905 when a passenger train near Harrisburg struck a car loaded with dynamite, whose explosion killed 21 and wounded 150; at the hospital a private branch exchange and patients' card index was set up, and free service, both local and long distance, was inaugurated by the Pennsylvania Telephone Company and American Telegraph & Telephone Company, so that the exact condition of the patients could be learned at all times from various parts of the country. Some of the leading express trains are equipped with telephones which are placed in service at terminals and certain intermediate points.

Dr. Woodbury stated that in the Boston Elevated Railway Company the number of stockholders is three-eighths of the employees, in the New England Telephone & Telegraph Company five-eighths. Great public service work has been established by the joint ownership of many people, capital being a collective noun as much as labor. The application of the telephone for train dispatching has resulted in a marked economy of both plant and operation in the ability of the superintendent to be informed as to the exact position of various cars. Single-track electric roads in sparsely-settled districts can be operated at an efficiency which would otherwise require a double-track road. Prompt cars can be directed to proceed to the next turnout in case the meeting cars are late enough. The advantages of the telephone with respect to the information which it gives as to the condition of the rolling stock, the location of snow plows, the need of wrecking cars, medical help, the transmission of details which may be of great importance in lawsuits, etc., were all touched upon. The efficiency of the telephone in times of emergency was illustrated last June by an incident on an interurban line in New York State, where the cars were limited to a single track, and to protect the block watchmen were placed at each end. One evening a car passed into the block at full speed with another car coming towards it in the single-track section. The watchman telephoned the power house to shut off the current, which was promptly done and a collision barely averted.

The three types of the telephone as applied to street railway dispatching are: Fixed telephone sub-stations in booths placed at suitable points along the lines; jack boxes at poles to which portable telephones carried in the cars may be hung and temporarily connected; and portable sets hung in the front of the car whose vestibule serves as a booth, connection being made with the jack boxes by flexible wires.

Portable sets are generally preferred to fixed sets for long mileage and few cars. There are several forms of these sets, one with its battery weighing only 13.5 lbs., though more substantial forms are considered preferable. Jack boxes must be shot proof and fool proof, and must not afford shelter for hornets or other insects, or a place for the lodgment of rain or snow. Telephone lines should be strung below lighting or power circuits, well insulated and transposed at least once in every eight poles to prevent disturbance from induced currents. When two telephone circuits are on the same line the transposition must be not only alternating the relative position of the wires of one circuit to another, but also of the two circuits. In the later forms of jack boxes for common battery service the plug is attached on the under side of an iron canopy, resembling a large petticoat insulator, the spring jacks being in the handle at the end of the flexible wires leading from the telephone set. Repeating coils and protectors should be used, either at jacks or instruments, to protect the equipment from crosses with foreign circuits of high voltage, and special designs of spans and guard wires are needed at overhead crossings of high-tension and telephone circuits. Electric railway telephone sets must be clear and loud in transmission and be able to stand the jar of continuous transportation on a car.

Fixed telephone sets are found preferable on electric railways having a large number of cars and congested traffic, as they may be used more rapidly by connecting with the pole jacks through flexible wires than when it is necessary to take a telephone from the car and hang it upon the pole.

Dr. Woodbury concluded his paper by referring to the use of the telephone in war, in marshaling and directing parades, at San Francisco after the earthquake, where pairs of insulated wires were laid from a wagon in the cable slots of the street railways, in ranching, on shipboard and in lumbering. He strongly advocated the rental of Bell telephone service by street railways on account of the standardization of equipment and greater facility of repairs by men specially trained for the work. Mr. Stetson described the equipments exhibited at the meeting and answered questions which arose in the discussion which followed.

THE EXHIBIT OF SAFETY APPLIANCES

The exposition of safety devices and industrial hygiene, to which reference has been made before in the Street Railway Journal, is now being held at the American Museum of Natural History, New York, daily, between the hours of 10 a. m. and 10 p. m., under the auspices of the American Institute of Social Service of New York, and will continue until Feb. 12. The exhibits consist of devices for safeguarding the lives and limbs of workmen and preventing accidents under the ordinary conditions of life and labor to which the general public is exposed, and includes "live exhibits," devices in operation and models, as well as photographs. The section of industrial hygiene includes improved dwellings; first aid to the injured, prevention of tuberculosis and other dread diseases harmful to the life of workmen; respirators and devices for supplying and maintaining pure air, and industrial betterment. As previously stated, the object of the exposition is to direct the attention of American public opinion to the necessity of doing something to lessen the causes of accidents to American life and labor, by means of a permanent museum of safety devices, where all problems of safeguarding life and limb can be studied in their working details.

In all there are about seventy-five exhibits, quite a number of applications being filed after the exhibition was formally opened. As classed under the head of industrial hygiene may be mentioned the reports and photos loaned for exhibition by the museums of safety devices in Berlin, Munich, Paris, Stockholm, Vienna, Amsterdam, Zurich and Moscow, which represent the progress made toward ideal industrial conditions in Europe, and the exhibits of photographs of such American companies as Brown & Sharpe Company, of Providence, the Westinghouse Companies, of Pittsburg, and others which show industrial conditions as they are in these plants. The Brown & Sharpe and the Westinghouse exhibits are, however, especially elaborate. In this connection the exhibit of the Paris, Lyons & Mediterranean Railway, of Paris, is worthy of special mention. It consists for the most part of photographs of workmen's dwellings, baths, reading rooms, dispensaries and stations. Statistics also have been made available by the company of the various forms of industrial betterment of its personnel. The exhibit of the McGraw Publishing Company includes the chart issued by "The Electrical World" for posting in central stations, etc., giving directions for resuscitating persons shocked by electricity.

Among exhibits bearing on the street railway industry may be mentioned devices shown by the Grip Nut Company, J. K. Wright, John Quern, A. L. Freed, S. F. Hayward & Company, Westinghouse Companies, Consolidated Engine Stop Company, General Electric Company, Sterling-Meaker Company, Edmund Mather and C. N. Washburn.

The Grip Nut Company shows in its exhibit various applications of a one-piece steel lock nut which it is impossible to jar from the bolt.

J. K. Wright has on exhibit a model of his safety engine stop and speed limit.

A. L. Freed, of New York, shows a complete line of goggles for the protection of millers, stone masons, motormen and others subjected to unusual exposure of the eye to flying particles in the air.

The Westinghouse Companies' exhibit, besides the photographs previously mentioned, comprises model flat cars, automatic couplers, coupler and draw-bar, buffers, and a new self-locking angle cock. An interesting feature of this exhibit is the detail drawing of the air-brake equipment.

The Consolidated Engine Stop Company, of New York, shows one of its stops in actual operation in the isolated plant of the museum.

The Norton Grinding Wheel Company, of Worcester, Mass., had several of its machines in operation, fully protected by safety guards.

The Sterling-Meaker Company, of Newark, N. J., has its Sterling brake, Giant brake, Berg fender and Sterling fender all on exhibition, attached to suitable platforms.

The Stillman Safety Lamp Company, of New York, has on exhibition a complete line of its safety lamps, including its railroad lanterns. Among the latter is a new type, intended for electric railway use, with an insulated handle affording protection in third-rail work against possible contact with the rail. The interior of the Stillman lamp is provided with a raised perforated metal false bottom and a vertical perforated wick chamber, the intermediate space being packed with wool, leaving an open space at the bottom for free oil. The wool absorbs the oil, holding it in suspension, and when the wick is lighted there are always slight drippings of oil into the lower open space whereby the wick continues to feed oil to the flame.

FINANCING RAILWAY EXTENSIONS

A large amount of money will be needed the coming year in making improvements and extensions to electric lines. It seems that the plan taken to get this money for the most part is the issue of short-time notes. The Northern Ohio did this some time ago and was followed by the Lake Shore Electric with $550,000 notes at 6 per cent. The Detroit United came next with $2,000,000 of the same kind of notes. These notes may later be replaced by bonds. It is not known what plan will be adopted to secure money for financing the Eastern Ohio, but in all probability provision for that will be made in the usual way. Had this action been taken a year ago, its accomplishment would probably have been much easier than now.

NOTES ON SPEED TIME CURVES

BY TRACY W. SIMPSON

At any instant during the acceleration of an electric car, the tractive effort due to the flow of current through the motors is overcoming the resistance to motion. The resistance to motion is divided into two parts, the train friction at the instantaneous speed considered, and the resistance caused by the acceleration of the car and the rotating parts.

With a series motor equipment, tractive effort decreases as the car speeds up; and as train friction increases at the

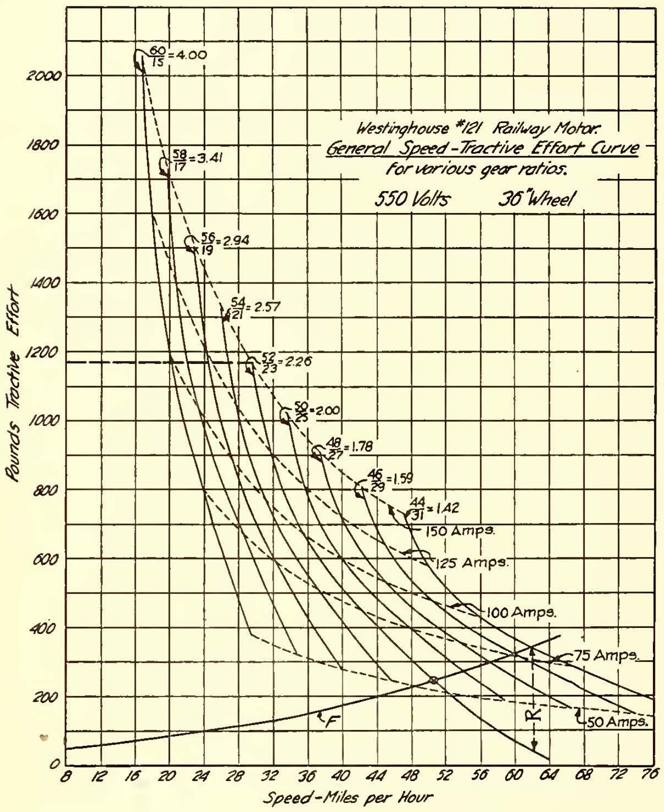


FIG. 1

same time, a speed is soon reached at which all the tractive effort is used in overcoming train friction. At this speed there is no excess tractive effort to cause further acceleration. Any change in the train friction, caused by grade, curve or head wind will disturb the balance and necessitate a re-adjustment of tractive effort and speed until a new balance is produced. A considerable length of time is required to produce these balances, and usually they are never completed, due to the continual change of train resistance conditions. Thus the speed of the car is continually changing, due to the attempt to adjust itself to new conditions of grade and alignment.

It is convenient to express that part of tractive effort that overcomes inertia and accelerates the car as "Accelerating Effort," designated herein as pounds per motor by the letter *A*. This quantity at any speed is evidently equal to the algebraic difference between tractive effort and train friction for the particular speed considered. On down grades *A* is usually greater than the tractive effort. The value of *A* for any condition of gear ratio and current with a particular motor may be found by means of curves similar to Fig. 1.

Fig. 1 shows a series of speed tractive effort curves for a modern railway motor. These curves are plotted from the characteristic curves of the motor as published by the manufacturer. It is believed the arrangement shown is much more advantageous than the usual one of plotting the curves against current input. For information regarding efficiency and heating capacity the latter method is preferable; but for problems regarding train dynamics the curves as shown possess many advantages. All the curves for the different gear ratios are plotted on one sheet, and the points on each curve that correspond to a particular current value are connected by dotted lines.

This arrangement makes it possible to determine at once any two of the four variables, gear ratio, current, speed and tractive effort, when the other two are assumed. If, then, a curve of train friction showing the pounds per motor required to propel the car at various speeds be plotted on the sheet as *F*, much interesting data regarding the motor equipment as applied to the car are at once available.

The point of intersection of this curve *F* with each of the tractive effort curves gives the maximum speed of the car for the various gear ratios, and reference to the dotted lines shows the current taken by the motor at each of these maximum speeds. By this means the proper gear ratio can be approximately found. As a rough rule, applying to conditions requiring fairly long runs, the proper gear ratio is such that will cause a current to flow through the motor, when the maximum speed is reached, that is equal in value to the rated continuous capacity of the motor at 550 volts.

The continuous rating of the motor shown is 80 amps. at 300 volts and 75 amps. at 400 volts, corresponding to a rating of about 67 amps. at 550 volts. Applying the rule to this case, 1.78 would seem to be the proper gear ratio for this motor and equipment. This would give a maximum speed of 57 m. p. h. As a matter of fact, curve *F* is plotted for a four-motor equipment, single-car operation, 35 tons weight. The motors are rated at 85 hp. The maximum speed is therefore quite consistent with present practice on the interurban railways of the Central West.

In the case considered here, a lower gear ratio (2.26) was chosen on account of the generally hilly country to be traversed, long grades of 2 and 2½ per cent being prevalent. The only accurate method of determining the proper gear ratio is to plot a series of speed-time curves for different gear ratios of a run that can be considered as typical of the entire system; and to determine the proper ratio by balancing in their most economical proportion the schedule speed, energy consumption, and temperature rise of the

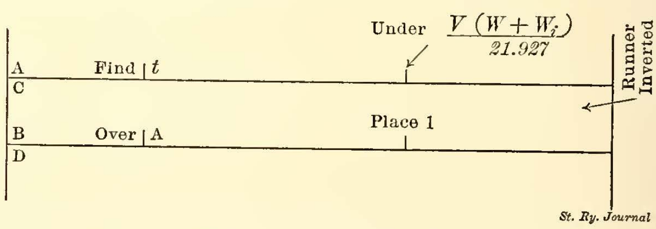


DIAGRAM OF SETTING OF SLIDE RULE FOR VALUES OF "t," "A" as VARIABLE

motor, all of which vary with the gear ratio. However, the rule given above is ample for preliminary assumptions.

The starting current for this motor is about 150 amps., corresponding to a tractive effort of 1170 lbs. per motor and a speed of 29.5 m. p. h. Up to this speed the current and tractive effort will be kept constant by means of the controller. The value of *A* in pounds per motor will at any speed be equal to the difference between the ordinate of curve *F* for that speed and the ordinate of the tractive effort curve for that speed. A pair of dividers will step off this difference at once.

Knowing the value of A for any speed, it is possible to calculate the time required to change this speed to a higher value. The interval between the two values of speed considered must be small enough to allow the assumption that during it A is constant. From the formula for uniformly accelerated motion (force $\times$ time $=$ mass $\times$ velocity) we derive, by reducing from absolute units to practical units,

$$t = \frac{V\,(W + W_1)}{21.927 \times A} \quad \text{when } g = 32.16$$

In which,

$t =$ the time interval in seconds required to produce a change of V miles per hour in the speed of the car.

$V =$ the arbitrary interval of speed during which A is practically constant.

$A =$ the mean accelerating effort in pounds per motor during the speed interval V.

$W =$ the total dead weight of the train in pounds divided by the number of motors on the train.

$W_1 =$ the weight in pounds per motor that is equivalent in effect to the added resistance to acceleration due to the inertia of the rotating parts. This is usually equal to about 3 to 8 per cent of W.

This formula can be set on the slide rule so as to read directly the value of t for different values of A. V is best chosen at about 5 m. p. h. for the low speeds, and 2 or 1 m. p. h. as the maximum speed is approached.

The process of plotting a speed time curve of the equipment whose friction curve and motor speed-tractive effort is shown in Fig. 1 is as follows: During the acceleration period from 0 to 29.5 m. p. h., $A = 1100$, $V = 29.5$, $(W + W_1) = 18{,}375$, for 5 per cent inertia of rotating parts, therefore $t = 22.5$ seconds. This determines the first point of the curve (P, Fig. 2). The initial acceleration is seen at once to be 1.26 m. p. h. per second. The next interval considered will be that in which the speed increases from 29.5 to 30.0 m. p. h. This is 0.4 seconds. The speed is now 30 m. p. h. and the total time from start is 22.9 seconds. From now on the interval V will be considered constant at either 1, 2, or 4 m. p. h., depending on the accuracy required. The slide rule can now be set to read

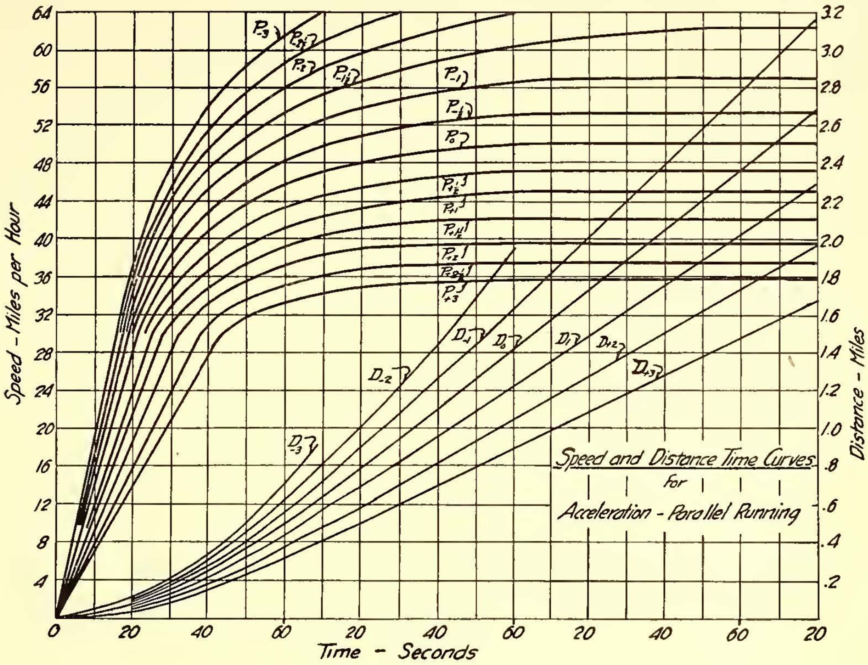


FIG. 2

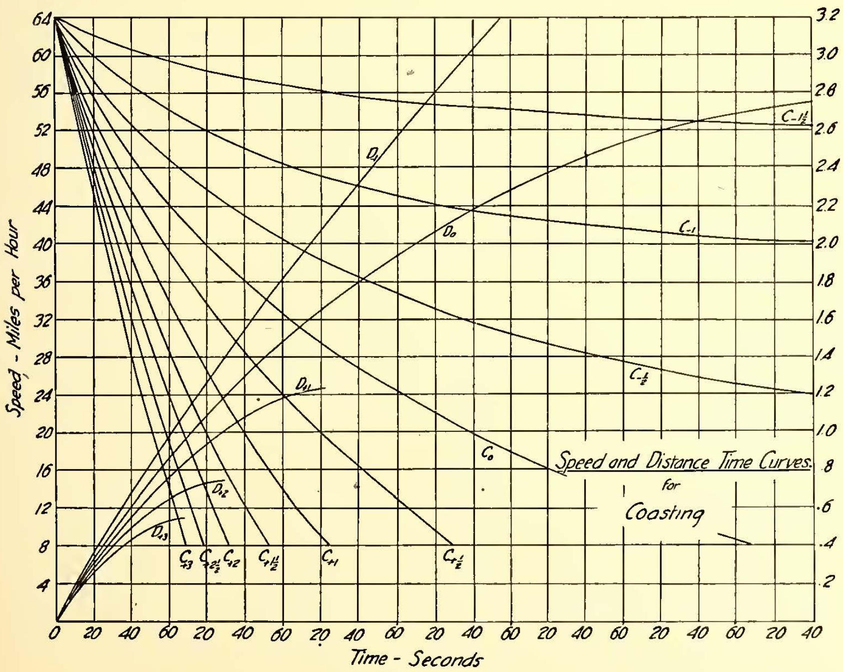


FIG. 3

directly t for different values of A. This setting is shown below, where A, B, C and D represent the four scales of the instrument shown on page 244.

The curve is then readily plotted (P, Fig. 2). When the car is accelerating on a grade, the effect is to change curve F (Fig. 1). The values of train friction are increased or decreased 20 lbs. per ton for each per cent of grade, depending upon whether the grade is up or down. This will give a new value for A for each speed resulting in a different speed time curve. These curves are plotted as P_{-3} to P_{+3} (Fig. 2), the subscripts referring to the per cent of grade for which the curve is plotted.

The area under the speed time curve up to any point is proportional to the distance traveled up to any point. Hence for each speed time curve a corresponding distance time curve is plotted, D_{-3} to D_{+3} (Fig. 2).

During coasting, the retarding force A is equal to the train friction, hence F (Fig. 1) becomes the curve of A.

The speed time and distance time curves during coasting are shown on Fig. 3. The curves are plotted in the same manner as those on Fig. 2, remembering, however, that as F is minus, the value t is the time required for a retardation of V m. p. h. rather than an acceleration. These curves are shown to a smaller scale of time than those on Fig. 2

in order to exhibit the changes and still keep the diagram down to a small size. In practice, it is best to make the curves all of the same time scale even though some of the sheets be very long.

During braking, the retarding effort is assumed constant throughout. This is not strictly true. With the same brake-shoe pressure A is greater at low speeds than at high. However, a skilful motorman can apply the brakes in such a manner that the retarding effort will be quite constant, and the speed time curve during braking will very closely approximate a straight line. Assuming this retarding effort or A to be 120 pounds per ton, we have curves as in Fig. 4.

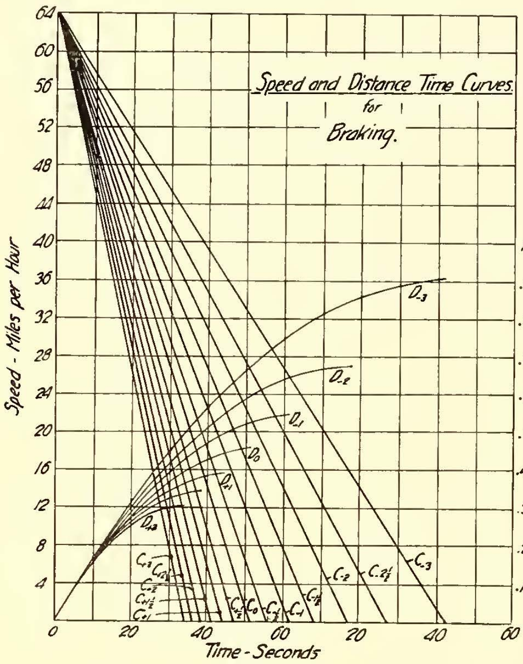


FIG. 4

Fig. 5 shows curves of retardation with motors connected in parallel. These curves show the effect of taking a run at a grade. For instance, suppose the car has been traveling on a down grade for a considerable length of time. According to Fig. 2, the car will have attained a speed considerably in excess of normal. If the car now strikes an up grade, its maximum speed for this grade will be less than the speed at which the car approaches the grade. The speed of the car will gradually lessen until the maximum value for this grade is reached. The rate at which this is done is shown on Fig. 5. The value of A for this case is evidently equal to the distance R on Fig. 1 when F is the friction curve.

Curves of this type are of great interest in considering the operation of freight trains by electric locomotives as compared with the hauling of the same train with a steam locomotive. If the minimum speed of a freight train to prevent stalling be found by experience to be a certain value (about 10 m. p. h.), curves of this type would show immediately the length of a grade of certain per cent that a train would surmount without its speed falling below this value of 10 m. p. h., if its initial speed at the foot of the grade were a certain other value greater than 10 m. p. h.

If then curves of this type are plotted for an electric locomotive and for a steam locomotive of approximately the same continuous rating and each hauling a similar train, the effect of the superior characteristics of the electric locomotive for this service would be shown in a graphic manner. The train hauled by an electric locomotive would be able to surmount a much longer steep grade without its speed falling below 10 m. p. h. than would the train hauled by the steam locomotive. Hence, by the use of electric locomotives, the maximum grades can be greatly increased in steepness, or the present maximum grades could be much increased in length without altering the maximum grade of the virtual profile; and conversely, with a given profile now operated by steam locomotives, the effect of substituting electric locomotives of the same continuous capacity would be to lower the ruling grade, thus enabling greater train loads to be hauled.

Fig. 6 shows curves which are similar to those of Fig. 2. In this case the controller is stopped at the series notch. The e. m. f. impressed on the motor is 275 volts. For any given value of tractive effort, the speed is one-half that shown on Fig. 1. The new speed tractive effort curve can be readily plotted and the value of A determined as in the case of Fig. 2.

Fig. 7 shows curves of acceleration on down grades when the car is coasting. The value of A for this case is shown by curve F (Fig. 1); but on down grade F falls below the base line for the greater part of its length. This is because the acceleration due to the grade is greater than the resistance to motion. The maximum speed for this case occurs at the point where the F curve crosses the base line.

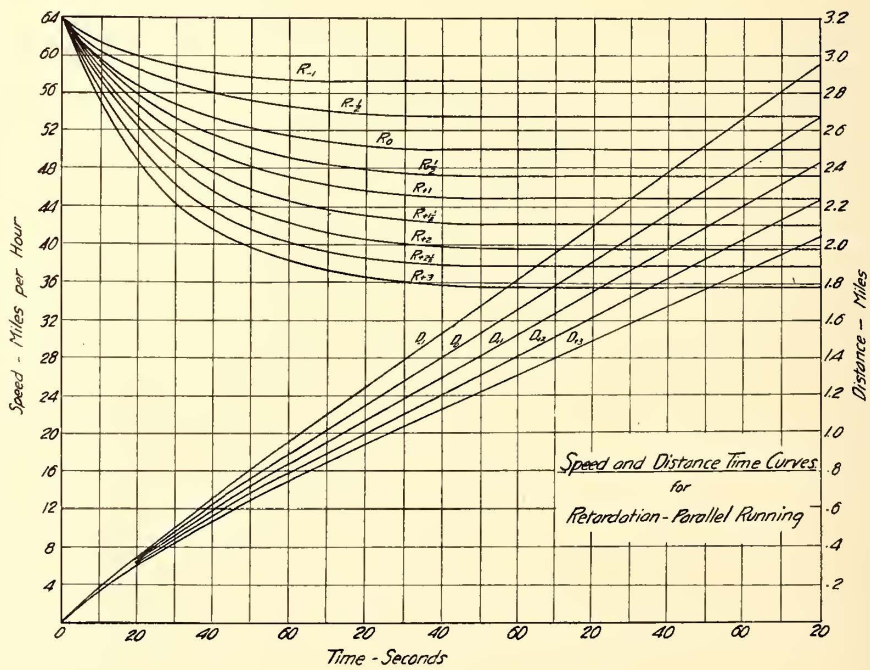


FIG. 5

The extra resistance on account of a curve can be reduced to an equivalent grade. For each degree of curvature the resistance is approximately equivalent to that of a grade of 0.05 per cent. We have, therefore, a set of curves in Figs. 2 to 7 that show the performance of this equipment under any condition either by direct reference or by interpolation. Fig. 8 shows a speed time curve of this equipment over a particular profile. It is entirely made up of portions of the curves Figs. 2 to 7. Each portion of this curve is found by reference to the figure that corresponds to the conditions for the portion of the run, and by noting the speed at which the car leaves the last portion of the run. Further details regarding the exact process of plotting this final speed time curve from curves similar to Figs. 2 to 7 can be found in "Electric Railway Economics," W. C. Gotshall, pp. 159-175. The only puzzling point in regard to it is the determination of the point at which to start braking in order that the total distance traveled will correspond to the actual distance between stations. The best method is to plot the speed time curve from start and cut off at the proper point to correspond to the total distance between stations, considering the braking curve to be a vertical line. This point is easily determined.. Then sketch in the actual braking curve so that the area of the total curve is the same in both cases. This will determine the approximate point at which to start braking. Then plot in the curve accurately and see whether the area is still the same. One trial is usually sufficient. A current time curve is also plotted on the same sheet, enabling energy determinations to be made. The values of current for different speeds are found on Fig. 1. It is to be observed that in the construction of Fig. 8 each type of curve on Figs. 2 to 7 is used.

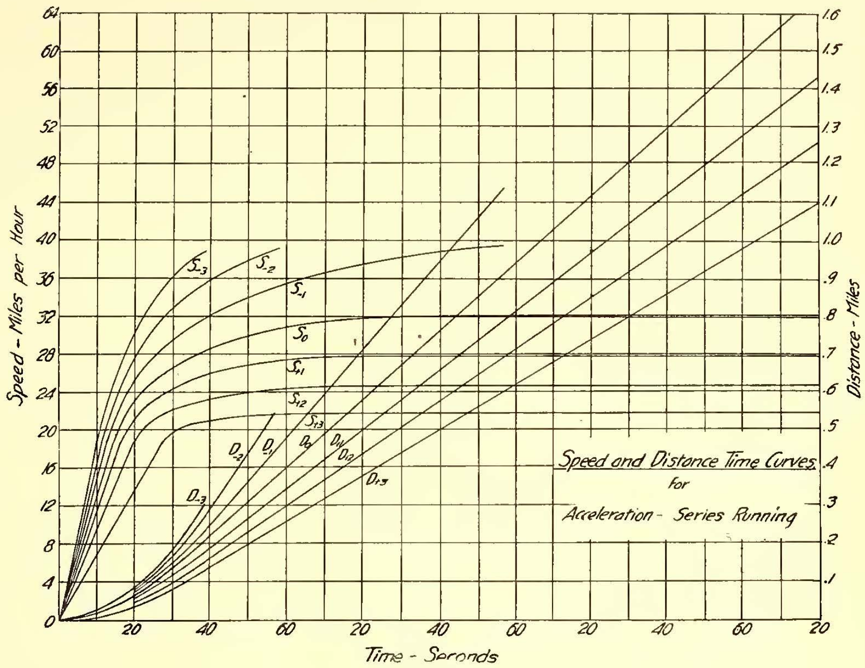


FIG. 6

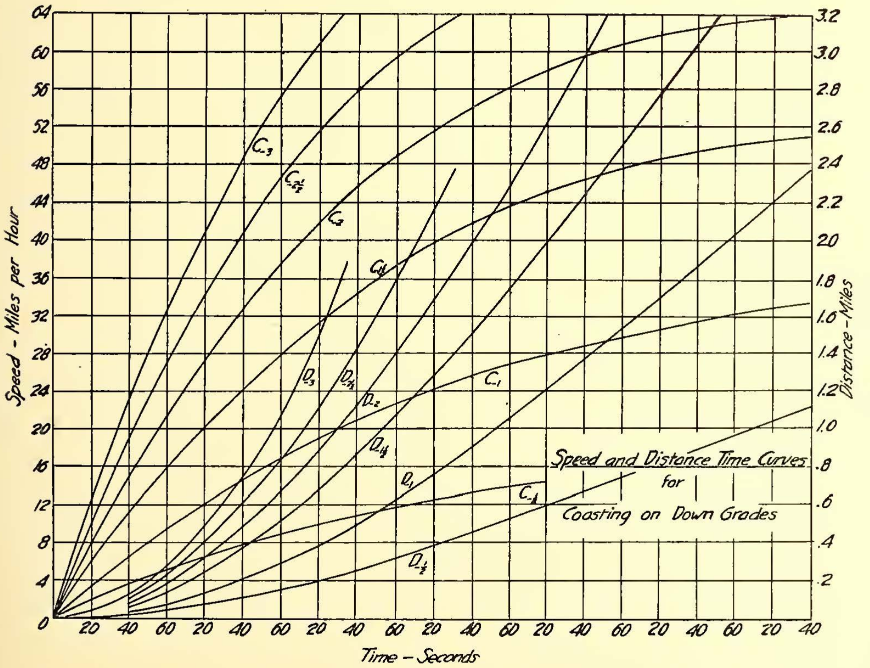


FIG. 7

In case only one speed time curve is to be plotted, it is unnecessary to plot a complete set as shown in Figs. 2 to 7. The value of A can be found at any instant as the sum of all the forces due to grade, curve and motor tractive effort at that instant. This method is described in "Electric Railways," Ashe & Keiley, pp. 37-46. However, when a number of speed time curves are to be plotted for one equipment, the method shown herein will be found the quicker.

There may be some doubt in the minds of electric railway men as to the necessity for any such analysis of motor equipment that requires speed time curves. The manufacturers of electric-motors have plenty of information as to what an equipment will do, and they are always willing to supply this to the user of electric railway apparatus; but this information is made up largely on the basis of a "typical run" analysis and is of little value when applied to anything but preliminary determinations, such as choice of motor and of gear ratio. After the motor and gear ratio are determined a complete set of curves Figs. 2 to 7 should be plotted. If possible this should be done before the final location on the ground is made. The curves are invaluable in determining such questions as—

1. What is the most economical grade for the approaches to an overhead crossing?

2. What will be the speed at a certain point where a curve is necessary, thus determining the sharpest safe curve that can be used?

3. How long can a certain down grade be made in order that the motorman need not apply the brakes to keep the speed of the car below dangerous limits?

In order to reduce energy consumption the keynote of an electric railroad should be "Use the brakes as little as possible." With the aid of a set of these speed time curves this criterion can be met with accuracy.

In the gradual relocation of present interurban lines, with a view to increased schedules and reduced energy consumption that is being made by most of the progressive companies at present, a set of these curves for the type of equipment used on their lines is most useful. They enable the problems to be solved on something other than a guesswork basis.

Similar considerations have led steam roads to analyze most minutely their equipment by means of curves similar to Figs. 2 to 7, these and more are used in their location problems. To be sure the steam roads have a somewhat different sort of problem, theirs being to haul as long a freight train as possible; and a mistake in location is far more serious than a similar mistake in electric railway location where passenger service only is the rule. The flexible operating characteristics of the series railway motor enable the equipment to negotiate almost anything in the way of grades, stops, and accelerations; but it is often overlooked that it costs money to do these things, and by a proper analysis the same schedule speeds could be maintained by slight changes in location, the energy consumption at the same time being decreased.

In conclusion, the writer claims nothing radically new for this method of plotting speed time curves. It is the same as the "interpolation method" introduced by C. O. Mailloux, Trans. A. I. E. E., 1902* However, several differences of procedure are incorporated. A simple slide rule setting takes the place of Mr. Mailloux's "Chart of Reciprocals," and the "General Speed Tractive Effort Curve" is also new. In regard to this last, the writer has found it so useful that he has plotted these curves for all the modern railway motors, thus enabling definite comparisons to be made for an equipment having a certain friction curve.

Other methods of plotting these curves are used. L. A. Freudenberger ("Electrical World and Engineer," Vol. XLII., pp. 96-97 and 219-221) has shown an important development with regard to Mr. Mailloux's method which tends toward a solution by an algebraic method of most speed time curve problems. H. S. Knowlton has also used a method of speed distance curves for the analysis of conditions on the Boston Elevated Railway ("Street Railway Review," October, 1904). However, for all-around usefulness I believe the method herein is as good as any other.

*See also Street Railway Journal, July 7 to Aug. 30, 1902.

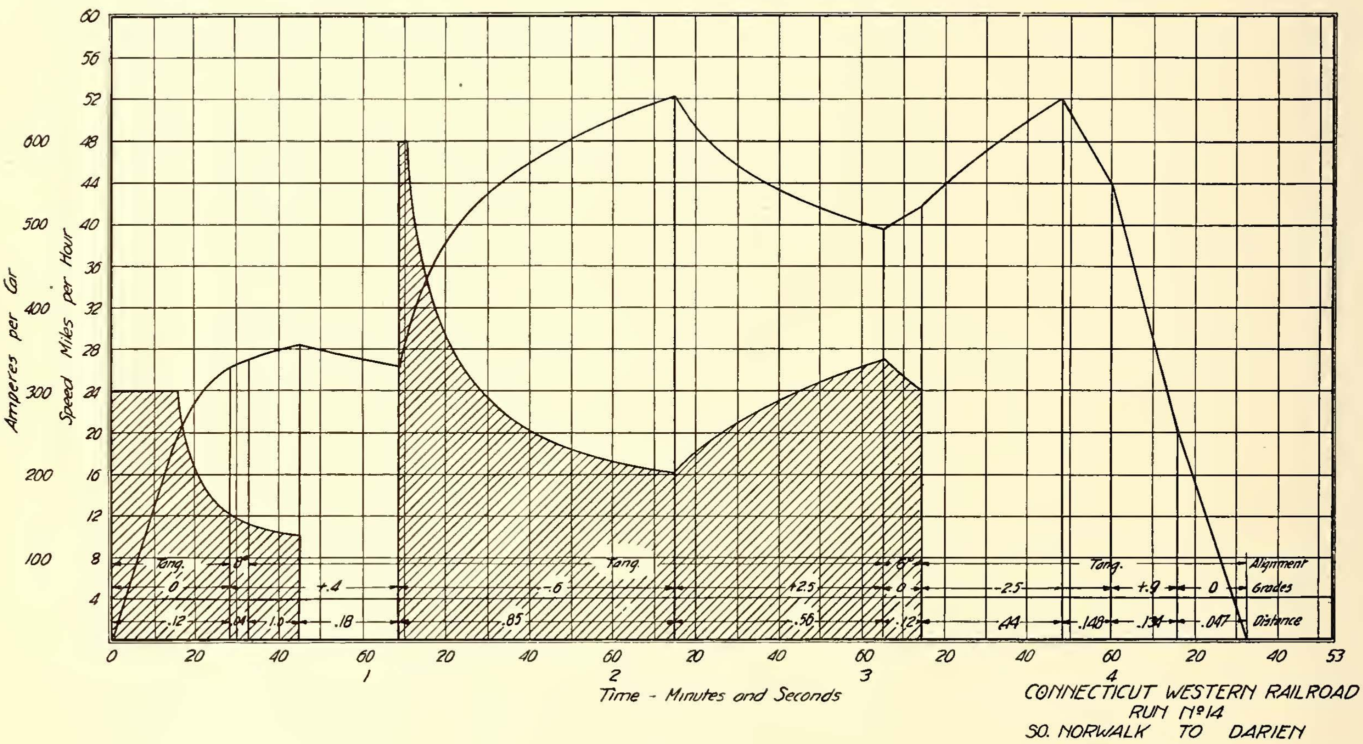


FIG. 8

STEAM ROAD ELECTRIFICATION IN NEW ENGLAND

The New York, New Haven & Hartford Railroad Company is reported to be making substantial progress in its task of electrifying stretches of its steam tracks in Central Connecticut. It is expected that the electric service between Middletown, Berlin and Meriden will be established in May. Power will be supplied from the Berlin power plant. It is probable that the service will be extended to New Britain. The electrification of the Highland Division tracks for the interurban trolley service between Hartford, Rockville and Melrose will probably be completed in March. A large amount of work has already been accomplished. Electric energy will be furnished by the Hartford Electric Light Company, which is now constructing a sub-station at Burnside. A cable to carry 9500 volts is being strung. A dispatch from Boston says that beginning next June the whole passenger service between Stamford and New York will be equipped electrically.

A letter to the Massachusetts Railroad Commission from Vice-President Van Etten, of the New York Central, was made public Feb. 6, and contains the first official statement as to the plans of the company in regard to the electrification of the Newton Loop. It discusses the proposed removal of the passenger terminal to the old Park Square station, which Mr. Van Etten advocates as a means of relieving the freight situation, and the electrification of the Newton circuit, but says: "The electrification of the circuit and the acquisition of the Park Square property mean an expenditure of $10,000,000 or more, and I think you will agree with me that our people are warranted in being absolutely positive that they are doing the right thing before undertaking to expend this large sum."

The Mahoning and Shenango Valley Railway & Light Company has established an inspection and instruction department.

CORRESPONDENCE

ON THE SUBSTITUTION OF THE ELECTRIC MOTOR FOR THE STEAM LOCOMOTIVE

New York, Feb. 5, 1907.

Editors Street Railway Journal:

Referring to some statements made by various speakers in the discussion of the Stillwell-Putnam paper at the last meeting of the American Institute of Electrical Engineers, which statements in one breath described the perfection of results attained by 25-cycle motors, and yet complained of their lack of capacity, I was reminded of a sign that I often see in the subway cars: "We could not improve the powder, so we improved the box."

My criticism of the single-phase a. c. 25-cycle motor was not because of the potential at which the trolley line must be operated. The relations of potential to size of conductor are really of such common knowledge that it is hardly worth while to discuss that particular feature. Obviously, if alternating currents are to be used then just as high potentials as the physical facts will permit should be adopted, and there is nothing revolutionary in the use of 11,000 instead of 3000 volts, but why stop there?

Capacity is the keynote of a railway equipment, and this is not measured alone by that of conductors, but ultimately also by that of motors. The testimony of the evening bore out my criticism that the present 25-cycle motor does not under like conditions approach the direct-current motor in this respect. It is proposed to increase this capacity by lowering the frequency. This, also, in itself is not a novel proposition, for it has been discussed for a number of years. It involves a good many questions, some of them going back to the central station. It may be advisable in the end to adopt for a. c. operation about this periodicity, and months ago I ventured to predict that the largest 25-cycle railroad enterprise now being installed would adopt a lower frequency.

However, in view of the fact that reduction of frequency, which brings a motor more nearly to d. c. conditions, is now advocated as essential, I find some difficulty in reconciling myself to that subtle reasoning which holds that because a motor is to be run on a part of its route from a direct-current supply it is better that it should be designed for the higher frequency.

I am in entire sympathy with every practical development, I care not by what means or along what lines, but I have opposed, and will continue to oppose, any basis of comparison which accepts in fullest measure every claim made for single-phase alternating motors, while denying the possibility, practicability or importance of known improvements in the direct-current field, whether used with overhead or third-rail construction.

Rightly or wrongly, my name seems now to be particularly identified with the efforts toward higher direct-current operation. It is not the first time I have advocated seemingly radical improvements, and I willingly accept the sponsorship of this development. In answer to Mr. Arnold, I venture to assert that, so far as public sentiment or restrictions are concerned, while it is quite possible that the continued introduction of an exposed top-contact third rail will be condemned, as it ought to be, it is quite as likely that high-voltage overhead lines, often in close proximity to highway bridges and crossings, and in dangerous proximity to the general public at city terminals, will come under the ban, as that a well-protected under-contact third rail will do so. Neither is free from objections.

Contrary to the authors' assumptions, operation at 1200 to 1500 volts by direct current has not been proposed by me as the "substitute" for high-pressure alternating currents for heavy electric traction, or as the only means available for this purpose; it has been advocated as a practical advance along existing lines, which under many conditions and with the present development of the 25-cycle alternating motor, offered possibilities of railroad operation denied to the latter.

I prefer to define my own position rather than to have it determined by others for me. I do not profess to know what the ultimate developments in this art are going to be, nor will I enter into any rivalry in predicting that a specific type of equipment must be universally adopted, for I feel sure that the selection of a system by any road must be largely individual, and determined by its own necessities.

There are many opportunities and possibilities for alternating-current equipment, but these are surely not the only methods worthy of serious consideration by such trunk-line divisions as may now reasonably consider the possibilities of electric operation.

Many of the critics of the direct-current development are not as familiar as they might be with what has been recently accomplished in this line, especially in commutating pole construction and gearless motors. The former one of my early babies and now a vital feature in single-phase alternating motors, has been reduced to practice with direct-current motors with such success that I fully confirm Mr. Potter's statement as to its efficiency. Within my personal knowledge, four-pole motors of this type, varying from 40-hp to 240-hp, normal hour capacity, will operate, so far as commutation is concerned, at excess voltages of 75 or 100 per cent with entire freedom from all commutator disturbance. This improvement alone is one of the most important in electric motor construction in recent years; and directly dependent upon it is the possibility of a return to my earlier methods of varying speed and torque of a motor by varying the field magnet strength, a principle now in common use in variable-speed shunt motors, and which is equally applicable to series machines. This addition of a shunt to the series field has an important bearing upon the comparisons made by Mr. de Muralt, for the series motor is no longer a machine with a fixed curve, but one with a very wide range of speed and torque control.

In connection with the other important development, it would be unjust to omit mention of that modest engineer in the railway department of the General Electric Company, Mr. Batchelor, who by one bold stroke has created a remarkable departure in gearless machines, individual to direct-current work, which has received its very practical proof and demonstration, much to the surprise of many critics, in the locomotives recently built for the New York Central Railroad.

In these gearless machines the previously accepted axiomatic principle of fixity of relation between field and armature has been abandoned, the latter being mounted directly on the axle, and the fields being carried upon and forming an integral part of the locomotive frame, supported by its springs and hence moving freely, irrespective of the armature. Not only gears, but armature and axle bearings are all dispensed with, and the acme of simplicity in motor construction reached. If desired, the armatures of course can also be spring borne.

In may interest those who have somewhat cynically questioned 1200-volt d. c. operation to know that the General Electric, the Westinghouse and the Electro-Dynamic Companies have all either taken, or bid for contracts requiring the use of motors at this potential.

On the matter of standardization perhaps I can add a few words. To a certain extent some things take care of themselves. The height of a trolley wire is dictated by the necessity of a clear height above a man on a freight car, and is about 22 ft. There can, of course, be considerable variations from this without interfering with actual operation. The location of the third rail, with center 28¼ ins. from the gage line, and with a working surface from 2¾ ins. to 3 ins. above the rail, has been practically accepted, as per a suggestion sent out a long time ago by Vice-President Wilgus, of the New York Central & Hudson River Railroad, chairman of that road's Electric Commission.

I suppose I ought to feel flattered to see the universal testimony to the benefits of multiple-unit operation, but some of the speakers out-did the parent in love of his child, and committed themselves to recommendations of an extreme character. Here, too, there is little to be said in the matter of standardization. I settled that nine years ago, when I created a train line composed of sections carried upon and terminating in couplers on each car, joined by reversible jumpers between the cars, all constructed, connected and located so that cars could be connected up in any required order, number or sequence, and indifferently as to end-relation; and the master controllers connected therewith had like characteristics with reference to track movement. One of the essential features of this train line is the relative location of speed and direction controlling wires, the former unchanged in any connection, and the latter reversed in connection when cars are reversed. Would-be improvers departed for a time from the essential five-wire system, abandoned automatic control, and introduced additional individual wires for various rheostatic steps in the speed control, as on the elevated road in this city, but the progress of events is carrying them all back to the original lines which I laid down. Practical experience, however, leads me to oppose the introduction of a train line of wires for trunk-line connections, heating, lighting or brake control.

I am not able to get up any enthusiasm about a proposition to equip the freight cars of the country with train lines. While the control of two distantly placed freight locomotives would at times be useful, it is not vital, nor are there the same reasons which make simultaneous control of motor cars in passenger trains essential. Certainly no train operation would be conducted without competent men on locomotives which are distantly removed from each other. Moreover, in view of the universal interchange of freight cars, even if the majority of them were equipped with train lines, the introduction of a single one without such equipment could easily make useless the balance, or make necessary a very objectionable amount of yard switching. It would seem that the possible advantages of adding train lines to freight cars would be much more than offset by the great cost.

It is my intention, in the near future, to present more fully before the Institute sundry technical facts bearing on the general problem of electric trunk-line operation by the various systems. FRANK J. SPRAGUE.

Schenectady, Feb. 2, 1907.

Editors STREET RAILWAY JOURNAL:

The observation made by "Steam Engineer" in your last issue, that electric roads pay because they earn more money and not because they save money, strikes me as very pertinent and reaching to the very root of the whole question of the electrification of steam lines. The electric motor is replacing the steam locomotive in certain instances because it can do something which is impossible with steam locomotive operation. The electrification of steam lines is being carried out with the intent of providing for greater comfort to the passengers and hence to increase gross receipts by making traveling more desirable. The electrification of the terminal roads centering in and around New York is taking place from no motives of economy, and though certain substantial savings will undoubtedly be effected, they are of no degree to warrant the expenditure of the millions of dollars required to effect the change in motive power. In one instance it may be the smoke nuisance, in another the congestion of the terminals, in another case other reasons of a compelling nature which make it desirable to change to the cleaner, quieter and safer electrical system of operation. But the attendant savings have not yet proved so enormous and assured as to warrant such a change, though later comparisons may easily prove that the savings in operation may be great enough to show a comforting return on the capital expended.

Having this fact strongly in mind, it is with some hesitancy that the writer ventures to comment upon the very excellent paper upon "The Substitution of the Electric Motor for the Steam Locomotive" read before the A. I. E. E. by Messrs. Stillwell and Putnam. Indeed, the first part of the paper outlined in no uncertain manner the various benefits secured to the operators of electric lines and showed why their success was secured in the face of steam competition. But the impression left with the careful reader of the complete paper is that the electric motor is ready to replace entirely the steam locomotive because of certain economies effected in its operation,—economies not possible with the continued use of its steam competitor. This was certainly the view expressed within the hearing of the writer by not a few steam locomotive experts present, and because a similar feeling is quite general among steam road operators at large, attention is directed to certain facts that may help to bring about a common understanding of a situation that will be of benefit alike to electrical engineers and steam operators.

There are two classes of steam service which are open to modification in operation, provided a motive power is adopted which possesses broader qualifications than the present steam locomotive.

The passenger traffic into and around our large cities is best cared for by the electric car or train operating at frequent headway and with many stops, a method of operating not possible until the coming of the electric motor. Further comments on this class of passenger service are unnecessary.

For a long-haul service, either freight or passenger, new qualifications are demanded of the motive power. Locomotive operation is perhaps imperative, and the advantages offered by the electric locomotive for this class of service have hardly yet received general appreciation. No such problem as the electrification of a through steam line, either in whole or in part, can be approached by the electrical engineer from the standpoint of saving in operating expenses with the expectation of receiving more than a courteous hearing on the part of the steam road management. Small items of economy when accompanied by the necessity of expending millions of dollars do not arouse a steam operator to enthusiasm, but new methods of operation giving increased tonnage capacity to his tracks, the elimination of the dreaded "ruling grade" and any suggestions as to the relief of the present congestion and danger in operation will command a very attentive ear.

It is idle to imagine that the electrification of a through line will be attended by any large reduction in fare or headway of train, warranting expectations of great increase in passenger traffic. It surely will not stimulate freight traffic unless methods of operation are introduced which will permit the lines to carry more tonnage on their present overcrowded tracks by reason of increasing the size, speed and safety of trains of all classes and eliminating some of the reasons for the present delays at terminals and congested points en route.

The electric locomotive does offer such a means of improving present methods of steam railroad operation, and small possible economies are lost sight of in the larger question of improvements of the most far-reaching character. As the receipts of our through steam lines are made up largely from the movement of freight, it is the problem of moving freight to the best advantage of both operator and shipper that the electrical engineer has to do with if he hopes for the ultimate adoption of the electric motor, and not the search after possible economies in operation while duplicating present steam operating methods. Electrical operation has not followed the lines of steam operation in the past, in fact it would never have reached its present enormous proportions had it not made good use of its greater possibilities. It is reasonable to expect, therefore, that the introduction of the electric locomotive will be attended by changes in handling through freight and even passenger traffic that have not been adopted to date because of the barrier imposed by the limitation of the steam locomotive.

Taking this broad view of the situation, it is hard to see the advantage of forcing the adoption of any electrical standards at the present time. At best the standardization of apparatus or methods is attended by the constant danger of Chinese stagnation. And, too, no piece of apparatus or method is ready to be standardized until its continued use has shown it to be the survival of the fittest. Surely it is premature to attempt the standardization of 15 cycles when it is of benefit to only one type of motor, the single-phase a. c. motor. There is as yet no 15-cycle apparatus in operation in this country, not even an electric locomotive equipped with a. c. motors designed for any frequency. It is true that small a. c. motors have given sufficient commercial success to gratify the adherents of such a type of motive power. Promoters of high-speed interurban electric roads can confidently look to the a. c. motor as an assured success, and its continued development should result in the production of such larger motors as are required for the equipment of electric locomotives. Granting the assured success of the a. c. motor locomotive and the improvement resulting from the adoption of a lower frequency than 25 cycles, no responsible claim can be advanced for the standardization of this lower frequency with our present knowledge of the relation of the electric locomotive to the movement of heavy trains over long distances. The adoption of a lower frequency in an initial installation is good engineering, considering the benefits to be secured to the a. c. single-phase motor, but no attempt should be made to standardize a lower frequency until continued commercial operation has demonstrated the universal superiority of the a. c. motor over all other types better adapted to operate at the present 25 cycles.

The selection of a proper system of electrical operation for a given installation should always be determined after a careful study of the local requirements, and should not be influenced by adhering too closely to any arbitrary standards. If a 600-volt d. c. motor can be installed more cheaply, will offer greater advantages in operation or is to be preferred for other well-defined reasons, sound engineering would suggest its selection. The different local conditions of another proposed installation may call for the adoption of the single-phase a. c. motor or the 1200-volt d. c. motor or the three-phase a. c. type for equally strong reasons. Each type of motor has certain salient features making it especially adapted to perform certain classes of work, and no railway motor having universal qualifications has made its appearance or is even foreshadowed as yet.

Then why this undue haste to standardize a lower frequency with all the attendant complications, especially as the present or proposed d. c. systems have not failed to make good in heavy electric railroading, nor has the a. c. motor had opportunity to demonstrate its fitness for such a service. Why handicap the d. c. and three-phase a. c. motor systems with the additional expense of low-frequency generating and transforming apparatus for the purpose of standardizing another system as yet untried?

The writer admits a strong leaning towards the single-phase a. c. motor system for heavy work. Its simplicity, high efficiency and cheapness are strong arguments in its favor when the conditions of operation are favorable, but it must be admitted that the interests of certain installations can be best subserved by the adoption of one of the several other types of motors; hence this plea for time to prove the relative advantages of the different motor systems, until each has had a representative showing in practice.

After all, the main lesson to be drawn from the most interesting Institute discussion was the apparent readiness of the electrical engineering profession to engage upon the work of steam road electrification, either in whole or in part. It is to be hoped that future papers of similar character will be forthcoming, and that the challenge of "Steam Engineer" to be heard will not be ignored. A free discussion of the broad question of electrification, hearing from both sides, will prove of benefit to both sides, for if the electrical engineer sometimes fails in fully understanding present steam operating methods, surely the steam operator studies the possibilities of the electric locomotive with equal advantage.

A. H. Armstrong.

New York, Feb. 5, 1907.

Editors Street Railway Journal:

I am glad that the very interesting paper by Messrs. Stillwell and Putnam has been published in your journal, and also in some of the other technical papers, as it gives the fraternity at large an opportunity to discuss some of the points which were only lightly touched upon when the paper was presented before the American Institute of Electrical Engineers. The actual discussion at the time of its presentation was limited principally to the frequency of the alternating current, as the paper bore more particularly upon single-phase apparatus than upon direct-current systems, but near the opening of this paper the authors ask the question: "Will it pay to electrify?" and the prominence which is given to this introduction would indicate that it was to constitute the principal burden of their paper. This in fact is found to be the case upon a careful perusal of the document itself, and the question of frequency is more of an incidental or subsidiary character.

While the subject of electrification of steam lines is of very great interest at the present time from a scientific standpoint, it is no less so from a financial one, and this latter phase of the question will really be of more general interest to the railroads the world over than the strictly technical discussion of voltage, kind of current, frequency, etc.

Will it pay to electrify? In order to consider this question in its various bearings we must first decide what is meant by "paying." There are two ways in which a device may ordinarily be expected to pay for its use. One is by decreasing the present costs, and the other is by increasing the returns without a proportionate increase of cost. There is no intention whatever to combat the advantages obtained by electric traction under many conditions, and in fact they are so obvious that they hardly need reference. The various items which are enumerated by the authors, such as frequency of service, speed, general comfort of passengers, safety, reliability of service, increased capacity of line, frequency of stops and convenient establishment of feeder lines, are so clearly presented, even to the lay mind, in regular suburban work, that there is no question that electricity at the present time is the only real suitable power for suburban work. By this, of course, we mean a service that is composed principally, if not wholly, of passenger transportation, as people will no doubt travel by that line which is most comfortable and gives them the greatest facilities for the same or less money. The density of the traffic is of prime importance in estimating whether the electrification of a suburban or interurban line will pay, and by density of traffic is meant not only the existing traffic but such traffic as may be attained with the additional facilities offered by electric service. Under such conditions we would no doubt have the second side of our question, namely, that the increased revenue produced by the improved traffic conditions would more than pay for the expense of electrification.

While this is true in populous districts where the passenger traffic greatly predominates, it certainly cannot be expected to apply to a large section of this country and upon those roads whose freight traffic is their principal source of revenue, and it must be borne in mind that a very large proportion of the railroad mileage throughout this country is such that there could not be any material increase expected in traffic by changing the motive power. Suppose, for instance, a railroad like the Norfolk & Western, whose main business is the transportation of coal from the mines to the seaboard. Considering that the service in each case is ample to transport the coal produced, it is difficult to see where any argument could be made for the electrification of such a line unless it could be demonstrated that the operating cost would be reduced, and as the authors have referred to the railroads of the country as a whole and have based their calculations and assumptions upon the total mileage of the country, it is perfectly legitimate to discuss this phase of the question and attempt to discover if it will pay to electrify lines and portions of lines that are not in the populous district whereby a large amount of traffic would be induced by a pleasanter method of propulsion. It will be noted in this connection that at the last International Railway Congress Mr. Aspinall, of the Lancashire & Yorkshire Railway, stated that the reason that they had adopted electricity on some portion of their line was not to save money but to make money, and this must really be the keynote of suburban or interurban electrifications. Our remarks, of course, must not be confused with such cases as the New York Central, where the absence of smoke and steam in a tunnel line and the increased acceleration of multiple control units produce certain advantages that could not be obtained with steam; nor on the other hand where some natural water power takes the place of fuel which must be purchased at a comparatively high cost, as it goes without saying that in such cases electricity is the power "par excellence."

In connection with the cost of substitution the authors seem to have taken only the electric apparatus actually needed for propulsion of trains, and do not seem to have considered the very great contingent expenses which accompany the electrification. This was brought out two years ago at a meeting of the New York Railroad Club, when Vice-President Wilgus stated: "That the cost of electrifying the suburban service will be about one-quarter of the total amount we will have to expend to secure the full value and benefit of electrification"; and again, that "We have not looked at this question of increased cost from the view of decreasing cost of operation, but rather from the standpoint of being able to build up an increase of business."

Let us now briefly touch upon some of the points where the authors expect to make their gains in economy and see which of them would actually hold good under the ordinary traffic conditions of the great bulk of American railroads.

The question of having freight cars equipped by roads not using electric traction, with train lines and couplings at a cost of from $50 to $75 a car from some one, or at the most two lines which might possibly use their cars in the interchange of freight several times a year, has been branded as outside of the scope of present consideration, but it would certainly be the wildest kind of a "pipe dream" to expect that such influence could be brought to bear upon roads not using electric traction. This would largely prevent the placing of locomotives at any point but at the head of the train unless they were operated by individual crews, in which case the conditions would be practically the same as a steam locomotive sandwiched in between the cars, so that the freight operation would necessarily have to be conducted in a manner practically identical with that now obtaining upon the steam roads. It is expected also that one electric locomotive would do the work of two steam locomotives, but this would only depend upon the amount of power which the locomotive was able to produce, and the same would hold true for steam or any other kind of motive power.

At the Master Mechanics' Convention of 1905, a committee report was presented on the "time service of locomotives," in which it was shown that the actual percentage of the time in which a locomotive was held at the round house for running repairs was a comparatively small proportion of the total; in fact the tables presented showed that this might be anywhere from 3 to 28 per cent of the time, and a record obtained for a single locomotive for one month showed that 23 per cent of the time it was under control of the motive power department at the round house, and 77 per cent of the time in the transportation department. The time in which it was under the control of the latter department was spent in making up trains, switching, passing, orders, delays at crossings, wrecks, waiting for orders, etc., and it is difficult to see how any of these items could be reduced one particle by the change from steam to electric power. It is ordinarily assumed that a steam locomotive should have a lay-over of from four to six hours between trains, and many locomotives are operated in passenger service with even a shorter lay-over than this; and while there are some operations that would not be necessary with the electric locomotives, there is no doubt that a certain time would be required, and if an armature were to be repaired in many of the types used it would require at least several hours to make the necessary repairs and changes. We see, therefore, that there is little prospect of one electric locomotive taking care of the work of two steam locomotives, assuming that in each case the locomotives are as large as can conveniently be used by the railroad operating them. It must also be borne in mind that electric locomotives cost practically double the amount paid for steam locomotives, and under these circumstances it is natural to expect that wreck repairs would also be more expensive.

The question of operating through trains by one man in the locomotive is also discussed, but we believe that for long runs the argument given would not be applicable. It is practically inconceivable, for instance, that a man should remain three or four hours in one position with his hand on the controller, as would apparently be necessary with the automatic safety arrangements proposed. The various auxiliaries of the locomotive would certainly require attention, and it would be necessary for the engineer to have more or less freedom of movement around his machine. With motor trains making frequent stops this condition is so entirely different that it hardly bears any analogy to the long-run proposition above referred to. It is questionable also whether other considerations would not be equally important in dispensing with the services of the additional man on the engine, and it hardly seems likely that any reduction of pay could be expected if we judge from indications which are presented to our notice practically every day.

The fuel question is another one of very great importance, as the fuel expense of a railroad runs from 10 per cent to 12 per cent of the total cost of operation. The continuous service given on the elevated railroads is certainly very conducive to a small fuel account, and we could not expect such satisfactory results from overland freight traffic. The tests made at the St. Louis Exposition indicate that under favorable conditions a locomotive may operate with a consumption of about 2 lbs. of coal per horse-power hour. But there are many cases, as where heavily-loaded freight engines are ascending a steep grade, in which the consumption may be two or three times that amount; therefore we believe that some advantage will accrue in the cost of fuel for train operation, but by the time we allow for the transmission losses and develop at our locomotive only 70 per cent of the power produced at the central station, it is apparent that we cannot expect such a ratio of improvement as 3 to 1, which has been suggested, or even possibly 2 to 1. Besides, our power house must be kept in continuous operation ready for sudden drafts of power, and if the units are large enough to carry a fair working load there will be many times when they will be working on a very small hourly load factor. Of course we will save the coal that is consumed when standing on side tracks waiting for orders, and which amounts in some cases to from 25 to 50 lbs. per locomotive an hour, but our power plant with its auxiliaries must be kept in operation at all times whether traffic is light or heavy, and when we consider that the average service for the United States is, as stated, seven trains per day passing a given point in each direction, a moment's reflection will show the great irregularities in traffic which exist upon roads whose business is principally the transportation of freight.

The cost of fuel has been practically cut in half in making the comparisons between the steam and electric operation, and this is further demonstrated by some diagrams which are reproduced on page 199 of your issue of Feb. 2. The method of constructing these diagrams has not been given in detail, but as far as I have been able to check them up, it seems as if they were based upon the movement of trains upon a level only, and that no allowance has been made for the adverse effect of rising grades. The average resistance of a freight train at the speeds commonly used is probably 5 lbs. or 6 lbs. per ton, and this is equal to the grade resistance due to a rise of 15 ft. per mile, which would really be a very low grade for practically 99 per cent of the roads in this country, in many cases the grades being double and quadruple this amount. It must not be assumed that an undulating profile will require no more power than a level division, because the work of ascending a grade is a very severe and heavy draft on the power, whatever it may be, and which is not compensated by the following run down hill, even if this should be as great in amount as the ascent. Under these conditions we should say that the amount of power needed for general operation in this country would be at least double that which has been assumed by the authors. This would practically double their figure for power or make it $152,000,000 per annum in place of $76,000,000,—a figure which is very close to the present cost of fuel as obtained from the Interstate Commerce Reports and which is given as $156,000,000 for 1905. Even if it be contemplated that regeneration by producing current from the motors when running down hill will assist in the up-hill runs, we would have the line losses to consider in both cases; besides many divisions are up grade entirely in one direction, and with single-track roads the tendency nowadays is to send freight trains in "fleets" in one direction on account of being able to get them over the road more quickly and with a smaller number of "meet orders." This would apparently put the cost of power under both assumptions on nearly the same basis.

The size of plants to supply the railroads of the country as a whole has been based upon an output of 12,500,000,000 kw-hours per annum, but we have just indicated that this is probably altogether too small. Considering a 70 per cent drop or loss in power from the power house to the locomotive, the 2,800,000-kw capacity of power plants needed for the entire country would give only about 50 per cent more power than the average requirements, basing it on the figures assumed by the authors of 12,500,000,000 kw-hours per annum. The New York Central electric installations provide over three times the amount of power which is used on the average during the day, even without trespassing on the overload capacity of the generators; besides the average of seven trains per day for the country will give an idea of what a variation may exist on any division, especially when we consider that eight or ten freight trains might be sent out at ten or fifteen-minute intervals to ascend a heavy grade, and that in the next eight or ten hours there might be little or no movement upon the line, as is the case with stock runs. We have indicated above that the required output is likely to be double that which has been suggested, and under these circumstances it would certainly be necessary at least to double the size of the power houses required, which would probably increase the average cost per mile from $10,320 to $12,000 for the electric equipment, and if we take our interest and depreciation at 5 per cent and 3 per cent, respectively, we have a charge of $960 per mile against the capital cost of our electric installation. If, as above stated, we assume that the cost of power in each case will be equal, our electric operating expenses for the United States as a total would be increased from $5,255 to $5,607 per mile, leaving a decreased cost of operation due to electric power of $802 instead of $1,154; and when we see that our interest and depreciation are likely to amount to $960 per mile, we have little argument to induce us to electrify the average railways of the country on the theory of reducing our cost of operation.

Moreover, we must refer again to the remarks of Mr. Wilgus in which he stated very clearly that the actual cost of electrification was only about one-quarter of the total cost of expenses made necessary by that electrification.

G. R. Henderson.

THE BOW TROLLEY IN GERMANY

Berlin, Germany, Jan. 28, 1907.

Editors Street Railway Journal:

Your issue of Jan. 19 contains a letter by Mr. Eugene Eichel, in which he criticises certain statements in my article in your issue of Jan. 5, but his remarks show that he has been misinformed as to the real condition of affairs in this country. The superiority of the bow for German conditions is no longer a question of individual opinion, as Mr. Eichel intimates. Recent statistics, compiled under entirely unbiased auspices, show that while the cost of both types of current collectors is practically the same so far as the wear of the collectors is concerned, the trolley wire wears out much faster, under the same operating conditions where wheels are used than where the bow is employed. Besides this, the sliding bow sets itself automatically in the proper direction when the car is being switched, never leaves the wire, and does not require that the wire should be exactly over the center of the track. Its greatest points of superiority as demonstrated after ten years' experience are therefore safety in operation because the collector cannot leave the wire, and a considerably reduced wear on the trolley wire.

The instance of the Charlottenburg street railway, given by Mr. Eichel as an example of change from bow to wheel, has no bearing on the question. The true reason for the change was the purchase of that line by the Grosse Berliner Strassenbahn, which was using the trolley wheel on the rest of its system, and naturally did not care to have two types of current collection. The mixed overhead and accumulator system of the Charlottenburg company was also abandoned at the same time. It is interesting to add that when this mixed system was in use almost twice as much current was collected by the bows as was afterward required by means of the wheels.

Among the lines which so far have changed from the wheel to the bow may be mentioned the street railways in Wiesbaden, Plauen and Aibling-Feilnbach. On the last named road the wheels left the wires so often in going around the curves at high speed that it was impossible to keep the schedule. In Amsterdam, after two lines had been equipped with trolley wheels, it was decided to adopt bows for the entire system. The cities of Düsseldorf and Nurnberg, as well as the Essen street railway, have also been contemplating changing from the wheel to the bow. The government of Saxony demands the use of the bow on all the street railways in that kingdom.

In all of these cases operating expenses were the deciding factor in the change. This fact I cannot state too clearly, and in Germany there is not an independent electrical engineer who prefers the wheel to the bow. The reason for the more extended use of the trolley wheel is simply that ten years ago, when most of the German street railways were electrified, the bow had not yet been fully developed, hence the wheel, which had already been adopted in America, was chosen in preference to the still almost unknown sliding bow. Another reason is that Siemens & Halske was the only company to adopt the bow while all the other electric companies used the trolley wheel, and, as previously mentioned in your columns, Siemens & Halske electrified only a small part of the German street railways.

Mr. Eichel is equally in error in his statement regarding horn lightning arresters. They are used not only on the Siemens roads, but also on the following: Bergische Kleinbahnen Neviges Elberfeld; Munich Lokalbahn; the tramway systems of Hamm, Augsburg, Nürnberg, Braunschweig, Nordhausen, Jekaterinoslaw (Russia) and Charleroi (Belgium), the Berlin-Charlottenburg street-railway, and on the Swiss railways equipped by the Oerlikon Company. It should be stated, however, that the lightning arresters with magnetic blow-outs furnished by the Allgemeine Elektricitäts Gesellschaft have been found to work very well.

American street railway managers naturally look somewhat askance at the bow collector, because there is no possibility in the United States of comparing both systems, but since Mr. Eichel has brought up the subject of German conditions and practice, I cannot but repeat that no unprejudiced railway man in Germany any longer believes in the superiority of the trolley wheel. The conclusions in the articles in "Elektrische Bahnen und Betriebe," referred to by Mr. Eichel in the footnote to his letter, were erroneous and were supposed to prove that the bow touches the trolley wire at only one point, whereas the wheel touches the wire in a series of points or a line.

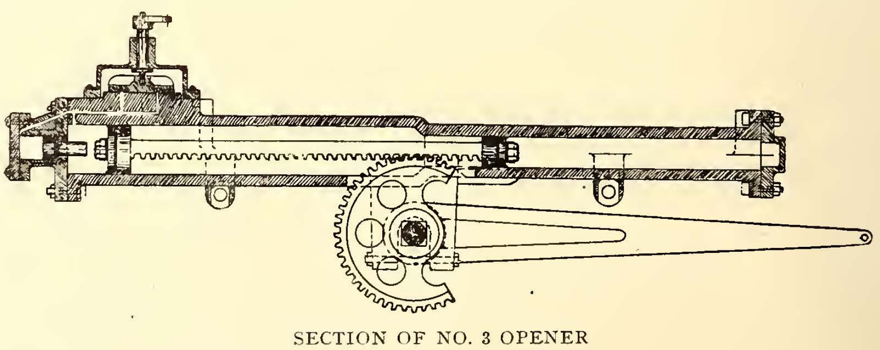
German Engineer.

PNEUMATIC DOOR OPENERS

Chicago, Jan. 31, 1907.

Editors Street Railway Journal:

I wish to take exception to some of the statements by Mr. Fox in your issue of Jan. 12 in regard to the inefficiency of made by Mr. Fox regarding perfect and inefficient mechan-



SECTION OF NO. 3 OPENER

my No. 3 machine, which is typical of all of the sizes made by me, is shown in the accompanying engraving. It is simple in construction and very positive in action, is controlled electrically, pneumatically or by hand, uses but one measure of air for two movements of the door, and has an arresting cylinder to prevent the slamming of the door when it is connected to the main drum of the air-brake system, dispensing with the reducing valve, which is an important item. As the pipe which supplies air to the small cylinder is out of center it is not shown in the accompanying section. The following is a statement to show the amount of air used for two movements.

This opener is designed for 70 lbs. initial pressure. The 1⅝-in. cylinder has a cross section of 2.074 sq. ins. The 2 5-16-in. cylinder has a cross section of 4.2 sq. ins. The door movement is 36 ins., and a 4-in. pitch diameter sector is used with an 18-in. lever. The piston displacement is 6½ ins.; 2.074 $\times$ 70 lbs. = 145 lbs.; 4.2 $\times$ 70 lbs. = 294 lbs.; 294 lbs. — 145 lbs. = 149 lbs.; 145 lbs. $\times$ 2 ins. (one-half pitch of sector) equals 290 lbs.; 290 lbs. divided by 18 ins. (length of lever) gives 16 lbs. push on door; 4.2 sq. ins. x 6.5 sq. ins. equals 27 cu. ins. of air used for two movements.

In the 90-lb. pressure No. 3 machine and 44-in. door movement a 22-in. lever is used, and 18½ lbs. push and pull at the door is secured. The consumption of air is 27 cu. ins. for two movements of the door.

In the construction of this machine, stuffing boxes, set screws and keys are not used, consequently three items that cause trouble have been disposed of.

J. E. OSMER, Master Mechanic.
Northwestern Elevated Railway Company.

A HOME MADE CONSTRUCTION CAR

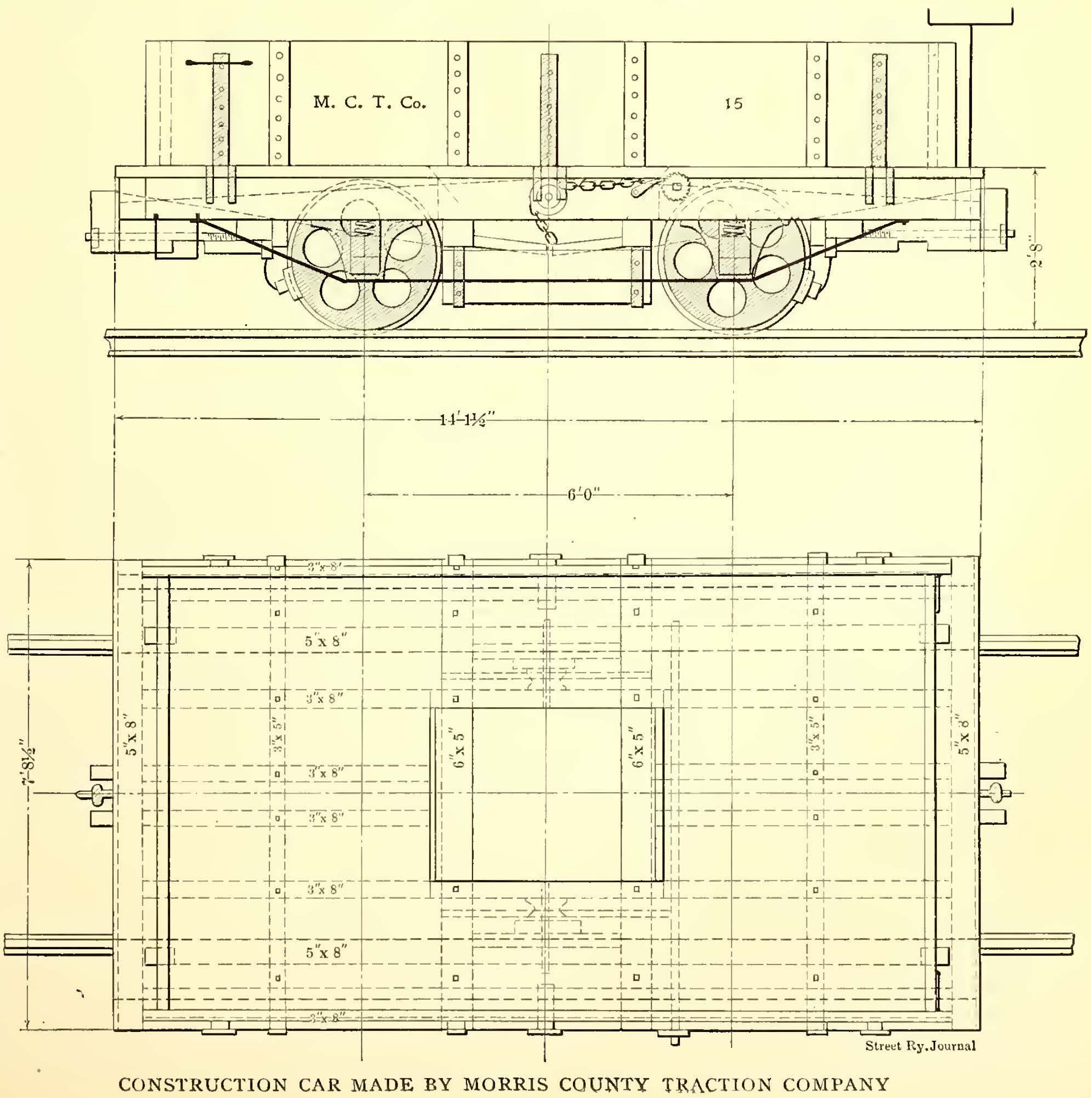
As noted in the STREET RAILWAY JOURNAL of Jan. 12, 1907, the Morris County Traction Company is building an extensive inter-suburban system in New Jersey territory contiguous to New York. Some difficulty was found in securing at reasonable cost construction cars substantial enough to carry the heavy ore-bearing ballast used on these lines, so the company decided to build its own cars.

Each car holds 6⅝ cu. yds. level full, 7 cu. yds. when loaded with sand, or about 10 tons of crushed stone. The car is built for standard gage and is mounted on a Brill four-wheel truck with 6-ft. wheel base. Hand brakes are used. The car body is 14 ft. 10½ ins. long and 7 ft. 8½ ins. wide. The floor is made of 2-in. plank and is 2 ft. 8 ins. above the head of the rails. The sides are also made of 2-in. plank and are hinged to the floor with three sets of hinges for each of the sides which are dropped when the car is to be unloaded. The hinge straps are of 3-in. x ½-in. iron and act as additional braces to the sides. When closed the sides are hooked on the outside to the ends. The latter are made of 2-in. plank and, like the sides, may be easily removed in case a flat car is desired.

There are eight longitudinal sills, 13 ft. 2 ins. long and 3 ins. x 8 ins. or 5 ins. x 8 ins. in width and depth as shown on the plan drawing. These are joined at the ends by two 5-in. x 8-in. sills, 7 ft. 8½ ins. long, through which are bolted six ¾-in. diameter longitudinal iron rods under the sills. There are also four crossbeams which are symmetrically placed with regard to the center of the car and clear the rail by 1 ft. 6 ins. They are 2 ft. 11 ins. apart on centers and 7 ft. 8½ ins. long. It will be noted that the end pair is 3 ins. x 5 ins. and the middle pair 6 ins. x 5 ins.

For use as a dump car, the center is furnished with a double drop door worked from the side by a ratchet wheel through a 2-in. diameter axle and 1-in. diameter wrench bar. The chains fastened to the ends of the doors coil up on this axle as the wheel is turned to close the door; in dumping, the weight of the material is sufficient to open the doors after releasing the ratchet. When open these doors clear the top of the rails by 2 ins. The chains are guarded from rock, etc., by 3-in. planking down to the doors. Outside of the chains are 1-in. board guards coming down to 5-ins. above the rails. The dump opening is 4 ft. x 3 ft. at the top. The doors are about 1 ft. below the floor level and are 1 ft. 2 ins. x 3 ft. 9 ins. They have hinge connections to the adjacent cross-beams. The door opening is 2 ft. 5 ins. x 2 ft. 10 ins. The total cost of material and labor for one of these cars was $302.25, made up as follows:

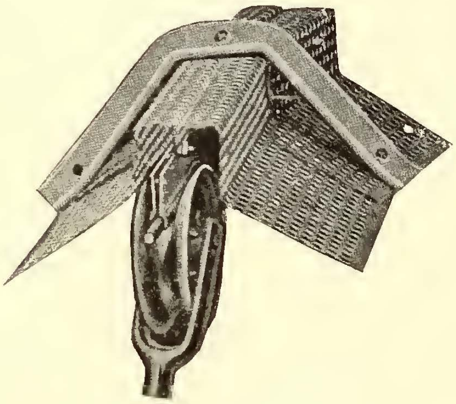
Eight hundred and fifty ft. B. M. lumber, at $35, $29.75; iron, including bolts, drawheads, brakes, shoes, hinges,



CONSTRUCTION CAR MADE BY MORRIS COUNTY TRACTION COMPANY chains, etc., except the truck itself, 2000 lbs., at 2½c. per lb., $50; carpenter work, $75; blacksmith work, $50; paint and painting (three coats), $7.50; and truck, estimated at $90.

A GUARD FOR STEAM RAILROAD CROSSINGS

A device designed to guard electric cars from becoming stalled on steam railroad crossings which, besides performing this vital function is simple in construction and combines a number of other important advantages, is being placed on the market by the Automatic Trolley Guard Company, of Buffalo, N. Y. It is known as the Automatic Trolley Guard, and as shown in the accompanying engraving consists of a trough which makes it practically impossible for the wheel to leave the wire, and insures the return should it by chance jump. The channel in which the wire is centered, it will be noted, is of sufficient width to allow the wheel to rotate freely without the harp or wheel striking the sides of the wheel. The guard is in sections for easy handling and erection, and is as light as is consistent with perfect rigidity and strength. While no material that can unravel is used in its construction, still the guard is so built as to admit of the easy escape of locomotive exhaust. The guard is adaptable to any curve. Another feature of it is that it cannot arc or burn. A. B. Weeks, of Chicago, is the Western agent of the company.

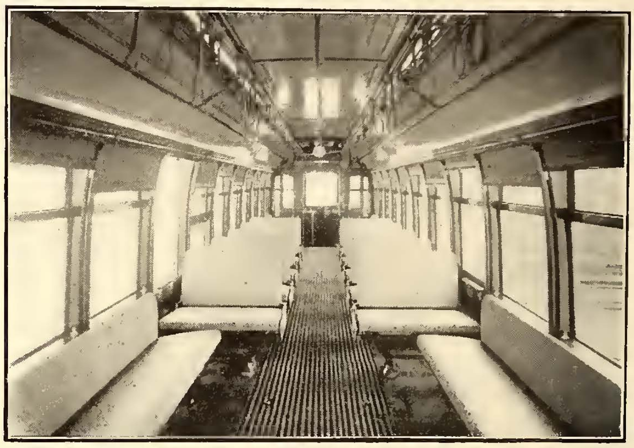


GUARD AS INSTALLED

SEMI-CONVERTIBLE CARS FOR CENTRAL PENNSYLVANIA TRACTION COMPANY

The Central Pennsylvania Traction Company, which operates all the lines in Harrisburg, Pa., has received within a year three lots of Brill semi-convertibles, one of the cars to be shipped last month being shown in the engraving. The company advocates plenty of standing room for its patrons. The cars shipped last spring and those just completed carry out this idea to the extent of having longitudinal seats at the four corners extending the length of three windows. The company also operates semi-convertibles having longitudinal seats entirely, and both the arrangements mentioned are somewhat unusual in cars of this type, and indicate that the majority of passengers carried will be short trippers.

The new cars are longer by one window than cars having the same seating plan shipped previously; the platforms are also a trifle longer. The cars measure 30 ft. 8 ins. over the end panels and 41 ft. 1 in. over the vestibules; other dimensions are standard and the bottom framing is also the standard found in this type of construction. No doors are provided at the entrances, the Brill folding gate being utilized. The car bodies are mounted on the Brill No. 21-E truck with a wheel base of 4 ft. 6 ins. There were five cars in the shipment.



INTERIOR OF CAR FOR HARRISBURG

NEW ROLLING STOCK FOR QUINCY, ILL.

The American Car Company, of St. Louis, included in its shipments of last month six 18-ft. closed cars for the Quincy Horse Railway & Carrying Company, which operates an electric road in Quincy, Ill. The accompanying engraving shows one of the new cars in operation on the streets of Quincy. It will be seen that the new cars have only one entrance on each side, the passenger entering the car through a door of the familiar Brill "Accelerator" type. Natural quartered oak forms the finish of the cars and the seats are arranged longitudinally. The builders have used their own type of sand box, and the angle-iron bumpers, signal bells and alarm gongs are of the Brill manufacture.

SINGLE-ENTRANCE CAR IN USE IN QUINCY

The truck employed is the Brill No. 21-E, and two motors of 35 hp each were installed on each car. The chief dimensions are: Length over end panels, 18 ft.; over vestibules, 28 ft.; width over sills including sheathing, 7 ft.; size of side sills, 4¾ ins. x 7 ins.; sub-sills, 3¾ ins. x 4 ins.; end sills, 3¾ in. x 6 ins.

"LIMIT" CAR HOUSES OF CHICAGO UNION TRACTION COMPANY DESTROYED BY FIRE

The southeastern portion of what is known as the "limit" car houses of the Chicago Union Traction Company was destroyed by fire early Thursday morning, Jan. 31. The loss in cars was confined to about twenty-five single-truck cars, of which ten were old cable trailers. The total loss was about $100,000. None of the new double-truck cars recently purchased by the company were consumed.

THE RUINS OF THE CHICAGO CAR HOUSE

The fire started from an explosion of the Pintsch gas tanks used in charging the lighting systems of the old cable cars, and the flames spread so rapidly that the efforts of the firemen were confined mainly to the saving of adjacent repair shops. The three bays which the fire reached were used for the storage and inspection of cars and were entirely consumed, only the roof trusses of the northernmost bay and walls remaining. The car houses were originally built for cable cars and were not provided with any automatic sprinkler system.

Very little delay in the operation of the lines was occasioned by the fire, as divisions in other portions of the city were each called upon to furnish a few cars to take the place of those burned.

General Manager Roach has given out a statement to the effect that one hundred new cars are now being built for the company, and that he believes the receivers of the company will give another similar order for cars within a short time. Early on the morning after the fire gangs of men were put to work cleaning up the ruins, and in all probability new and modern car houses will be erected at once.

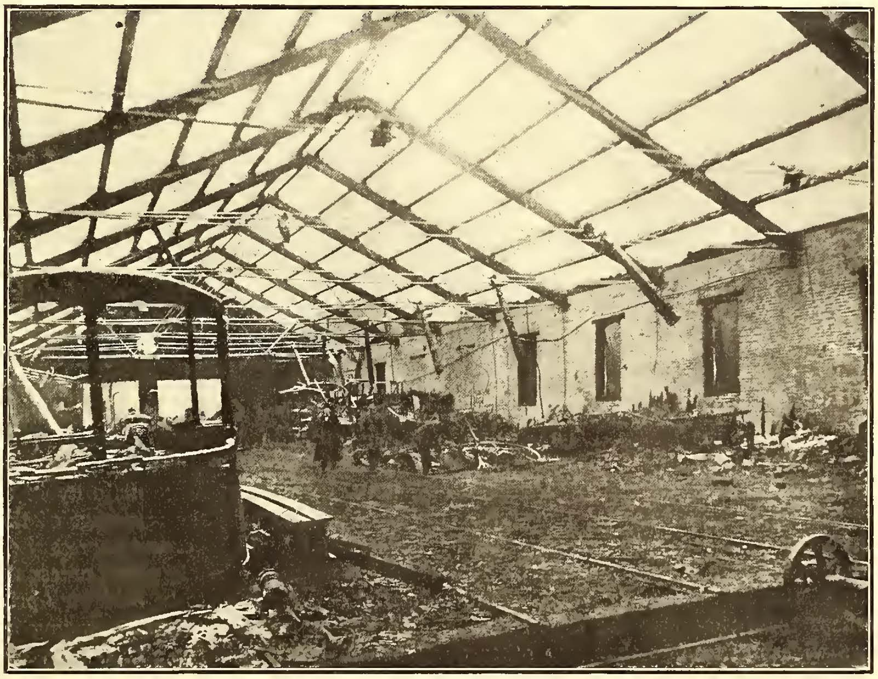
The cars of the Rhode Island Company, which operates in Providence, Pawtucket, Central Falls and other places in Rhode Island, are all to be equipped with vestibules.

BAGGAGE AND EXPRESS CARS FOR ILLINOIS SYSTEM

The increased mileage of the Illinois Traction Company's system has necessitated from time to time additions to the rolling stock. During the earlier portion of last year three large buffet cars and several passenger cars built by the St. Louis Car Company were put in service on the line, and this car company has just completed several additional cars for the system built much in accordance with the plans of some of the cars furnished last year.

The new cars, which are constructed with baggage and passenger compartments, measure 51 ft. 6 ins. in length over all and are 8 ft. 6 ins. wide over the siding. They are intended for operation in one end only. The motorman's cab is located in the left corner of the forward or baggage compartment, and entrance is gained to it either from the outside of the car through a narrow door or from the baggage compartment through a door about 3 ft. high in the side of the partition separating the cab from the baggage compartment. The rear of this partition contains a switch cabinet in which are placed all of the switches for the type-M multiple-unit control system, for the pump motor and for the lights, and also a cabinet for the emergency tools. This latter cabinet is provided with a glass door which opens out into the baggage compartment. The toilet room is located in the rear of the car on the left side of the rear door. Opposite it is the hot-water heater.

The car is mounted on St. Louis Car Company No. 61 trucks having wheels 33 ins. in diameter and with 4-in treads. The car is designed to take a curve of 42-ft. radius. In addition to the air brakes an 18-in. vertical brake lever is provided. The fact that the cars are built along the same lines as cars already in service indicates that this style of car is well suited for interurban service.



EQUIPMENT DAMAGED BEYOND REPAIR

FINANCIAL INTELLIGENCE

The Money Market

Wall Street, Feb. 6, 1907.

A somewhat firmer tendency developed in the local money market during the past week. Money for day to day use was in abundant supply at rates ranging from 4 to 1¼ per cent, the latter figure being the lowest rate for call money recorded in many months. In the time loan branch, however, the tone was decidedly harder, and asking rates for all maturities were fully ¼ per cent higher than those heretofore ruling. Sixty-day money commanded 5¼ per cent, ninety days 5½ per cent, four to six months 5¾ per cent, and nine to twelve months 6 per cent. The higher rates were due in part to the continued demand for fresh capital on the part of corporations. During the past week announcements of several issues of short time notes were made, the most important of which was that of $50,000,000 made by the New York Central and affiliated lines. Other important factors working in favor of higher interest charges were the sale of $30,000,000 bonds by the city of New York on Feb. 1, and the repayment by the banks of the special deposits of Government funds, made by Secretary Shaw to relieve the money stringency which prevailed during the closing months of last year. A feature of the week was the sharp fall in rates for sterling exchange of 110 points, as a result of the purchases of short-time railroad notes and other securities in the local market by foreign investors. The offerings of bills against these purchases carried sterling to a point permitting the importation of gold from Europe at a profit, but it is doubtful if our bankers will be able to secure any considerable amount of the yellow metal for shipment to this side. Thus far $1,000,000 has been engaged for import, and while additional amounts may be secured in the London open market from time to time, the general opinion in banking circles is that as soon as the movement shows signs of assuming large proportions, London bankers will find effective means of checking the outflow in this direction. The bank statement published on last Saturday was better than expected. The net loss in cash was only $500,000, or about one-third as large as the preliminary estimates, but, on the other hand, loans increased $11,800,000, owing to the shifting of loans from other institutions to the clearing house banks. The reserve required was $2,427,100 larger than in the preceding week, thus reducing the surplus reserve $2,928,700. The surplus now stands at $12,734,100, as against $15,562,800 in the previous week, $11,127,625 in the corresponding week of last year, and $19,841,925 in 1905.

The Stock Market

The growth of pessimism was the distinctive feature in connection with the stock market during the past week. This was all the more pronounced for the reason that prices have been on the downgrade ever since the announcement that the Union Pacific had been placed on a 10 per cent dividend basis, and also on the ground that liquidation has been of a broad character from the Wall Street point of view. The selling has been not so heavy as persistent, and each rally merely serves to bring more stock on the market. The reasons for this downward movement are not obscure. They include, first of all, the monetary situation, which is far from satisfactory, notwithstanding the renewal of gold imports; the destruction of confidence by the continued attacks upon corporations by Federal and State authorities, and the large demand for new capital through the issue of short-time notes by railroad and industrial companies. Perhaps the attack upon the Union Pacific interests has had a more widespread effect than any other development, but it is a period of adverse rumors, and sentiment has shifted strongly to the selling side of the market. Interest continues to center in the so-called Harriman group, and the illness of the head of this system doubtless had no little influence in bringing about lower prices for all these shares, especially Union Pacific. Southern Pacific held up remarkably well, and this may be due to the large earnings which the company has reported and the favorable outlook for even larger totals. The weakness in the coal and iron stocks is not to be accounted for by any decrease in earnings, present or prospective, while the lower prices for the United States Steel shares does not appear to be justified, as the earnings of the company for 1906 were of record volume, and the amount of new business booked is larger than can readily be handled. The copper stocks slumped pretty badly, but the copper metal situation has not changed, and the demand is still far ahead of possible production for the next six months. The decline in Amalgamated has been rather more than expected, and the lack of support in this stock had an unfavorable influence on the entire list. Foreign interests have been buyers of nearly all the international shares and also of the short-time notes issued by railroads. The Hill stocks have not been weak but have followed the general market, instead of, as usual, being leaders in the price movement. These companies are under legal fire, but they are in a strong position and already have had a decline, which would appear to discount all unfavorable conditions. The local traction stocks have suffered like all others. Summing up the situation little is found that is encouraging, but it will not do to ignore the fact that the market has passed through a period of drastic liquidation, that weak holders have been shaken out and that a large short interest has been created.

Among the few redeeming features of the situation are the undoubted fact that the Federal administration is inclined to withhold any further hostile measures for the time, and a general disposition to "discount" the adjournment of Congress, though that event is still some weeks off.

Philadelphia

Trading in the local traction stocks was comparatively quiet during the past week and prices generally displayed a declining tendency. Interest centered almost entirely in Philadelphia Rapid Transit, which was under pressure practically throughout the entire week. After selling at 21⅝ at the opening, it ran off more than a point on sales of about 10,000 shares. Philadelphia Traction, after selling at 96, dropped to 94¼, and Union Traction declined from 58 to 57½. Other sales included American Railways at 50⅝, Philadelphia Company 45½ and 45, Philadelphia Company preferred at 47, United Companies of New Jersey at 254, Union Traction of Pittsburg preferred at 47½ and Railways General at 6½.

Baltimore

The market for tractions in Baltimore was generally quiet, but prices as a rule showed very little change from those prevailing at the close of last week. United Railway issues were very firm except the incomes, which lost nearly a point to 57⅜. The 4 per cent bonds sold at 89⅝ and 89¾, the refunding 5s at 86½, and the free stock at 12¾. Knoxville Traction 5s brought 106¾ and Richmond Traction 5s sold at 105⅜. Other transactions included City & Suburban 5s at 108¼ and 108½, Baltimore Traction 5s at 111, Baltimore City Passenger 5s at 110½, and Norfolk Railway & Light 5s at 98 and 97.

Other Traction Securities

The most important development in the Chicago traction situation during the week was the action of the Chicago City Council in passing the Chicago City Railway and Chicago Railway's (Union Traction) ordinance by a vote of 56 to 13. It is expected that Mayor Dunne will veto the ordinance, but the large majority in the Council in favor of the measure insures the repassage of the ordinance over the Mayor's veto should it become necessary to do so. The ordinance, however, does not take effect unless the question is ratified at the general election to be held on April 2. The passage of the ordinance failed to stimulate trading in the stocks of the surface lines, but prices for all of the issues held decidedly firm. Other sales were: Metropolitan Elevated common at 26, Metropolitan Elevated preferred at 69 and 70, and South Side Elevated at 86¼ and 87. The Boston market was very quiet. Boston Elevated, after selling at 151 broke 2 points, and later recovered a small fraction. Massachusetts Electric common and preferred were steady, with sales at 19 and at 69, respectively. Boston & Worcester common sold at 27 and 27½, West End common at 94 and 93, and West End preferred at 108¾.

Quite a little activity has been shown in traction securities on the Cleveland Stock Exchange the past week. Between 900 and 1000 shares of Cleveland Electric stock changed hands, while 200 shares of Northern Ohio, 100 of Cleveland & Southwestern and 370 certificates of the Washington, Baltimore & Annapolis were sold. Cleveland Electric showed quite a little decline for some reason, while other securities about held their own. It is expected that Cleveland Electric will be variable until the announcement of the finding on the holding plan. Forest City Railway stand 95 bid and 99 asked. Cleveland Electric 63½ bid and 64 asked.

Security Quotations

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

	Jan. 30	Feb. 6
American Railways	50⅝	50½
Boston Elevated	150	149½
Brooklyn Rapid Transit	72⅞	73½
Chicago City	160	a180
Chicago Union Traction (common)	4⅞	4¾
Chicago Union Traction (preferred)	16	16
Cleveland Electric	—	63½
Consolidated Traction of New Jersey	75½	75½
Detroit United	a79	77
Interborough-Metropolitan	34¼	35½
Interborough-Metropolitan (preferred)	71⅛	71¼
International Traction (common)	—	59
International Traction (preferred), 4s	—	80
Manhattan Railway	141½	142¾
Massachusetts Electric Cos. (common)	19¼	19
Massachusetts Electric Cos. (preferred)	69	69
Metropolitan Elevated, Chicago (common)	—	a26
Metropolitan Elevated, Chicago (preferred)	—	67¼
Metropolitan Street	104	104
North American	81	81½
North Jersey Street Railway	40	40
Philadelphia Company (common)	45¼	45
Philadelphia Rapid Transit	20¾	20¾
Philadelphia Traction	94¾	94¼
Public Service Corporation certificates	—	68
Public Service Corporation 5 per cent notes	—	96½
South Side Elevated (Chicago)	—	86
Third Avenue	117½	117½
Twin City, Minneapolis (common)	103	103
Union Traction (Philadelphia)	57	56½

a Asked.

Metals

According to the "Iron Age" the movement east of the Allegheney Mountains was lighter during the past week. The demand for early and late delivery is light, and a canvass of the different sections of the trade indicates considerable indifference at the present level of prices. The protest against making the advance in rate of freight from Southern furnaces of 25 cents per ton effective on Feb. 1 has been successful, and March 1 is now named as the date. The steel market is easier east of the Allegheney Mountains, the Western mills being willing to deliver at $32. Eastern steel works are not generally meeting that price, and are cautious as to commitments for the second half. Comparatively little business was put through in steel rails. The demand for sheets and steel bars continues lively.

Copper metal continues decidedly strong, with lake quoted at 25 and 25¼c., electrolytic at 24¾ and 25c., and castings at 24¼ and 24¾c.

BOSTON ELEVATED TAKES LAND FOR WEST SIDE ROUTE

The Boston Elevated Railway Company has made the land takings necessary to give it the entire line recently authorized by the Massachusetts Railroad Commission between the North Station and the Charles River Dam. The extension of the structure in this direction is a requirement of the Cambridge Subway act passed by the last Legislature, and the route begins at the head of the incline at the northerly portal of the present Tremont Street subway, follows Causeway, Billerica and Lowell Streets across private land and parallel to Leverett Street, crossing the edge of the Boston & Maine freight yard on the site of the dam. Construction must be begun by June 22, and finished within three and one-half years.

A. S. & I. R. A. MOVES ITS OFFICES

Secretary B. V. Swenson, of the American Street & Interurban Railway Association, has issued a notice to the effect that the headquarters of the association will be moved on Tuesday, Feb. 12, from 60 Wall Street, to the Engineering Societies' Building, 29 West Thirty-Ninth Street, New York. The association in its new home will have more commodious offices than heretofore, and it is believed that the plan of having the headquarters of all the national engineering and allied societies in one building will work out most advantageously to the general interests and welfare of these associations.

NO DEVELOPEMENTS AT MEETING OF THE COLUMBUS COMPANY

At the annual meeting of the stockholders of the Columbus Railway & Light Company, of Columbus, Ohio, Jan. 29, there was no indication that negotiations were pending for change of control of the system as reported recently. All of the old directors and officers were re-elected. The only business out of the ordinary that was transacted was the ratification of the terms by which the Central Market Railway system of Columbus is to be leased to the Columbus Railway & Light Company by the Columbus Traction Company. The latter company recently purchased the system from A. E. Locke, of Boston, who bought it at receivership sale a year ago for the Morgan-Dolan-Schoepf traction syndicate. The lines are leased for fifty years with the right of renewal, making it in effect a perpetual lease. In case the Columbus Traction Company fails to secure a renewal of its franchise, the lease will terminate. Preferred stock amounting to $500,000 of the Columbus Traction Company is delivered to the Columbus Railway & Light Company. Of this $250,000 is returned to the Columbus Traction Company for its treasury. This stock, however, can only be sold to the Columbus Railway & Light Company. Of the common stock, $400,000 is to be delivered to the Columbus Railway & Light Company and also $90,000 in money. The cash represents the 1000 shares of stock which were subscribed and paid in for the organization of the company. Of the $100,000 received for this, $10,000 is retained in the treasury of the Columbus Traction Company for expenses of that organization.

The preferred stock when issued is to be paid dividends of the rate of 1¼ per cent quarterly by the Columbus Railway & Light Company. On the common stock, dividends of 1 per cent are to be paid in January and July, 1908, and January, 1909; 1½ per cent in July of 1909 and January of 1910; 2 per cent in July of 1910 and January of 1911; thereafter 1¼ per cent quarterly. The Columbus Railway & Light Company does not assume the payment of the Central Market bonds, but only the interest charges of $25,000 a year on them.

President Robert E. Sheldon read the annual report, which showed the gross earnings of the company to be $1,931,088, which is an increase of 7 per cent in the railway department and a good increase in the lighting and power department over 1905. The net earnings were $784,667. The surplus earnings for year of $207,265, which, added to the surplus carried over from the preceding year of $85,432, made a total surplus of $292,697. Out of this $69,419 was paid for depreciation and renewal, leaving a net surplus account of $223,178. Out of this two dividends of $50,000 each were paid, leaving the total net surplus at the close of the year $123,178. Deducting the amount paid out for renewals and depreciation, the net surplus of the stock for the year was $137,846. The renewal and depreciation charge for the year was very heavy and should have been spread over several years, but as the money was all expended in 1906, it was all charged out of the earnings for that year. This showed about 4.1 per cent for the stock without taking out this large charge. The number of revenue passengers carried during the year was 42,329,204; transfer passengers, 11,600,432; total passengers, 53,929,686, an increase of 4,045,656 over 1905.

The members of the directory who were re-elected are R. E. Sheldon, E. K. Stewart, G. W. Sinks, Theodore Rhoads, Clarence M. Clark, C. H. Lindenberg and Carl J. Hoster. The board organized with the same officers, R. E. Sheldon, president; E. K. Stewart, vice-president, treasurer and general manager; C. M. Clark, second vice-president; P. V. Burington, secretary and auditor; Linden G. White, general superintendent.

CHICAGO TRACTION ORDINANCES PASSED BY THE CITY COUNCIL

The Chicago traction ordinances were passed by the Chicago City Council at 4 a. m. Tuesday, Feb. 5, after a session which began at 8 p. m. Monday, Feb. 4. This action by the Council means that the traction question, which has been before the people for ten years, is settled forever, or that it will have to be taken up anew. The result of the election in April, when the ordinances are to be submitted to a referendum vote, will settle this question. No matter what may be the result of the April election, according to the promises of the traction companies, service is to be improved at once.

The ordinances were passed with an amendment which assures the voters that if they do not approve of them at the April election the measures become null and void, and if there be no referendum on the ordinances they are to be void anyway. This last clause was adopted to allay the fears of those who believed that since the April election is not a "general" election no referendum can be taken at that time. Attempts of the opposition to delay the passage of the ordinances resulted in the presentation of many amendments. Some of these, which were lost, were to compel the companies to sell six tickets for 25 cents at all times and eight for this price during rush hours; one containing provisions for financing the proposed subway, and one providing that the city's share of the net receipts should never fall below 8 per cent of the gross earnings. An amendment was passed providing for the interchange of transfers between the Chicago City Railway and the South Chicago and the Calumet Electric Railways, as soon as the franchises of the two minor companies expire.

The question of the referendum vote in April is still in doubt, although 184,000 names, or about double the number required, have been signed to the petitions circulated, asking that the traction question be submited to the people. Many of these names it is generally admitted were obtained illegally, but the fact that the faction in favor of the ordinances was willing to adopt the amendment providing that the ordinances be declared void if no referendum is taken is evidence in itself that there will be no attempt to prevent a referendum by an investigation of the signatures on the petitions. If those signing the petitions for a referendum should vote against the ordinances they will be declared void, as the signers to the petitions, assuming no fraudulent names are on them, constitute a majority of the voters.

As previously stated in the Street Railway Journal, the ordinance adopted provides briefly that the city shall issue twenty-year franchises to the Chicago City Railway Company and the Union Traction Company, with the understanding that on six months' notice at any time the city may purchase the street railways controlled by the companies for $50,000,000, plus the cost of rehabilitation. The companies are at once to reconstruct and re-equip all the lines under the supervision of three experts, one to be appointed by the city and two by the street railway companies. Under the new ordinance the street railway companies for the usual fare will grant universal transfers to all parts of the city.

That portion of the ordinance which provides for division of the receipts is especially interesting. Briefly, settlements are to be made between each company and the city once a year, on or before April 15, for the previous year ending Jan. 31. From the gross receipts are to be deducted all expenses of operation, including maintenance, repairs and renewals; all percentages set aside as special funds for maintenance, repairs, renewals, depreciation and personal injury claims; all taxes and assessments on the property of the company, including capital stock or franchise taxes levied after the year 1906; all salaries and expenses of the board of supervising engineers, and "a sum equivalent to 5 per centum per annum for said preceding year upon the amount of the cash purchase price which the city would then be obliged to pay" for the property if it were purchasing it for municipal operation on such Jan. 31, interest being adjusted as to items added to the purchase price during the year. A deduction for a special fund may be made in the case of the Union Traction receipts to protect the city against interest charges on bonds. The net receipts remaining after these deductions is to be divided in the proportion of 55 per cent to the city and 45 per cent to the company. Under specified conditions of not perfecting title and removing liens and incumbrances the Union Traction share of net receipts may be suspended.

AFFAIRS IN CLEVELAND

At the McKinley Day banquet of the Tippecanoe Club in Cleveland last Tuesday evening, Circuit Judge F. A. Henry surprised the friends of the holding plan by roundly scoring both the plan and those who are advocating it. As a result, the Cleveland "Press," organ of the city administration, struck back at the Judge with the assertion that he had no right to pass judgment on the plan, as some of the questions relating to it may later come before his court. However, the expression from Judge Henry seems to have come in the line of criticism of some of the things that are holding the city back and retarding movements for better things instead of encouraging them. He is quoted as follows:

"If this holding company plan goes through, it will be because of the glamour of the 3-cent fare and the desire for peace; not because of any real advantage to the people. In the first place, the security franchise ought to be on at least as favorable a basis for the people as the seven-for-a-quarter offer already made. And this is because there is a high possibility that the holding company and the 3-cent fare will be short lived. There is not and cannot be any advance assurance that so complicated and unprecedented an arrangement will stand the test of the courts. There is not and cannot be any advance assurance, except mere opinions, that 3-cent fare will pay—especially where ownership stimulus to economy is wanting. A holding company trying to operate on 3-cent fare, amid high and rising prices of material and labor, and with only a public interest in its success, may well be foredoomed to failure.

"If the persons in charge of the holding company shall, directly or indirectly, owe their appointment or tenure to the Mayor, or to any other elective representative of the people, what law is there to hinder the street railways being used as a political machine? To what depths of disreputableness and inefficiency may it not fall, uncontrolled and unrebuked?

"Do we not now have dirty streets and the highest tax rate ever known? Yet we can remove our public servants if we choose. Not so of the holding company, though it give us dirt and discomfort to any extent its irresponsibility may carry it. The holding company plan, if it persists, has every evil of municipal ownership, without any of its safeguards, and if it does not persist, it remits us to a higher rate of fare than the highest that has been considered in this whole controversy. I have pointed out the responsibility of supporting what must remain a fundamentally vicious arrangement will rest upon the present city administration."

President Andrews, of the Cleveland Electric, and President Du Pont, of the Municipal Traction Company, have spent much time the past week in the work of getting together data upon which to base conclusions on the holding company proposition. The value of the unexpired franchises is giving the two presidents considerable trouble. This is especially true of the franchises in the suburban villages. They have perhaps spent as much time on this feature of the work as any other, but feel they have been making rapid progress toward a conclusion.

W. B. Colver a few days ago tendered President A. B. Du Pont, of the Municipal Traction Company, $6,000 for joint use of the Forest City Railway tracks on East Fourteenth Street by the Low Fare Railway Company. It was refused, Mr. Du Pont telling Mr. Colver that he could do nothing until the expiration of the agreement made with the Cleveland Electric not to assist in the invasion of its tracks while the truce lasts. It is said that the Low Fare Railway Company has made tenders of sums aggregating $35,000 for the use of its tracks on Euclid, Superior and Detroit Avenues and West Twenty-Fifth Street, all of which has been refused. Under the franchises granted by the City Council, it is said that the company is now free to commence the operation of its cars, although it may be stopped by injunction. Secretary Colver stated that his company is not bound by the armistice, but declined to state his intentions as to operating his line.

President Du Pont has announced that the Municipal Traction Company has placed an order for fifty new cars. They will not be of the double-end pattern, but will have very large rear platforms.

It is possible that the result of the negotiations on the holding plan may be announced within a week, but there is nothing definite in regard to the time. The work is being done in a most thorough manner, and requires time on each point.

ELEVATED RAILWAY PROPOSED FOR SAN FRANCISCO

The plan of having an elevated railway along the water front of San Francisco, which has been suggested before, has again been broached. The present plan, as reported, is to build an elevated railroad for the transportation of freight and passengers from the northern end of the city to the southern end, the project involving an expenditure of $5,000,000. Under existing conditions, it is very difficult to get freight from the North Beach district across Market Street; it is also exceedingly difficult to have freight handled within the city limits except by drayage or by water. Passenger transportation between the north and south sections is also greatly hindered by the present condition of the streets. It is to relieve these conditions that the new road has been proposed. The route of the proposed road will be along North Beach, through the wholesale district, crossing Market Street on a viaduct, following the water front, through the Potrero and down south as far as Visitacion Valley. It is purposed to handle passengers over the elevated tracks during the daytime and freight at night. Owing to the freedom from obstruction the trains will be able to make fast time and will afford a ready avenue for freight exchange.

THE ANNUAL MEETING OF THE IOWA STREET & INTERURBAN RAILWAY ASSOCIATION

The announcement has been made that the convention of the Iowa Street & Interurban Railway Association for 1907 will be held at Lafayette Inn, Clinton, Ia., April 19 and 20. As yet the program for the convention has not been completed, so announcement of it in detail cannot be made at this time. It is understood, however, that the program will include among its numbers a paper dealing with the steam motor car and its value for interurban service, and that other subjects will be assigned, such as Freight Handling by Electric Lines; Amusements—How should this Feature be Handled by the Operating Companies? Modern Train Dispatching Methods for Electric Railways; Handling the Peak of Rush-Hour Traffic on City and Interurban Lines. This is the fourth convention of the association, and a feature of it will be the attendance of the trade, ample space having been provided for suitable exhibits. In connection with the announcement of the meeting, L. D. Mathes, secretary and treasurer of the association, says that the paper presented at the last meeting entitled "The Adoption of Gasoline Motors for Street and Interurban Service," by F. W. Hield, has provoked considerable discussion since its presentation and has resulted in a great many inquiries from outside sources for copies of the paper. Inquiries regarding the hotel reservations and other matters in connection with the convention should be addressed to P. P. Crafts, general manager of the Indiana & Iowa Railway Company, Clinton, Ia. The officers of the association are F. J. Hanlon, president, Mason City, Ia.; P. P. Crafts, vice-president, Clinton, Ia.; L. D. Mathes, secretary and treasurer, Dubuque, Ia.

SOME INTERESTING FIGURES FROM PENNSYLVANIA STATEMENTS

In his forthcoming annual report Secretary of Internal Affairs of Pennsylvania, I. B. Brown, will give some interesting statistics showing the growth of the street passenger railway business in Pennsylvania during the past twenty years. The following comparison is submitted:

	1887	1907	Gain in 20 Years
Companies reporting....	67	238	171
Capitalization	$25,588,811	$163,653,441	$138,064,630
Cost of road and equip..	12,326,069	140,916,435	128,590,366
Operating receipts	10,025,906	41,039,186	31,013,280
Total trackage (miles)...	519.85	3,325.33	2,805.48
Passengers carried	184,835,994	949,647,802	764,811,808
Killed by street railways.	11	224	213
Injured by street railways	63	4,681	4,618
Cars in service..........	2,207	8,484	6,277

Secretary Brown states that electric cars were not in use in Pennsylvania twenty years ago, and points to the fact that the percentage of increase in the number of passengers carried, capitalization, etc., is much less than the percentage of increase in accidents.

"One of the most remarkable features connected with these transportation companies," continues the report, "is that there is scarcely a vestige left of their physical or tangible affairs which were utilized only two decades ago. The motive power has entirely changed except that there may be in some isolated cases a few cars which are hauled for a short distance by horses, and there may also be some localities where the cable is still in use, but the prevailing power is that of electricity. The transition from one condition to another has been not only rapid but effectual. Of the old conditions existing twenty years ago there is practically nothing left but the bare rights and franchises."

PRESIDENT MELLEN ON RAILROAD MERGERS

President Charles S. Mellen, of the New York, New Haven & Hartford Railroad, addressed the committee on railroads in the Senate chamber at Hartford, Conn., Jan. 30, in reference to House petition No. 20, which calls for a change in the position of certain convertible debenture bonds. He presented to the committee a substitute bill for the measure already requested, and referring to the second section of it he declared that he desired an absolute merger of certain properties which the New Haven road and its closely affiliated company, the Consolidated Street Railway Company, have purchased recently. The petition on behalf of which Mr. Mellen spoke will give holders of convertible debenture bonds equal rights in subscribing for shares of the capital stock, which are to be issued at a future date, under authority already held by the company.

Mr. Mellen described the recent development of the New Haven system and the purchase of certain electric property. He declared that the new issue of stock was made imperative by the great growth of business, and said that already contracts had been made for new rolling stock to the amount of $21,500,000, to be delivered within fifteen months. He said that one item was 17,000 freight cars. He held that the latitude of a company in the issuance of stock should not be restricted. He referred to the purchase of the Ontario & Western road as an instance wherein the New Haven Company was able to thwart the designs of the roads that were trying to control the anthracite coal traffic, which would have meant the increase of price of coal to New England manufacturers.

He explained some of the reasons which had impelled him to purchase trolley properties, and he said that it was the intention to merge all these roads, as far as they are able, and wipe out their corporate existence. Mr. Mellen said that the public press had criticised him for the purchase of the stock of the Connecticut Railway & Lighting Company, but he said the criticism did not justly lie against the New Haven road. In reply to a question from a member of the committee as to the merger of roads in Massachusetts, President Mellen said he had received authority for every merger that he had asked for.

CALIFORNIA RAPID TRANSIT RAILROAD

Mention was recently made in these columns of the incorporation of the California Rapid Transit Railroad Company. This company was incorporated at Phœnix, Ariz., with a capital stock of $10,000,000. The route of the proposed railway is as follows: Commencing in the city of San Francisco, and running thence along such route as may be selected through or near Burlingame, San Mateo, Redwood City, Palo Alto, San Jose, Monterey, and thence to the southerly shore of Monterey Bay, thence to Carmel River, a distance, as near as may be, of 140 miles. At some point near San Jose a branch is to commence that will run through Alameda County, via Alameda, Oakland and Berkeley, thence to Point Richmond, and terminating at Martinez, Contra Costa County, a distance of 75 miles.

Commencing at a point near the lines of the main track at Redwood City through Palo Alto, to connect at or near with the line at San Jose, a distance of 22 miles. It is contemplated to build a line from some point between Redwood City and Palo Alto, thence east to the Bay of San Francisco, and cross at Dumbarton Point, thence to the city of Niles, the branch mentioned to be 13 miles in length. The total aggregate mileage of the railroad and its branches is 250 miles.

The life of the corporation is to be twenty-five years, and may be prolonged in additional periods of the same length perpetually. The incorporating directors are as follows: William G. Alberger, L. E. Lee and William Minto, all of San Francisco. The temporary officers elected are: William C. Alberger, president and chief engineer; L. E. Lee, secretary; William Minto, vice-president; W. H. H. Hart, treasurer. It is certified that $250,000 of the capital stock has been subscribed for by the following persons: W. J. Morgan, H. C. Cutting, W. H. H. Hart, A. H. Butler, M. D. Eddy, H. P. Bowie, C. W. Clark, L. E. Lee, William C. Alberger, William Minto and the California Tunnel Company.

REPORT OF SOUTH SIDE ELEVATED FOR YEAR

The earnings of the South Side Elevated Company in 1906, as reported to the stockholders at their annual meeting Thursday, Jan. 31, show an increase in gross but a decrease in net, as compared with the figures of the preceding year. The amount available for the stock, after the payment of operating charges and interest on only $750,000 of the company's bonds, was $547,900, or 5.4 per cent on the outstanding issue, as compared with $626,000, or a shade more than 6 per cent, in 1905. As noted elsewhere in this issue, Leslie Carter retired from the presidency of the company and was elected chairman of the board of directors.

Following is a comparison of the earnings and expenses for 1906 with those of preceding years:

EARNINGS	1906	1905
Passenger	$1,721,213	$1,647,987
Other earnings	63,591	62,662
Miscellaneous	4,171	2,698
Total earnings	$1,788,975	$1,713,347
EXPENSES		
Maintenance of way	$77,984	$72,175
Maintenance of equipment	144,318	141,078
Conduct. transportation	534,946	437,934
General expenses	191,658	165,519
Loop rental	258,363	236,256
Total expenses	$1,207,269	$1,052,962
Net earnings	581,706	660,385
Bond interest	33,750	33,750
Balance	$547,956	$626,635
Dividends	409,177	409,165
Surplus	$138,779	$217,470

The balance sheet as of Dec. 31 compares as follows:

ASSETS	1906	1905
Cost of property	$12,238,803	$12,255,944
Cost of property—construction and extensions	6,367,591	3,989,900
Capital stock in treasury	92,400	92,400
Materials and supplies	126,314	137,879
Due from individuals and companies	11,489	15,905
Due from agents	5,855	9,242
Current assets	67,027	23,443
Cash	142,396	154,059
Cash—construction and extensions	83,135	949,250
Totals	$19,135,013	$17,628,023
LIABILITIES		
Capital stock	$10,323,800	$10,323,800
Funded debt	7,110,000	5,610,000
Current liabilities	255,049	336,839
Depreciation	50,000	50,000
Reserve	1,396,163	1,307,384
Totals	$19,135,013	$17,628,023

The balance sheet shows that $1,500,000 of construction bonds were delivered during the year. This increase is more than balanced by charges against new construction and extensions. The item of "construction cash" was reduced about $850,000.

REPORT OF THE PRESIDENT

In his final report to the stockholders Mr. Carter said:

"Gross earnings of the company from passenger traffic increased during 1906, 4.44 per cent. The net earnings decreased 11.9, or $78,678. Causes of the decrease in net earnings were: Increase in taxes, in wages and in the price of materials and supplies; increased competition of the surface lines; cost of operation during construction; the cost of operating short portions of new lines.

"Coal, for example, increased in cost for the year $26,753, and was the leading single item in the decrease of net. The second cause is one which we have long been expecting and, taken in connection with the third, is probably felt as much now as it will be. The building of the new lines and the construction of the third track were undertaken partly to meet the expected improvement of service on the surface lines. It is impossible to say how much reduction of patronage during the last few months is due to this competition, and how much to operating under the difficulties of construction. The unavoidable interruptions caused by the necessities of construction have undoubtedly deprived us of the patronage of some of our friends until construction on the third track ceases—a time not far distant.

"The strike of the structural iron workers, which delayed the construction of the road's extensions 228 days, cost the company in interest alone $158,000. Since the resumption of operations, May 23, 1906, a large amount of work has been accomplished, resulting in the completion of the third track—only excepting the straightening of the curve which we have so long desired to remove at Twelfth Street. This will be completed in about six weeks. The completion of the new steel constructed yard at Sixty-First Street; the completion of the Englewood main, or westerly, line, and such substantial progress on the south branch, Englewood, that our chief engineer believes that we will have that work finished by July 1.

"The Chicago Junction Railroad is progressing rapidly with its elevation, and its chief engineer hopes to turn over—ready for operations—the east line to Lake Michigan in the early summer, and the stockyards line in the autumn of this year.

"We feel sure that the whole construction, including many necessary and valuable additions, will be finished within the amount of the bond issue. The progress already made with the Englewood main line is encouraging, and promises a profitable business when it is all opened. In addition to the three stations opened last year, the station at Harvard Avenue and Sixty-Third Street was opened in November; Parnell Avenue and Halsted Street stations, opened in December, are doing well. Center Avenue station and Loomis Street station will soon follow. The south branch, Englewood, is now being erected, and we hope to open Sixty-Fifth Street station, Sixty-Seventh Street and Sixty-Ninth Street stations, successively in the spring, and to have them all in service by July. The express service and the through local trains to Englewood are well patronized."

SEVERE SNOW STORM

New York was the center last week of a severe snowstorm which affected transportation seriously and worked great hardship, especially upon those living out of the city and dependent upon the suburban steam lines. Delays in New York itself were not severe, however, the city lines almost to a unit operating continuously and frequently. The suburban lines in the Bronx, on Long Island and Staten Island suffered delays, but these were due to the openness of the country and the opportunity which such districts afford for the piling up of large drifts. Eleven inches of snow fell in all, the storm beginning Monday afternoon and continuing through the night. In Brooklyn traffic was practically normal, the "L" lines not being affected. The suburban surface lines in Brooklyn that suffered were those in isolated districts. It is said, unofficially, that the new type of surface car of the Brooklyn Rapid Transit Company demonstrated its superiority to the lighter car, equipped with maximum trucks. The storm proved that the gratings arranged for ventilating the subway which open into the street may be converted into a source of considerable annoyance in a severe storm such as the one just experienced on account of the snow drifting in. The Erie Railroad's trains on the local service were 20 to 40 minutes late, and the through trains from 2 to 3 hours. New York Central was not greatly affected. The locals were nearly all on time. The midnight train from Boston, No. 1, arrived 4 hours late. The New Haven trains ran about 15 minutes behind schedule time and through trains from 1 to 2 hours. The Pennsylvania Railroad was in about as good shape as any of the lines; all trains were from 1½ to 2½ hours late. On the Lehigh Valley Railroad all trains were late from ½ to 3 hours. The Delaware, Lackawanna & Western Railroad abandoned its coal and heavy freight traffic temporarily. Eastbound through trains were from 2 to 4 hours late and westbound trains also had trouble. Two-thirds of the suburban cars were in operation, but suburban trains were from 20 to 30 minutes late.

REPORT OF THE NORTH AMERICAN COMPANY

The pamphlet report of the North American Company for the fiscal year ended Dec. 31, 1906, has been issued. President C. W. Wetmore, in his statement to stockholders, calls attention to the fact that the company owns stocks of the par value of $43,818,897. The dividends received during the fiscal year were derived from stocks of the par value of $16,743,872. No distribution has yet been made of the surplus earnings pertaining to the remaining stocks—$27,075,025 par value. Continuing, Mr. Wetmore says: "The amount of dividends received during the fiscal year is less than the amount received during the fiscal year ended Dec. 31, 1905, by $233,133. In that year, in addition to the regular established dividends, paid quarterly or semi-annually, an extra dividend of $360,000 was received."

In explanation as to why the North American Company received no dividends from such a large portion of its stockholdings in other companies during the past year, the report says: "While the net income of the electric railway, light and gas companies in which the North American Company is interested, for the year 1906, after the payment of all dividends, was $1,195,066 (of which upon distribution the North American Company would be entitled to 82.2 per cent), it was deemed best not to distribute any part thereof, for the reason that the companies are all engaged in construction and development work, and the financial conditions, prevailing especially during the last six months of the year, have not been favorable for the sale of their interest-bearing obligations, which, as described in the last annual report have been created to provide for the capital requirements."

President Wetmore directs attention to the purchase by the United Railways Company, of St. Louis, of the St. Louis & Suburban Railway Company, for which it paid $4,000,000, par value, of United Railways Company preferred stock held in the treasury, which stock, however, is not to be entitled to dividends until after Jan. 15, 1908. It also assumes the indebtedness of the Suburban Company. This purchase was authorized in August, 1906, and consummated Dec. 31, 1906, the United Railways Company entering into possession of the property Jan. 1, 1907. By this purchase, the trackage of the United Railways Company has been increased 105.82 miles (41.21 in the city of St. Louis and 64.61 in the county of St. Louis), which makes its total trackage 456.64 miles, of which 350.59 miles is within the city limits and 106.05 miles outside of the city. It has attained an additional east and west trunk line running through the best part of the city, and through the business center; a line built on private right of way from the city limits half way to the business center, two additional cross-town lines and suburban lines, which extend to the western section of St. Louis County, and connect all of the important suburban towns and villages.

The United Railway Company of St. Louis has constructed extensive shops, adapted to the construction as well as the repair, of cars and their equipment, and has reconstructed, according to the highest standard, about 25 miles of track, and has otherwise improved its facilities. Extensions of the Milwaukee Suburban Railway system from Pewaukee Lake to Oconomowoc, a distance of 13 miles, and from Muskego Center to East Troy, a distance of 15 miles, will be open for service in the Spring. Reference is also made to the new light plants in St. Louis and Detroit.

REPORTED CLEVELAND & SOUTHWESTERN NEGOTIATIONS

Nothing official is available regarding the negotiations said to be under way by the Cleveland & Southwestern Traction Company for taking over the Webb line, now in operation between Columbus and Marion and the one under construction between Marion and Bucyrus. It has been stated that the offer of the Cleveland & Southwestern is to lease the Webb lines, for which 1 per cent dividends will be paid on the capital stock the first year and 1 per cent additional each year until the stock is paying 6 per cent. A conference was held with John G. Webb in Cleveland two or three weeks ago, when, it is said, he was made acquainted with the arrangement the Cleveland & Southwestern is willing to make. Previous to that time, President E. W. Moore had conferred with him in New York, and it was thought that some arrangement would be made by which this road would eventually connect with the Columbus, Delaware & Marion over the line now under construction between Marion and Bucyrus. This included the completing of the line from Sandusky to Fremont and Tiffin and an additional extension from Tiffin to Bucyrus. It is said that the Lake Shore now has under consideration the purchase of the Birchifield line between Norwalk and Plymouth. The completion of a short stretch of road now under construction will connect this line with the Mansfield Railway & Light Company's line at Shelby, and the distance across to Bucyrus is not great. With both the line from Fremont and Tiffin and that from Norwalk connecting with the Webb line at Bucyrus, Cleveland, Sandusky and Toledo would have direct connection with Columbus. The ultimate merger of the Lake Shore and the Webb lines with the shorter connecting lines mentioned would make a system which, in connection with the line from Toledo to Detroit and that from Cleveland to Ashtabula, would take in most of the southern shore of Lake Erie.

The owners of the Cleveland & Southwestern Company have been looking over a route from Mansfield to Columbus by way of Mount Vernon. A few days ago a party of Columbus men met President Pomeroy, A. E. Aikin and others at Mount Vernon to go over the matter. There is a possibility that a road from Mansfield by way of Homer and Gahanna may be built. At Gahanna it would connect with the Columbus, New Albany & Johnstown, now in operation between Columbus and that point, and it is thought that this road could be purchased at a fair price and an entrance to Columbus gained in that way.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 22, 1907

841,694. Brake; Van Buren Lamb, New Haven, Conn. App. filed May 26, 1906. A laterally divided brake head, the two parts of which clamp an engaging shoulder of the brake-shoe when assembled.

841,695. Brake; Van Buren Lamb, New Haven, Conn. App. filed May 26, 1906. A transversely divided brake head in which the shoe is mounted by means of a tapering dovetail connection.

841,709. Electric Brake; Frank C. Newell, Wilkinsburg, Pa. App. filed May 3, 1900. The running controller has a single shaft with a switch and resistance controlling device thereon, and means whereby the switch and controlling device may be moved together, or the resistance device may be moved independently of the switch by rotation of the shaft.

841,71e. Electric Brake; Frank C. Newell, Wilkinsburg, and Edward H. Dewson, Edgewood Park, Pa. App. filed April 11, 1904. Relates to modifications of the above. The motors are adapted to be connected up as generators in the local brake circuit. Provides a braking controller and circuit connections whereby the current in the brake circuit may be controlled.

841,746. Rail Joint; John W. Webb, Columbus, Miss. App. filed April 14, 1906. An integral chair having vertical side flanges, one of which has a lateral flange bearing against the side of the rail head, and clamping means for the chair and rail sections.

841,750. Air Brake; Herman H. Westinghouse, New York, N. Y. App. filed April 16, 1904. Comprises means for reinforcing or supplying air to the auxiliary reservoir from an additional source, such as supplemental or storage reservoir, when the pressure in the auxiliary reservoir is reduced a predetermined amount.

841,751. Air Brake; Herman H. Westinghouse, New York, N. Y. App. filed Oct. 6, 1904. Provides means for controlling the release of the brakes upon the locomotive or head car independently of the other cars of the train, whereby the train brakes may be released while the brake on the locomotive or head car may be retained applied as long as desired.

841,767. Signal; Edward J. Condon, Dixon, Ill. App. filed Nov. 13, 1905. Air is compressed, to actuate a semaphore, by the engagement of the train with tappets alongside the track. The release of the semaphore is effected electrically through the actuation of the next succeeding semaphore.

841,778. Frogless Railway Switch; Thomas W. Harber, Springfield, Mo. App. filed May 3, 1906. Provides means whereby the movable portions of the rails at their crossings are actuated simultaneously with the throwing of the switch point.

841,855. Electric Signal; William F. Dreer, Coulters, Pa.

App. filed Oct. 27, 1906. A mechanical arm or bearer is depressed by the wheel flanges so as to move a switch arm into position to close a red light circuit.

841,897. Material for Deadening Sounds; August V. Ringstrom, Stockholm, Sweden. App. filed April 21, 1905. A material for deadening sound to be attached to wheels, brake-shoes, etc., comprising a thin strip of metal bent zig-zag and softer material interposed between the bends.

84 ,899. Metallic Tie; John C. Schafer, McKeesport, Pa. App. filed March 14, 1906. The tie consists of a channel bar, the flanges of which are cut or sheared and bent to form lugs which are adapted to engage the base-flanges of the rails.

841,973. Metallic Tie; Judd W. Hulbert, Hartford, Ohio. App. filed May 19, 1906. Details of construction.

842,004. Fender; Samuel D. O'Harra, West Washington, Pa. App. filed May 3, 1906. Relates to means for raising and lowering the fender.

842,045. Operating Mechanism for Fare Registers and Recorders; David B. Whistler, Dayton, Ohio. App. filed Sept. 19, 1906. Comprising a rotatable shaft adapted for connection with the setting mechanism of a register, winding wheels or drums driven from said shaft, and an indicator extending substantially parallel to the shaft and comprising flexible end portions wound on said wheels or drums, and an intermediate portion provided with an index or pointer, and an indicating scale co-operating with said index or pointer.

842,124. Railroad Rail; Mark W. Trimble, Idabel, I. T. App. filed May 8, 1905. To prevent cars from leaving the track the rail is provided with an upwardly and outwardly projecting guard flange.

PERSONAL MENTION

MR. LEWIS CASS LEDYARD has resigned from the New York Rapid Transit Commission.

MR. T. L. VANDERSLICE, formerly counsel for the Philadelphia Rapid Transit Company, is dead.

MRS. STELLA B. ARNOLD, wife of Mr. Bion J. Arnold, of Chicago, died at Colorado Springs Feb. 1. Mrs. Arnold's health had been failing for some time and she went to Colorado in the hope of prolonging her life.

MR. L. W. HARRINGTON has been appointed soliciting passenger and freight agent of the Columbus, Delaware & Marion Traction Company. Mr. Harrington is a railway man of ten years' experience with the Hocking Valley. He worked his way through the auditor's office and became chief clerk in the passenger department.

MR. T. W. RYLEY has been appointed superintendent of the Groton & Stonington Street Railway Company, of Mystic, Conn., to succeed Mr. J. B. Crawford who, as announced in the Street Railway Journal of Feb. 2, has been appointed superintendent of the Fort Wayne & Wabash Valley Traction Company. Mr. Ryley formerly was assistant to Mr. Crawford at Mystic.

MR. J. T. HARMER, of Boston, has been elected to the newly created position of comptroller of the Worcester Railways & Investment Company, of Worcester, Mass., the holding company of the Worcester Consolidated Street Railway Company. A new treasurer of the company also has been elected in the person of Mr. Leverett Candee, of Boston, who succeeds Mr. E. E. Foye, of Boston. Mr. A. George Bullock, of Worcester, was elected president, and Mr. Francis H. Dewey, of Worcester, president of the Worcester Consolidated Street Railway Company, vice-president. Mr. B. W. Warren, of Boston, was elected secretary.

MR. LESLIE CARTER retired from the presidency of the South Side Elevated at the annual meeting of the company Jan. 31, and was elected chairman of the board of directors. He was succeeded as president by Mr. Marcellus Hopkins, formerly general manager. Mr. Hopkins was elected a director, also, in place of Mr. George E. Adams, resigned. Mr. C. E. Nichols was elected a vice-president. The other officers and directors were re-elected. The executive committee for the ensuing year will consist of Mr. T. J. Lefens, Mr. C. H. Wacker and Mr. Hopkins. Mr. Carter served as president of the company for ten years, or since its reorganization, and has directed the development of the property to its present position.

MR. C. L. WILCOXON has resigned as general superintendent of the Western Ohio Railway, of Lima, Ohio, to become general superintendent of the Pittsburg & Butler Street Railway Company, of Butler, Pa., a single-phase road now nearing completion. Mr. Wilcoxon has been engaged in street railway work since he was seventeen years old, his first service being with the Decatur (Ill.) Street Railway Company. After about five years' service with this company he became identified with the Western Ohio, then under construction. When the road was placed in operation Mr. Wilcoxon was appointed night train dispatcher. Subsequently he was appointed train-master and later succeeded his father as general superintendent.

MR. EDWARD J. DAVIS has tendered his resignation as general passenger and freight agent of the Columbus, Delaware & Marion Railway Company to Mr. George Whysall, general manager of the company. The resignation became effective Feb. 1, and with Mr. Davis' retirement the position of general passenger and freight agent has been abolished. To look after the traffic end of the company's business in Columbus, the position of soliciting passenger and freight agent has been created and Mr. L. W. Harrington has received the appointment. Mr. Harrington has been a resident of Columbus for thirty years and has been in the service of the Hocking Valley Railway Company for ten years. He was formerly associated in the Hocking Valley service with Mr. A. L. Neereamer, general superintendent of the Columbus, Delaware & Marion.

MR. H. A. CURRIE has been appointed assistant electrical engineer of the New York Central & Hudson River Railroad Company, to succeed Mr. J. D. Keiley, whose appointment as electrical engineer of the company was announced in the issue of this paper for Nov. 17, 1906. Mr. Currie has been associated with the electrical department of the New York Central Railroad since 1903, when the plans of the company for electrification were first undertaken. He has had a long electric railway experience, having been connected with the Brooklyn Rapid Transit Company for the nine years between 1894 and 1903. In Brooklyn he was engaged in power station work for six years, and later he was appointed as assistant to Mr. Keiley, who had charge of the engineering work in connection with the rolling stock of the surface and elevated divisions of the company.

MR. EDWARD PAYSON BRYAN, who was recently elected president of the Interborough Rapid Transit Company, is a native Ohioan. He was born at Windsor, in that State, on July 2, 1850, and was educated at Granville, Ohio, in the public schools, at the academy and Denison University preparatory department, leaving the latter institution before entering upon the regular course. After leaving his studies, he learned telegraphy at the age of sixteen, and took a position at Lebanon, Ky., on the Louisville & Nashville Railroad, remaining with that road until December, 1895. During the years he remained with this corporation he occupied the various positions from telegraph operator to superintendent. Upon severing his connections with the Louisville & Nashville road he accepted the position of vice-president and general manager of the Terminal Railroad Association, of St. Louis, on Dec. 1, 1895. This position he retained until May 1, 1902, when he resigned and accepted the position of vice-president of the Interborough Company. He was later placed in a similar position with the Subway Construction Company. Upon accepting the executive office of the Interborough he personally organized the present operating force, and at the same time organized and placed on a working basis the entire engineering force which equipped the Interborough lines, which includes power house, cars, interlocking block signal system, etc. Mr. Bryan is a member of the Lawyers' Club and the Society of The Kentuckians. He was married to Miss Arabella Welch at Frankfort, Ky., and has five sons, Mr. John Love Bryan, Mr. Edward P. Bryan, Mr. William Scott Bryan, Mr. Ashbel Welch Bryan and Mr. Sylvester Griswold Bryan.

MR. EDWARD PAYSON BRYAN