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Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1905 to date, 351,950 copies, an average of 8180 copies per week.

A Setback for Mayor Dunne

Mayor Dunne, of Chicago, who was elected last spring on the platform calling for immediate municipal ownership of street railway lines, has received two severe setbacks at the hands of the Chicago City Council. Ever since he was elected on this radical platform, it has become daily more evident in Chicago that the Mayor's programme for immediate municipal ownership is one that was virtually impossible for him to carry out, and further, that the City Council, and especially his local transportation committee, as well as the majority of their daily papers and more intelligent citizens, are convinced that no scheme for immediate municipal ownership is practicable under existing legal conditions, or even desirable. The Mayor has now been defeated in two attempts to get the City Council to follow his programme. The first was to get the Council to take out of the hands of the local transportation committee his scheme for municipal ownership, known in Chicago as the contract plan. This plan called for the formation of a company to be controlled by the city. Mayor Dunne's plan was not taken very seriously in Chicago until he attempted to force it upon the Council, when the attempt was defeated by an overwhelming majority. The local transportation committee is now negotiating with the companies and attempting to frame an ordinance providing for an extension of franchise, with provision for the purchase of the lines by the city at any time. The Mayor, in a recent Council meeting, attempted to get the Council to pass a resolution ordering the local transportation committee to cease these negotiations on the grounds that they were contrary to the expressed will of the majority of voters at the election of last spring. While it is true that the vote taken last spring was overwhelmingly in favor of municipal ownership, it is very significant that the City Council upheld the action of the local transportation committee in conducting these negotiations and voted down Mayor Dunne's attempt to have them cease. From this, two things are evident: First, that the Council and local transportation committee are convinced that no scheme for immediate municipal ownership is feasible or desirable, and second, that the members of the Council do not take the vote of last spring as evidence that the people will not at next spring's election approve an ordinance providing for extensions of franchises, with the option of the purchase of the lines by the city at any time. The Council is evidently convinced that the people of Chicago will vote in favor of a tangible solution of the traction problem when once such a definite solution is placed before them rather than to cling to the impracticable theories of Mayor Dunne as to immediate municipal ownership.

Lights in the Pits

If many shop superintendents could be made aware of the amount of trouble and time taken by their motor and truck inspectors to get proper light on the under side of the cars, they would undoubtedly place more lamps in the pits of their shops. In not a few shops no pit lights at all are provided. To get light to work by, the workman must climb in the car, unscrew a lamp and place an extension or drop cord in the socket. Considering the cost of power to them it would naturally be expected that electric railway companies would have light placed at every convenient point about their shops. Probably one reason why poor lighting of pits exists so frequently is that the presence of oil and grease increases the fire risk when the wires are installed openly. But it is not necessary that the wiring should be so installed. While there is considerable cost in placing wires in pipe conduit, we believe the expense in most instances would be justified by the convenience afforded. The lights might be installed on either side of the pit at distances of about 10 ft. apart. To prevent the sockets from being torn down and to guard against the entrance of oil, sockets should be protected by iron covers or shields. The circuits may be arranged in sections of about one car length, each section to be controlled by a switch conveniently located.

The light from stationary lamps is not sufficient to note the clearance of armatures, and properly to inspect many parts. Lamps with extension cords are essential. When these are made with unprotected lamp cord they give no end of trouble. "Repairing drop lights" is a rather familiar item on the workman's time card. Much of the expense of such repairs and a great deal of delay and inconvenience may be avoided by using flexible conduit instead of uncovered wires in the construction of the extension lights. To be sure, those made with flexible conduit are heavier and stiffer than those with naked cord, but when workmen once become accustomed to the conduits, they will not notice the difference.

Fluctuations in Car Lighting

The time of the year has arrived when a number of hours of most profitable operation each day occur after darkness has set in. This brings up again the question of providing sufficient light so that passengers who make long journeys on interurban roads can read with as much comfort as on competing steam roads. Well managed city systems have sufficient money invested in feed wire and power distributing systems, so that drops in the voltage are not serious. On interurban roads it is comparatively rare that there are not wide variations in the voltage, and consequently in the light at points between sub-stations, when cars are approaching each other and one or both start up about the same time. The result is that, while the car may be flooded with light when near sub-stations, when it is at points between sub-stations the voltage is so low that, no matter how many lamps may be in use on a car, the lighting is not satisfactory to passengers who are reading. We are not prepared to go into the economics of the matter in this editorial, but we can hear some one say that where such conditions exist, more feed wire should be put in so as to maintain a more constant voltage. It must be admitted that this is usually the proper solution of the problem and the one that is most feasible. Nevertheless it would be desirable if some steadier source of voltage than the trolley wire of an interurban line were available for car lighting on such lines. The unfortunate thing about it is that, at the very times when the car is delayed by low voltage from one cause or another, it is most important to keep up the passenger's spirits and keep him in a good humor by furnishing him good light wherewith to read. Nothing is more dismal than a dimly lighted car dragging along behind time on an interurban road with the lights so low that reading is impossible. Passengers do not think nearly as much about a belated car if the illumination is only up to par.

It must be admitted that there is no satisfcatory solution of this little problem at present, but it is worth thinking about. An electric railway man hardly wants to add Pintsch gas to the formidable array of apparatus he has to put on a car now. He has a feeling that he might better be investing the money in additional feed copper, yet the fact remains that voltage fluctuations are very great in many cases in spite of our theories as to what they should be. Storage batteries and automatic voltage regulators have also been suggested. The storage battery is a thing to be avoided in a car equipment whenever possible, but steam and electric railway men are being forced to adopt it in a number of cases; the steam railroad man for passenger car lighting, and the electric railway man for multiple-unit control. A simple voltage regulator would solve the problem, but its simplicity must be extreme if it is to be a satisfactory thing to put on a car.

The Rules of the Road

From the records of the past summer, we observe an increasing tendency on the part of our space-devouring contemporary, the chauffeur, to try conclusions of momentum with electric cars. The casualty list has already become unpleasantly long and is growing rapidly. Now of course we understand that sort of sport, and that the guild of chauffeurs holds that anything less weighty than a steam roller is fair game, but we regard as unsportsmanlike the increasing tendency to ram the car amidships instead of meeting it in a dignified front-end collision. We have no doubt that if the guild of chauffeurs would agree to proper rules for such contests, street railway managers would be willing to put armored bulkheads in place of the dashers, and meet the issue squarely. But it is asking too much to expect them to put a complete armor belt around the car. It would be inconveniently heavy, and besides there is no convention yet to forbid the use of spar torpedos. And moreover the passengers object that it does not give them a fair show to be butted in the back.

The fact is that our present rules of the road have outlived their usefulness. They were not devised for vehicles running 30 or 40 miles per hour and built with a ram bow at that. An electric car is confined to its own track, and is not at liberty to turn out, however much it may wish to do so. At sea a ship sailing close hauled has the right of way against one with the wind free, or against a steamer, and by the same logic a vehicle confined to a track which is predetermined and visible to all, ought to have an unquestioned right of way against vehicles capable of greater speed and having the whole road in which to cruise about. It is bad enough when a car is stopping for passengers to have a big touring car swoop down upon the crowd with a blast fit to crumble the walls of Jericho and scatter it to the uttermost parts of the sidewalk. But it is even more objectionable when it tries to climb upon the platform and through the end of the car. It would seem to be a reasonable requirement to give passengers boarding a car the right of way, particularly since it is alleged that a proper automobile can be stopped in about one length. If it be so easy to stop, what hardship would be worked by stopping? Foot-pasengers may have small rights in the street, but they certainly have some upon the crossings, and right of access to a street car should be one of them. It is no proper excuse to complain of not seeing passengers in time, for the location of crossings is known to all men, even chauffeurs. In the latest case of ramming a street car, two automobiles were scorching, and the one ahead raised such a dust that the following one was lost in it until too late to dodge the car—at least such was the statement of the survivors. Now assuming this to be true, were not the machines running at speed entirely unjustifiable in view of the conditions?

We willingly recognize the fact that the automobile is a useful machine and that it has become a permanent part of the world's vehicular outfit. We have no quarrel with it as such. Nevertheless, we think it is time for such a revision of the rules of the road as shall give it equal and not exclusive or exaggerated privileges. Granting that speed is a characteristic and valuable property of automobiles, it should not be so used as to endanger other traffic. We have, to be sure, speed-limit laws which are daily violated by nearly every machine that is not temporarily crippled. Many of the speed-limit laws are essentially foolish in that they cannot be properly enforced, and also oppressive in that they specify limits that are essentially unreasonable. The abuses of automobile speeding cannot be corrected by any definite number of sleuths with stop watches. But rules of the road can be established that with malice toward none will fix the responsibility of speeding, with penalties that will make even a drunken driver think twice before he takes chances. The street railways of the country carry and will continue to carry the vast majority of all who travel by means other than those furnished by nature. Quite apart from the rights of pedestrians, those who are passengers in street cars have the right to enter and to use these cars in safety. The street railways in carrying passengers have to assume a responsibility for their safety almost equivalent to insurance, and the railways therefore may properly demand such regulation of traffic as shall enable them with reasonable precautions to carry out their trust. The rules of the road are an inheritance from days when electric cars and automobiles were undreamed of. The times have changed and the rules should change with them. The street railways do not ask for unreasonable favors, but considering their enormous passenger traffic, they may properly ask such regulations of other traffic as shall remove what has now become a serious additional peril to street traffic.

The Location of Toilet Rooms and Heaters on Interurban Cars

One point not yet definitely decided upon in the design of interurban cars is the location of the toilet rooms and heaters when hot-water heaters are employed. On a car intended to be operated in one direction only, the heater is usually placed either in the motorman's cab, adjoining the partition between the forward and the rear passenger compartments when two exist, or near the rear entrance of the car. The toilet room is likewise found in different positions, sometimes being located in the forward end and sometimes at the rear of the large section of the car. A study of the floor plans of the various interurban cars described in these columns from week to week will show that very little preference is given to any of these locations, and that one is about as popular as another. Each position has so many advantages and disadvantages that it seems impossible for car designers to adopt one location as standard, notwithstanding the fact that the governing conditions are very nearly similar on all interurban lines.

The location of the heater in the motorman's vestibule is open to several objections. One is the appearance presented by it as viewed from the passenger compartments. Passengers almost without exception enjoy the view ahead, and they object seriously to having it obstructed by the heater and accompanying pipes. Again, when the heater is placed in the cab, the motorman will naturally give more or less attention or, at least, thought to it. A motorman's time should be devoted as much as possible to running the car, and any disturbing feature should be kept away from him. A third difficulty is that it keeps the vestibule uncomfortably warm for the motorman and tends to produce moisture on the inside of the sash. The car designer has still another objection to placing the heater in the extreme end of the car. The heater, its pipes and the expansion drum have considerable weight. This gives an increased load to be taken care of at a most difficult point. The liability of drooping platforms is considerably increased unless more material is put into the bottom framing.

To weigh against these several objections there is one advantage gained when the heater is placed in the motorman's cab. The passengers are not disturbed by flying dirt and dust when the heater is shaken up or a new supply of fuel added. Then, too, it is not necessary to carry the fuel and ashes through the interior of the car, which is thus kept clean the more easily.

The practice of locating the heater between the forward and the rear compartments is also open to adverse criticism. With the mahogany or cherry finish of the car for a background, a heater as usually kept does not make a very pleasing appearance. When so located, it is for the object probably of enclosing it in a room. This, however, induces an additional expense in the construction of the car. A more serious drawback to this location is that the coal must be carried to the heater and the refuse carried from it through half the length of the car. As this is usually done by more or less careless employees, a trail of dirt is frequently left on the floor. The position between the forward and rear compartments is, however, more desirable than at the ends, when the disposition of the weight of the heater is considered. Lying as it does between the trucks, this weight is easily taken care of. There is usually but one drawback to placing the heater at the extreme rear of the car body. The passageway through the rear door is restricted.

The same objection is urged against locating the toilet room at this point. With the heater on one side and the toilet room on the other, a narrow passage is formed at a place that should by all means be kept open. The natural tendency of passengers in a crowded car to congregate about the door blockades this passage to an extent that much time is lost in waiting for passengers to get through it when leaving the car.

Not considering this feature, the rear of the car is undoubtedly the more desirable location for the heater and toilet room. When the latter is placed in the forward portion of the car some passengers are subject to more or less embarrassment on being compelled to enter it. For this reason it may be urged that the heater and toilet room be placed on different sides of the car and opposite each other. The appearance of greater isolation of the toilet room gained is greatly appreciated by many. A consideration favoring the location of the toilet room between the two compartments is that of the disposition of the waste matter. When placed in the rear portion of the car, the closet is immediately over the truck. Sometimes this makes the appearance of the trucks very objectionable, and especially is this true when the car passes through city streets.

If in the design of the car the attempt is being made to give passengers in both forward and rear compartments a clear view ahead, the heater and the toilet room cannot be placed between the two compartments. Sometimes, however, because of the usually objectionable appearance of the smoking compartment, as much separation as is possible of the two compartments is desired. In such a case this is well obtained by locating the toilet room and the heater at this partition, one being placed on each side of the car.

After considering the several points in favor of and the drawbacks against each position, it is readily understood why a definite opinion regarding the locations of these two features of interurban cars has not already been formed. So long as each designer weighs with a greater or less degree of importance the advantages and the disadvantages, differences of opinion will continue to exist.

THE BERLIN-ZOSSEN TESTS OF 1902

In the STREET RAILWAY JOURNAL for Sept. 9, an abstract was published of the high-speed tests conducted during the fall of 1901 on the Berlin-Zossen Military Railway by the Studien Gesellschaft. It is proposed to continue this subject by the publication in this issue and one soon to follow of abstracts of the results of the 1902 tests. These three articles, with the 1903 tests which have been published in book form, will give those interested in the subject of train resistance and braking at high speed practically all of the data secured during these memorable experiments. The accompanying portion of the 1902 tests discusses the air resistance and its relation to the shape of the car, and the other resistances to train movement. In a later issue the report of the 1902 tests will be concluded by an abstract of the portions relating to losses in the transmission system, measurement of energy consumption and braking tests.

As stated at the end of the report of the tests made in the fall of 1901, the results obtained were not sufficiently complete to determine unqualifiedly the best methods, from a technical and economic standpoint, of constructing an electric high-speed equipment for trunk lines. For this reason the tests at high speeds which were begun in 1901 were continued during 1902. Unfortunately, the negotiations which the company had entered into with the State authorities by which the latter would furnish the necessary heavier track for the experimental section were still uncompleted, and from all appearances would not be closed until after the approval of the recommendations for the year 1903 made by the State Railway Commission at its annual meeting.

To make good use of the intervening period, a further series of tests were conducted during 1902 over the existing tracks of the military railroad. Throughout these tests a speed of more than 125 km per hour was not permitted on account of the structural weakness of the track, but it was possible, even within this limit, to obtain further valuable information and thereby to increase the knowledge already secured as well as to lay out a comprehensive programme for future tests.

Through the valuable aid of the Royal Commission in charge of the military railroad it was possible to conduct the tests in September of 1902 according to the following programme:

1. Measuring the resistance of the motor cars at different speeds.
2. Measuring the energy consumption of the cars at different loads and speeds.
3. Determining the losses in the transmission lines.
4. Making a series of brake tests to determine the best braking conditions.
5. Determining the most judicious alterations to be made in the cars to insure their smooth running.
6. Observing the behavior of the track during the tests.

The following report is submitted on the manner of conducting the tests and the results from them:

MEASURING THE TRAIN RESISTANCE

The total resistance to be overcome by the movement of the train is made up of the following separate components, viz.: the friction at the truck king bolt and bearings; the track resistance, which, on account of the rolling and sliding friction of the wheels, causes uneven conditions of the track and bending of the rails; and finally, the air resistance.

For determining the separate resistances of the car and the track, each motor car was drawn over the track by a locomotive, and the draw-bar pull was measured, and, to eliminate the air resistance as much as possible, only low speeds were used. On account of the great weight of the motor car, which produced a decided variation in the draw-bar pull at each revolution of the driving wheels of the locomotive and was especially marked at low speeds, it was not possible by this method to obtain a smooth curve of the draw-bar pull. This was also the case when the motor car was attached to a slowly moving freight train. Somewhat better results were obtained by drawing the car with an alternating-current locomotive, although the curve obtained even by this method is not absolutely reliable.

On this account, the direct measurement of the train resistance had to be discontinued, and instead the coasting tests which had been begun in 1901, but which were stopped on account of insufficient time, were resumed.

These tests were conducted both by starting a car from a standstill position on a down grade and at a given speed from a definite point on the track. During that part of the tests in which the speeds were low, the slight inequalities of the roadbed and track made themselves evident when the speed curve was plotted, and to correct them the profile of the track had to be accurately determined with leveling instruments.

The results of measuring the profile of the section between Marienfelde and Mahlow, upon which the coasting tests were made, are given in Fig. 1. In the upper curve, the uneven line shows the average grades determined at intervals of 50 meters each and, for comparison, the lower curve shows the original profile in dotted lines with the later profile in full.

As may be seen from the curve plan of the road, there are no curves in the coasting section of less radius than 2000 meters. At these points the train resistance showed only a slight increase, less, in fact, than that resulting from the difference in roadbed and unevennesses of the track, so that this increase in resistance did not need to be considered in making the final corrections.

For securing a continuous record of the speed during the tests, a special writing instrument was installed in the motor cars. It was similar in construction to the Morse apparatus, and recorded the speed on a paper ribbon by means of an electrically operated contact point. Each apparatus contained three electromagnets and three writing levers. The first magnet, which was connected with a contact disc fastened to one of the car axles, was used to record the revolutions of the car wheel. The second was connected with a contact clock which made contact every 10 seconds and recorded this interval. The third contact was operated through a hand-key placed in the motorman's cab, and was used to record on the paper ribbon the times at which the car started, when the current was cut in and out, the beginning of the braking period, and the number on the kilometer stones.

To insure the greatest possible accuracy, indicator paper was used and the records were made with a metal point in notched lines. With the aid of this apparatus it was possible to determine the relation between time and distance, and also that between the variations in speed and the profile of the road, with extraordinary accuracy. Besides this, a Hausshalter & Grossmann registering speed indicator was installed in each car to control the results obtained for the individual trips.

The resistance of the car was determined from the coasting tests.* From the speed curve plotted in increments of 10 seconds each, the

$$\text{retarding force} = \text{mass} \times \text{retardation}$$

was determined and plotted in curve form. Also from the fixed profile of the road, the force resulting from the grades, which equals the car weight $\times$ grade in per cent, is plotted negatively in dotted lines. The perpendicular distance between these two curves then directly represents the train resistance.

After smoothing out the irregular line of forces due to grades, and taking into consideration the calculated curve of the retarding force in connection with the variation of speed,

* The curves referred to here are not reproduced. Fig. 2, referred to later, gives "final results" only of these curves.

the smooth curve of train resistance shown in Fig. 2 is obtained. The irregular and smooth curves of grade forces correspond

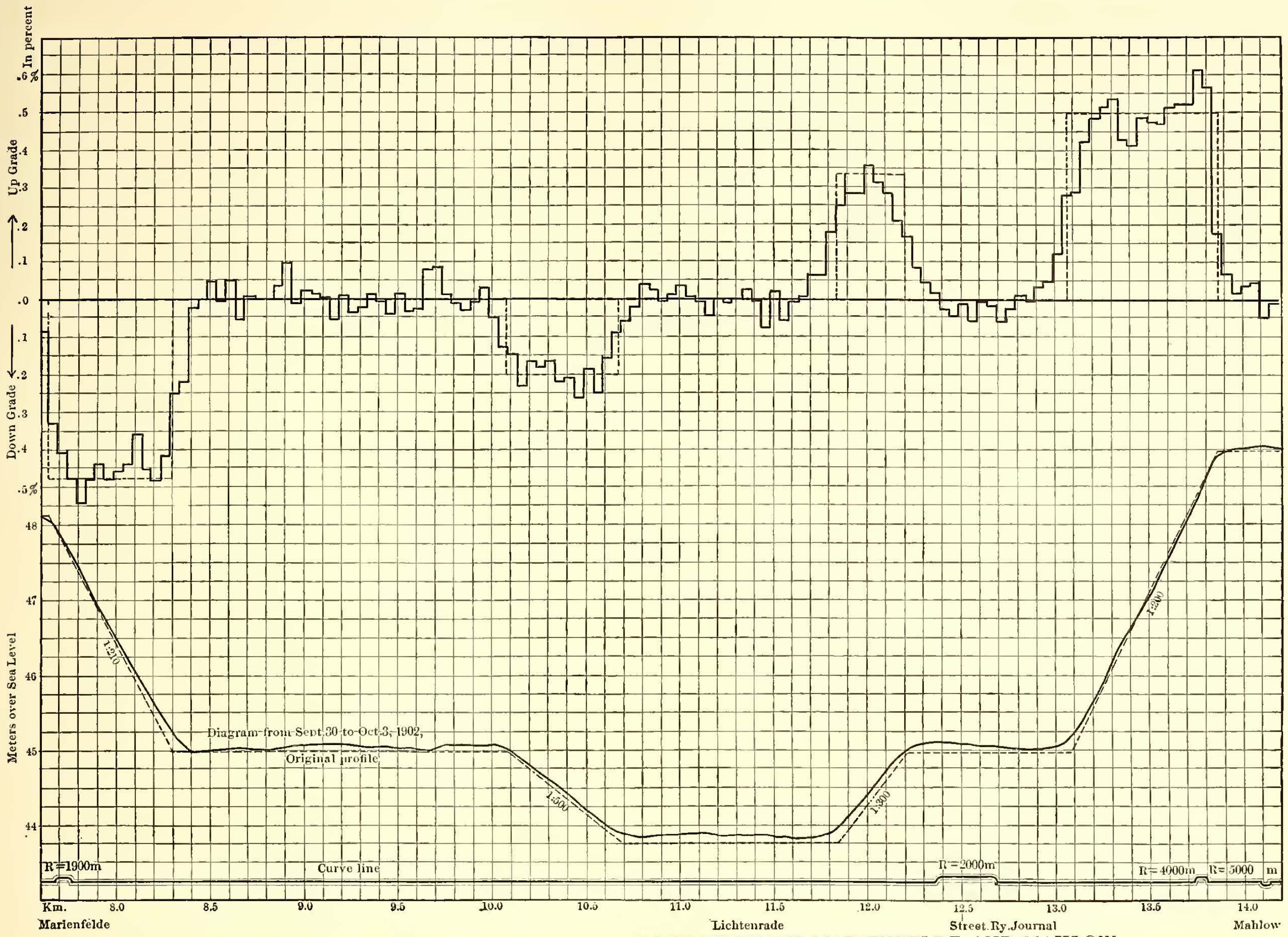


FIG. 1.—PROFILE OF THE EXPERIMENTAL TRACK BETWEEN MARIENFELDE AND MAHLOW

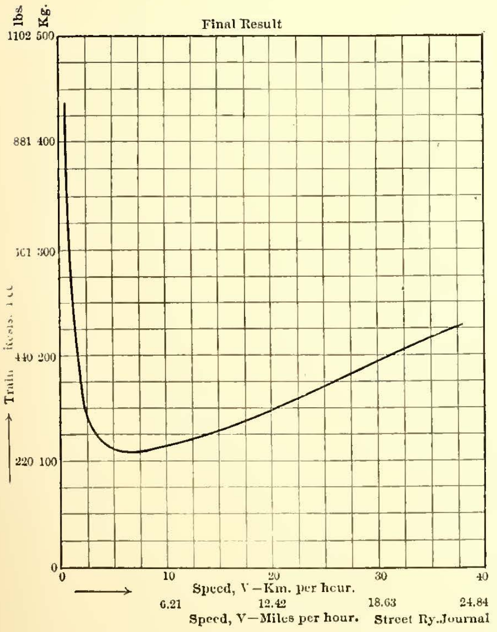


FIG. 2.—FINAL TRAIN RESISTANCE CURVE OBTAINED

very closely, showing that the methods used in their determination were trustworthy. No advantage would have been gained in fixing the profile of the road through measurements taken at shorter distances, or by reducing the time interval for determining the retarding force, as the fact must not be overlooked that the accuracy of taking the measurements has a certain limit which is fixed by disturbing factors resulting from inequalities in the track, through momentary gusts of wind occurring during the run, and by similar causes.

For determining the air resistance, coasting tests at high initial speeds were made, and Fig. 3 indicates the method used in these determinations for fixing the total train resistance. In this case, the distance covered in the recorded intervals of 10 seconds each was so great that it is not necessary to consider the small variations in the grade of the track, and each division can be considered as having a constant grade. These grades are noted on the speed curve which represents the average for the entire division.

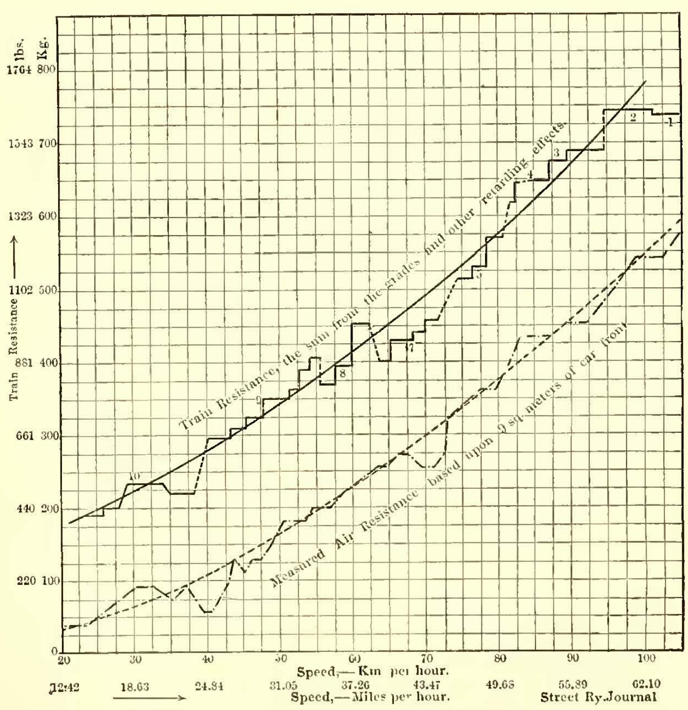


FIG. 3.—DETERMINATION OF RESISTANCE OF CAR A, FROM SECOND RUN ON OCT. 15, 1902

The total retarding effect resulting from the sum of the retarding forces and those due to the difference in grades is plotted in functions of the speed. The air pressure recorded demonstrates clearly the important effect exercised upon the power required by the condition of the bearings and the lubrication. During the later runs at higher speeds no great differ-

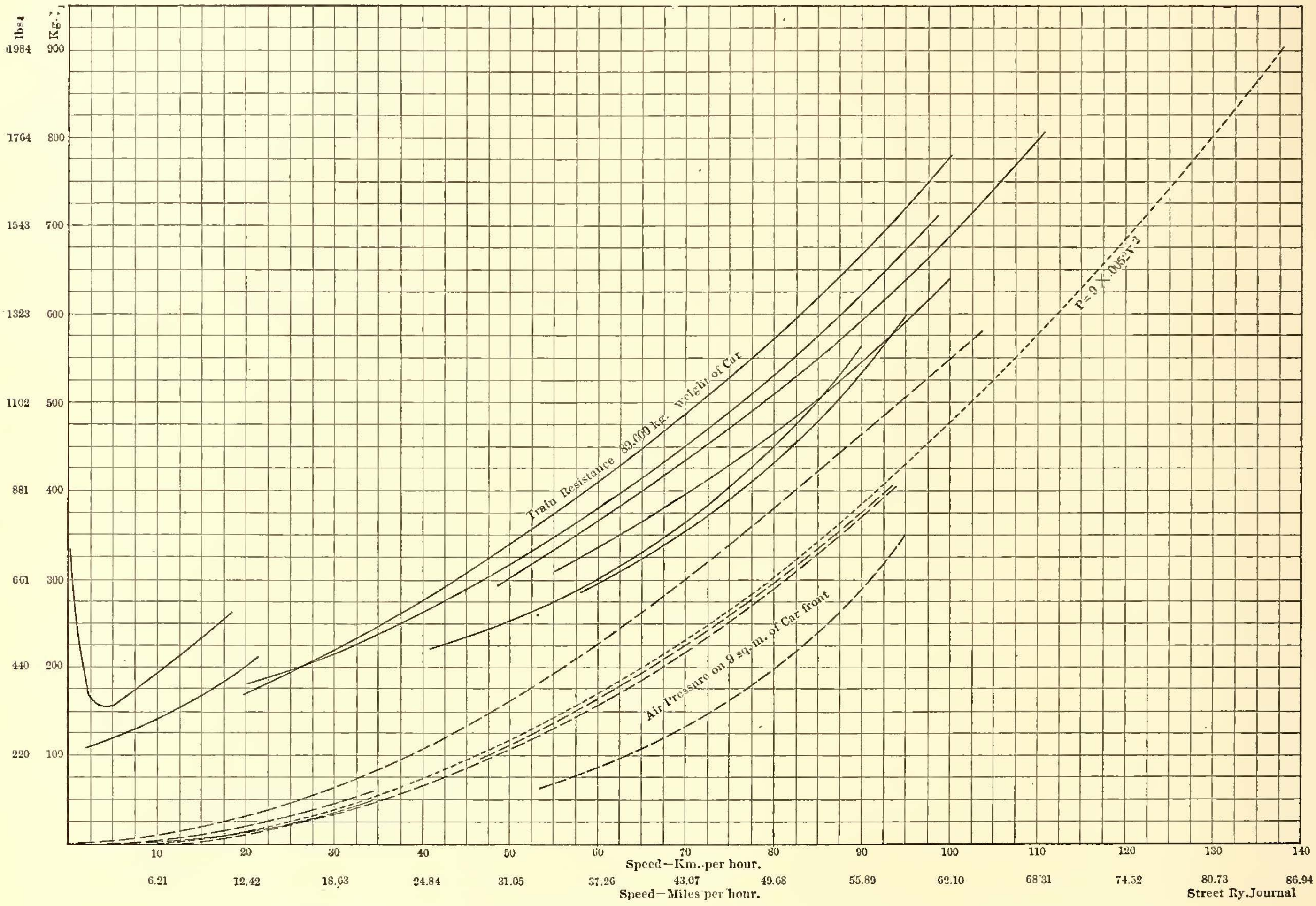


FIG. 4.—RESISTANCE OF CAR A, DETERMINED BY THE COASTING RUNS IN THE FALL OF 1902

during this run is corrected and plotted for a car front of 9 sq. meters. A car having a smooth front surface of 9 sq. meters at right angles to the direction of motion and running at the same speed as this car, would encounter the same air pressure as in this case.

Chief Engineer von Loessel, in his works on "Laws of Air Resistance," calls this surface the "Equivalent Surface." The accurate determination of this equivalent surface is surrounded with considerable difficulty and could not be absolutely fixed for the two high-speed cars. It is taken at 9 sq. meters for each car, and this figure will be found not very far from the correct value.

The results of many coasting tests were treated in the same manner as those just described, and the corrected average values are plotted in the curves of train resistance and air pressures given in Fig. 4 for car A and Fig. 5 for car S. The individual curves vary somewhat from each other, but, in general, they lie close enough together to show the power required for operating high-speed trains.

The curves of train resistance for car A show a decided variation at the lower speeds when compared with those obtained for car S, which lie closer together. This is due to the fact that car A had stood half a year from the time that the first coasting tests were commenced, and during this time the truck bearings and king bolt had not been cleaned. This fact

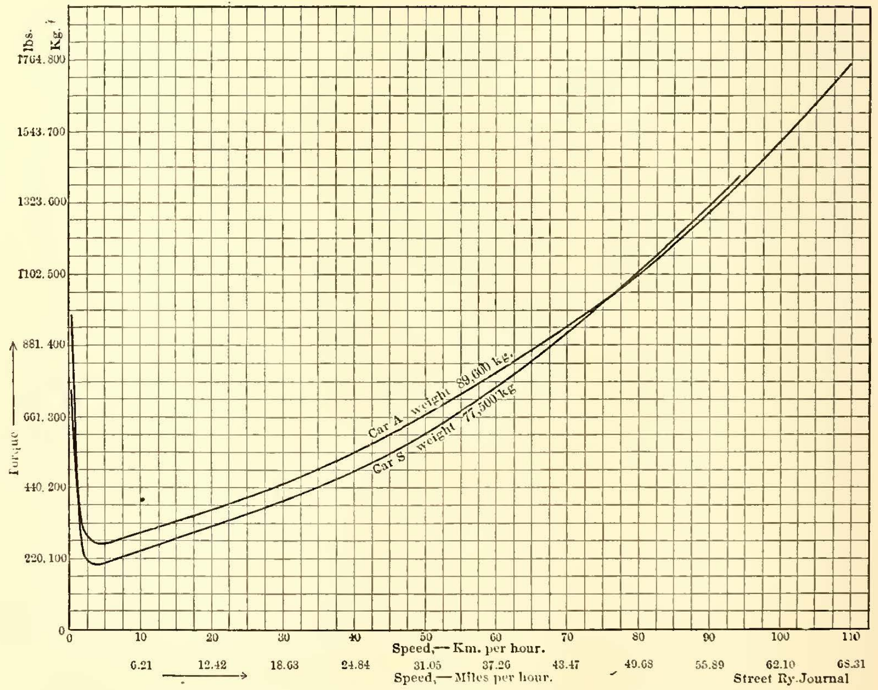


FIG. 6.—AVERAGE TRAIN RESISTANCE OF CARS A AND S, DETERMINED FROM THE COASTING RUNS IN THE FALL OF 1902

ences could be detected between the resistances of cars A and S.

The average of all of the curves in Figs. 4 and 5 are placed alongside of each other in Fig. 6, and show comparatively small divergence. The final results of the coasting tests are given in Fig. 7, in which the total resistance of the cars, the air resistance corrected for a 9 sq. meter surface, the deduced rolling resistance, and finally, the energy consumption in metric horse-power necessary to overcome the total resistance are all plotted. The dotted extensions of the curves are approximated for the higher speeds and were more accurately determined by the tests of 1903.

The frictional resistance of the motor car is especially large at starting, but falls immediately after starting, and is only 130-140 kg, or approximately 1.5 kg per 1000 kg of car weight, at a speed of about 5 km per hour. As the speed increases, the train resistance increases slowly and gives substantially different results if the measurements are made right at the beginning of the tests or after the car has been run for a considerable length of time. In the latter case, a lower value is obtained than in the former, which may be attributed to the heating of the truck king bolts and bearings as the run continues, and the consequent lowering of the coefficient of friction.

According to the elaborate tests on bearing friction made by Chief Engineer Lasche (Zeitschrift des Vereins deutscher Ingenieure, 1902, Nos. 50-52), the coefficient of friction for the bearings and king bolt decreases with increasing temperatures, other conditions remaining the same, and within certain limits varies inversely with their temperature. When, for instance, the bearing is heated from 20 to 40 degs. C., the coefficient of friction decreases approximately to the half of its original value. The rolling and sliding friction of the wheels against the rails increases with the speed and seems slowly to approach a maximum value. This factor, however, is not of much consequence compared with the other resistances at the higher speeds.

For measuring the air pressures on the surrounding sides of the car, the U-formed glass tubes fastened in the interior of the car, and described in the previous report, were used. Besides these tubes a special air-pressure measuring apparatus designed by the Allgemeine Elektricitäts-Gesellschaft was fastened at each end of the car A. This apparatus, which is shown in Fig. 13, consists of a thin disc (*a*) fastened to a ball-bearing shaft (*b*) and held in the direction of motion by a spiral spring. The air pressure against the disc compresses the spiral spring, and through lever arms operating over a scale this pressure may be read directly from the scale. A ball and socket joint was placed between the disc and shaft, and was so arranged that the disc could be turned not only at right angles to the direction of motion, but also at any other desired inclination. It was intended to fasten different shaped hollow forms on the shaft to determine the effect of the air pressure on different shaped bodies, but on account of lack of time, the tests could be made only on the cylindrical form.

In order to make proper corrections for the side winds prevailing during the tests, which was not done in the earlier tests, the direction and velocity of the wind was noted on each day at the beginning and close of the tests. For this purpose,

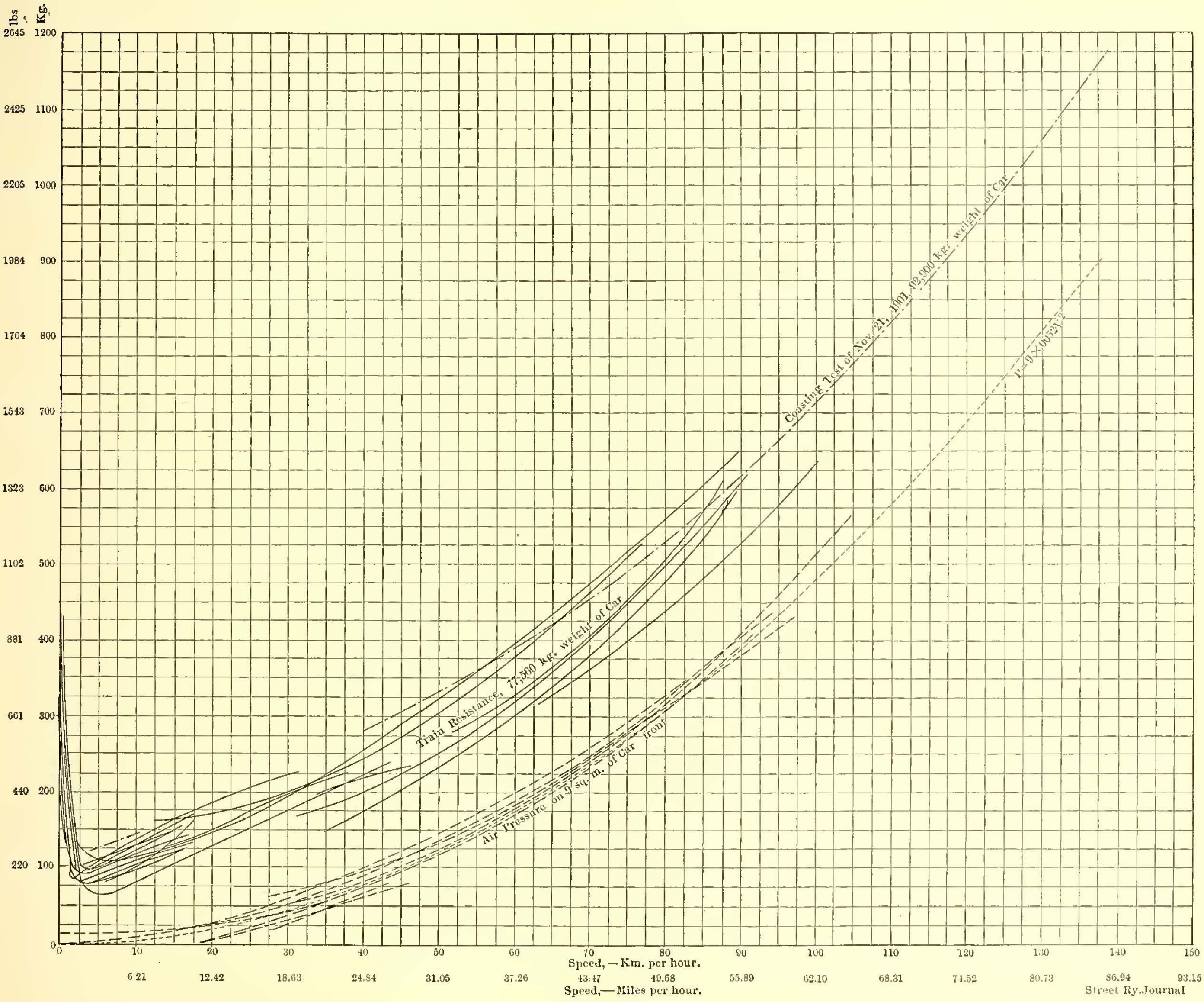


FIG. 5.—TRAIN RESISTANCE OF CAR S, DETERMINED FROM THE RUN CURVES OF THE FALL OF 1902

a sensitive windvane and an anemometer was located at a convenient distance from the car house at Marienfelde.

The air pressure records in the car were taken at the same instant that the other observations were made, that is, at intervals of 10 seconds each, which were announced by an electric bell set in operation by a well-regulated clock. The direct measurements of the air pressures on the front end of the car, according to the method described in the first report, gave the same results as in the previous tests, and are shown by the curves of air pressure plotted in the speed diagrams of Figs. 10, 11 and 12. In these results, however, the influence of the prevailing direction and strength of the wind are not entirely neglected. For instance, at a speed of 100 km per hour, with a wind velocity of only 5 meters per second, or approximately 18 km per hour, blowing in an opposite direction to that of the motion of the cars, the air pressure on the car would be the same as that experienced when running 118 km per hour in still air, and according to the following formula the air pressure was approximately 72 kg per sq. meter, while, if there had been no wind, this pressure would have been only 52 kg per sq. meter. This fact may be recognized from the diagrams in Figs. 8 and 9. The upper parts of the diagrams give the direct readings without taking into consideration the wind pressure. The small dots refer to the results obtained when running in the direction from Marienfelde to Zossen and the small crosses for those obtained when running in the opposite direction. The effect of the wind is particularly evident in Fig. 9, which gives results obtained on October 15, taken during a prevailing wind having a speed of 5.8 meters per second. The curves given, determined by the formula

$$p = .0052\, V^2$$

in which p represents the air pressure on 1 sq. meter of smooth surface perpendicular to the direction of motion and V the speed in km per hour, is the mean of the several air pressure points for the going and return trips.

The test section was divided into three practically straight parts, and the components of speed lying in the direction of motion were $\pm$ 10 km per hour for the first part of the stretch, $\pm$8 km per hour for the second part and $\pm$ 4 km per hour for the third part. In the lower parts of the diagrams the points are corrected according to these figures. The direct readings for October 13, given in Fig. 8, show less divergence from the air pressure curve, because the wind speed on this day was only 2.8 meters per second.

In the calculations of these air pressures the formula for the air resistance

$$p = .0054\, V^2$$

determined from the previous tests, had to be changed slightly.

The absolute value for p is $.0052\ V^2$. The measurements of the air pressure exerted against the disc perpendicular to the direction of motion obtained by the apparatus illustrated in Fig. 13, agrees in general with the readings obtained from the water tubes, although these latter devices are more reliable, and on this account were used in all of the test runs.

When a particular disc used for measuring the pressure was placed at an angle to the direction of motion, as illustrated in Fig. 14, the resulting pressure was lowered approximately in proportion to the projection of the surface of the disc perpendicular to the direction of motion. If instead of the disc, a cylinder of the diameter d and the length l, was used, the measurements recorded had the same value as a smooth upright surface of 0.7dl placed perpendicular to the direction of motion. These values correspond with the results given by Moormann in the "Centralblatt der Bauverwaltung" for Nov. 22, 1902, No. 931, where, according to his observations, the wind pressure against a round chimney is stated as being exerted only against that part (ab, Fig. 15) of the cylindrical surface enclosed by an angle of 86 degs. This portion, ab, is approximately 7-10 of the diameter, and agrees throughout with the observations of the effects of the air on the rounded corners of the car A.

As illustrated in Fig. 16, the pipe II was fastened in the front end of the car. The water glass connected with it recorded the same height of pressure as that in pipe I as long as the mouth of the former lay in the plane of the front end; but

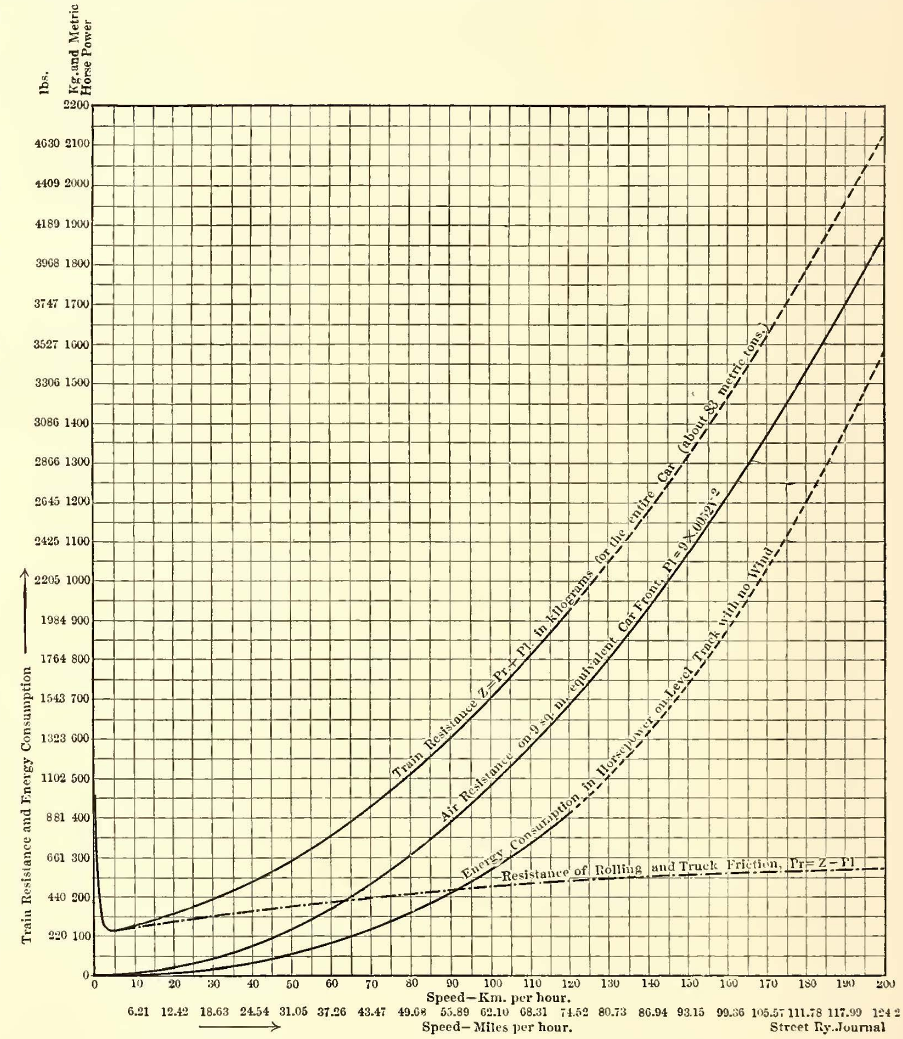


FIG. 7.—RESISTANCE AND POWER CONSUMPTION OF CARS

just as soon as it was turned out of this plane the air pressure was notably decreased until finally, by further turning of the pipe, an actual suction was observed.

In this connection, an instructive incident occurred which was accidentally noticed. A window pane was lacking in the curved side of car A between the front and side of the car, and the resulting opening ab (see Fig. 16) was closed by a sheet of pressboard. When running in the direction of the arrow the pressboard fell outward and not inward, as might naturally have been expected, and the observer who stood by the water stand glasses at the rear end of the car noticed a sudden falling of the water level, which was finally attributed to the attenuation of the air in the car. The air did not flow into the car through the opening in the window, but along the rounded edge, as illustrated by the dotted lines, producing a suction effect. The observer standing behind the opening in the window, consequently, did not notice any difference in air currents during the run. Similar observations were also made earlier

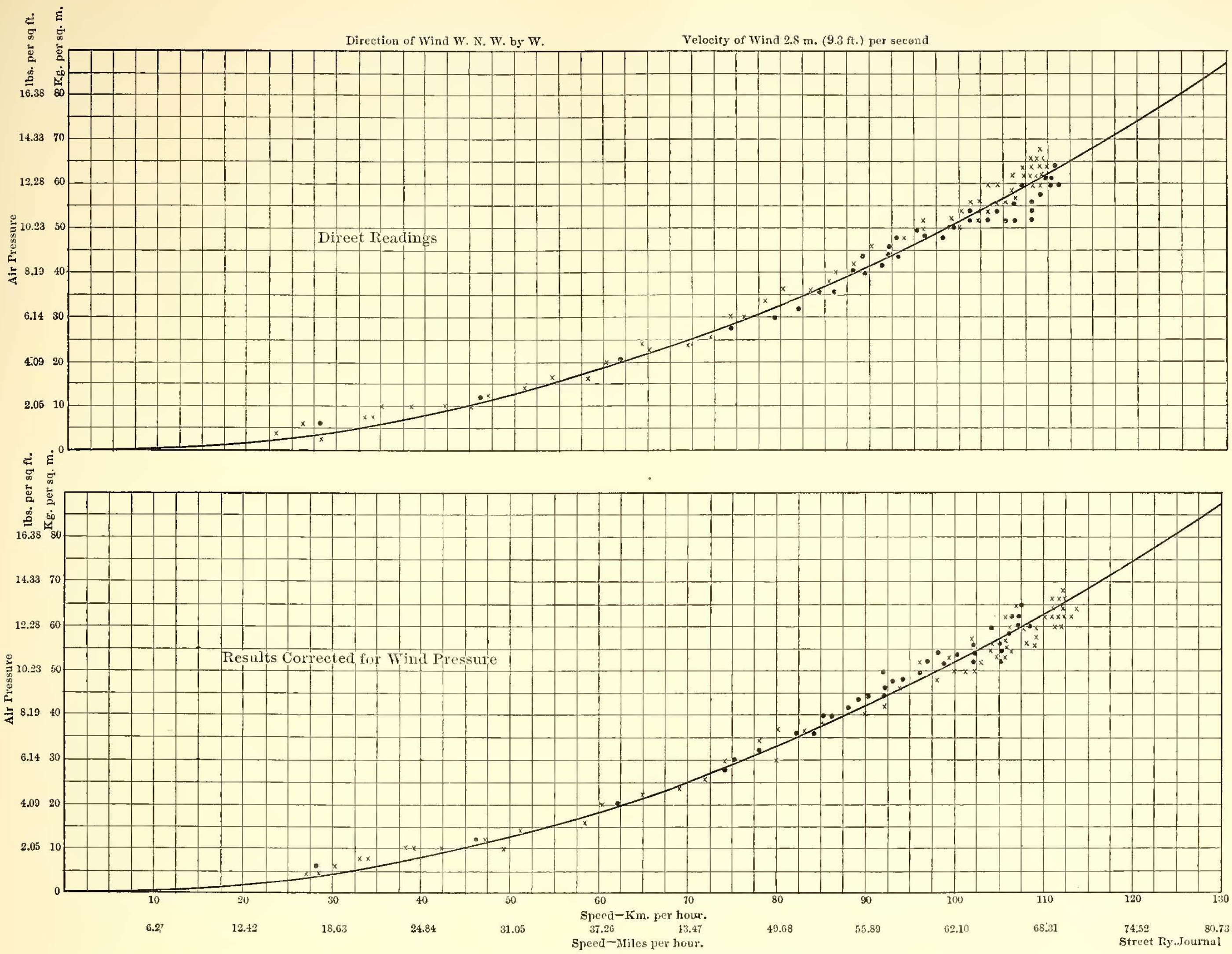


FIG. 8.—MEASUREMENT OF AIR PRESSURES

Trip on Oct. 11, 1902, from Zossen to Marienfelde; frequency = 20.8 cycles per second; four motors, two transformers.

Trip on Oct. 17, 1902, from Marienfelde to Zossen; frequency = 24 cycles per second; two motors, one transformer.

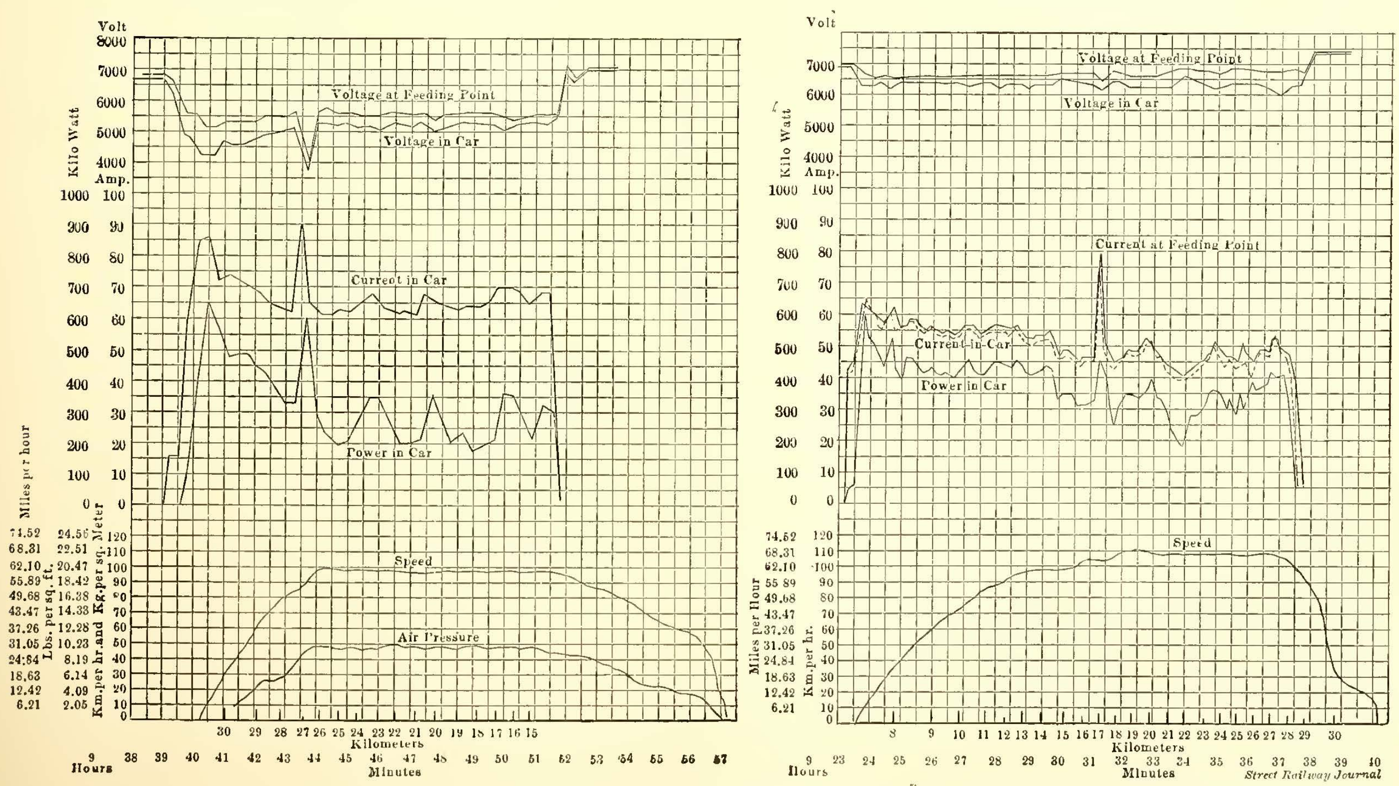


FIG. 10.—CURVES OBTAINED FOR SPEED, AIR PRESSURE, CURRENT, VOLTAGE AND POWER, WITH TWO TRIPS ON CAR A (WEIGHT, 89,500 KG.)

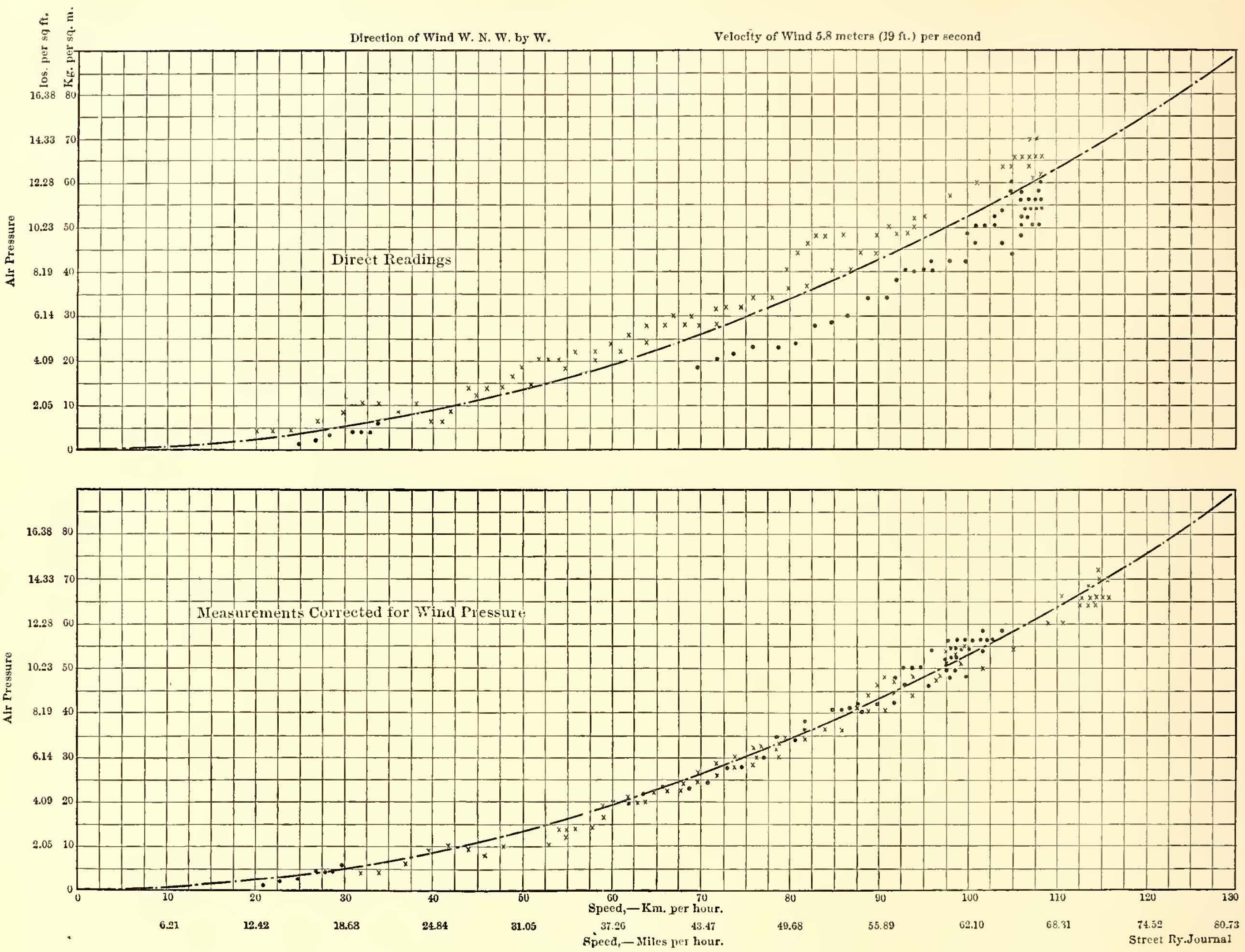


FIG. 9.—MEASUREMENT OF AIR PRESSURES

Trip on Oct. 9, 1902, from Zossen to Marienfelde; frequency = 20.8 cycles per second; two motors, one transformer.

Trip on Oct. 13, 1902, from Zossen to Marienfelde; frequency = 24 cycles per second; two motors, one transformer.

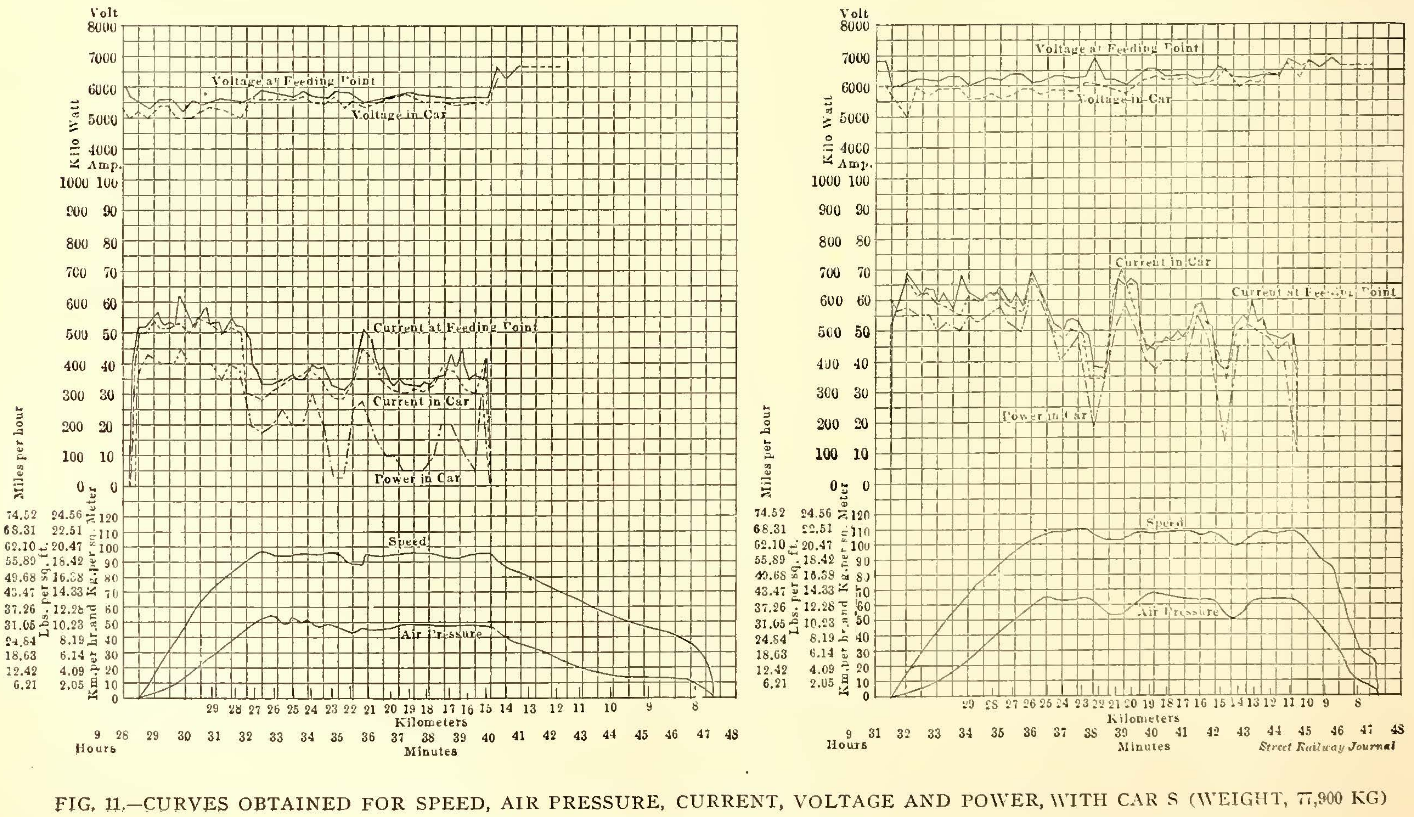


FIG. 11.—CURVES OBTAINED FOR SPEED, AIR PRESSURE, CURRENT, VOLTAGE AND POWER, WITH CAR S (WEIGHT, 77,900 KG)

in the tests at the tubes fastened in the rounded ends of the car.

Tubes were arranged in the forward corner of the car S, as shown in Fig. 17, having their mouths placed right at the corner and lying near each other. Pipe II showed a strong suction, while pipe III registered the same pressure as the opening I in the middle of the front wall. A strong flow of air toward the rear of the car prevailed at this corner and continued along the side, the full air pressure being felt only at the front end of the car, the surface of which was perpendicular to the direction of motion. Moreover, a tube having its mouth turned toward the front and placed a short distance from the forward corner, approximately in the position represented by IV, did not show the full pressure as recorded at the middle of the front end of the car, which might have been deduced from the dotted lines representing the flow of air in the illustration.

Trip of Car A on Oct. 25, 1902, with three-axle trailer (total weight = 188,400 kg), from Marienfelde to Zossen; frequency = 25 cycles per second; four motors, two transformers.

Trip of Car S on Oct. 25, 1902, with three-axle trailer (total weight = 193,400 kg), from Zossen to Marienfelde; frequency = 25 cycles per second; four motors, two transformers.

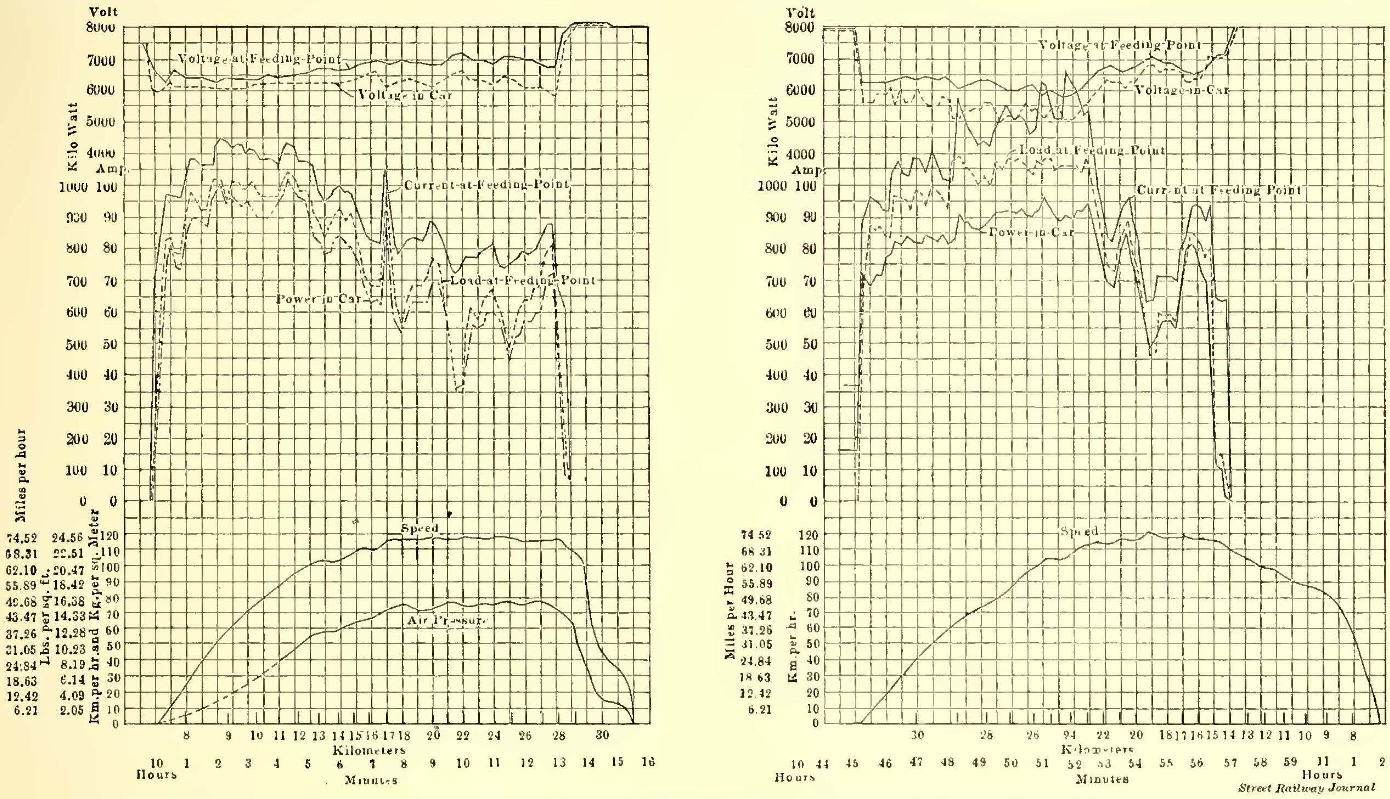


FIG. 12.—CURVES OBTAINED FROM TRIPS WITH TRAILERS ATTACHED TO CARS A AND S

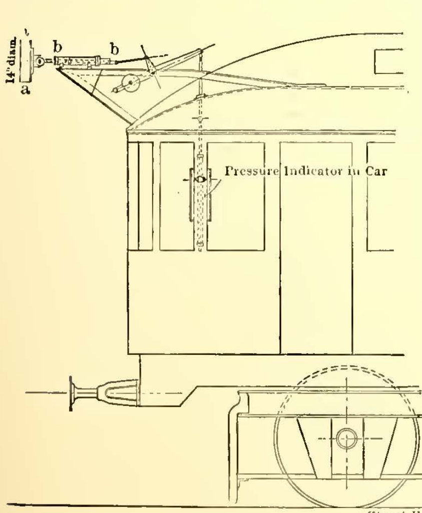


FIG. 13.—SPECIAL AIR-PRESSURE MEASURING APPARATUS

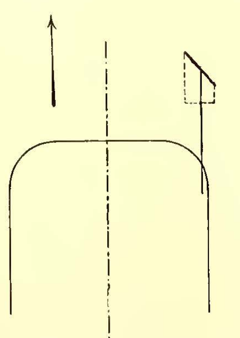


FIG. 14.—PRESSURE-MEASURING DISC

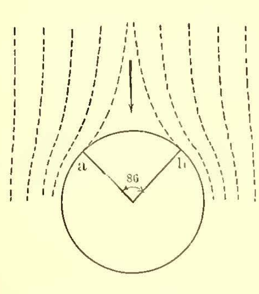


FIG. 15.—PRESSURE-MEASURING CYLINDER

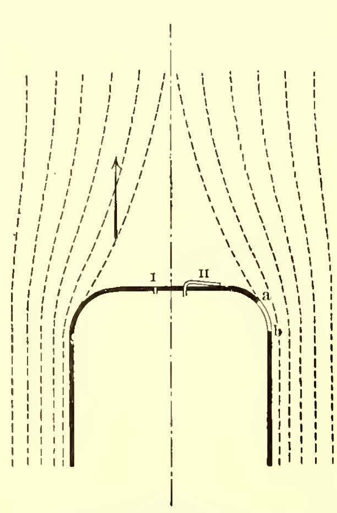


FIG. 16.—SHOWING PRESS-BOARD COVERING AT *A B*

Especial importance is laid upon the tests made this year on account of the valuable results obtained by observing the air pressure conditions at given distances from the front and rear end of the car, similar observations being noted and described in the first report made by the extended tube, which was sealed air tight to the shank of the water-stand glass. At the mouth of this tube, extending from 3 to 5 meters before the front end of the car, the air pressure was the same as that recorded near the front end of the car, and, as was also noticed in the present experiments, a cone of compressed air was formed before the mouth of each tube. Equal air pressures were obtained when the mouths of the tubes were placed out of the center line of the car. To determine how far the compressed air cone extended in front of the moving car, the ends of the tubes were bent backwards, and were also extended up to a point 4.75 meters in front of the surface of the front end of the car, and 1.85 meters on either side of the center line of the car. In running in the opposite direction, these tubes were used to ascertain the state of the air drawn along at the rear end of the car.

In Fig. 18, the outlines of the cars are given and the location of the mouths of the tubes are shown by small crosses and dots; the former referring to car A and the latter to car S. The figures represent the air pressure and the air attenuation. These figures are corrected for a speed of 110 km. per hour by multiplying the height of pressure noted at the speed V by $\frac{110^2}{V^2}$. The figures are also corrected by taking into consideration the direction and speed of the wind according to the method already described.

Finally, the tubes were carried upward through the roof of the car and then still further to a height of 6.3 meters above the heads of the rails. Fig. 19 shows the different positions of the tube. As was expected, tube I showed a suction when its opening was toward the rear. Up to the height of 6.3 meters above the heads of the rail the air pressure was the same as

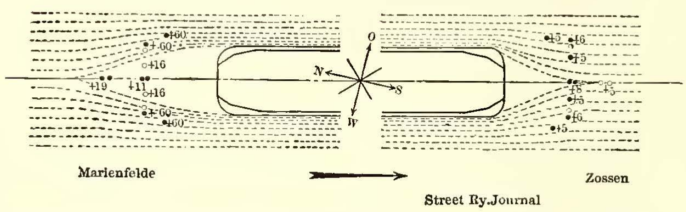


FIG. 18.—DISTRIBUTION OF AIR PRESSURES AROUND CAR

that directly against the front of the car as long as the mouth of the tube was pointed in the direction of motion. When the mouth was turned toward the rear, however, a suction effect up to 20 mm water column was produced. Tubes carried up to about 4.8 meters height above the rails showed similar suc-

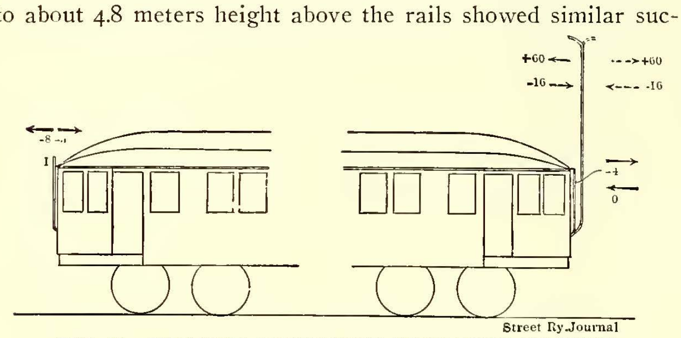


FIG. 19.—SHOWING DIFFERENT POSITIONS OF TUBE

tion and pressure effects, but decidedly lower values were noted.

Mention should be made of the fact that a parabolic shaped end of sheet iron was fastened to the front of the car A, illustrated in Fig. 20, to ascertain what effect it would produce in

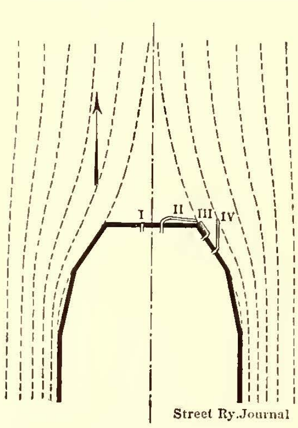


FIG. 17.—TUBE ARRANGEMENT IN FRONT END OF CAR S

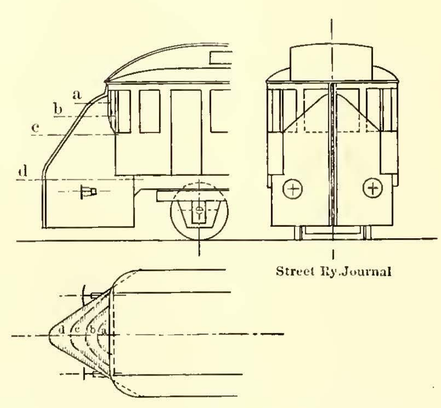


FIG. 20.—PARABOLIC SHIELD TRIED ON CAR A

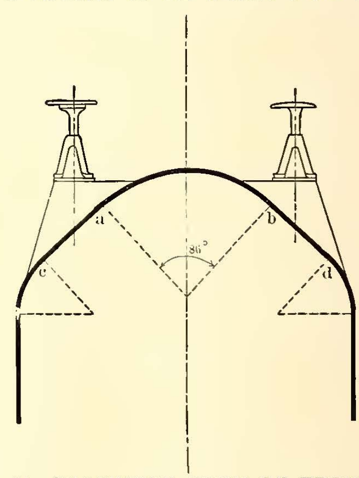
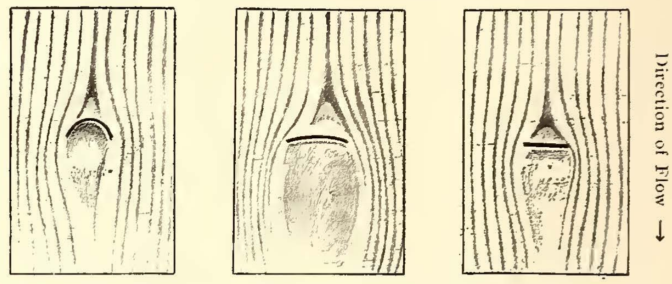


FIG. 24.—SUGGESTED FORM OF FRONT END OF CAR

decreasing the air resistance. By its use a lower energy consumption was noted; but as the shield covered only a part of the front end of the car and the speed at which it was tried was not much above 100 km per hour, the effect produced was not of great magnitude.

From the results of these tests it is approximately possible to decide what movement of the air takes place in relation to the car.

At a distance of about 4½ meters before the front of the car the zone of compressed air seems to cease, while directly at the front wall and extending to the rounded or sharpened corners of the sides, a cone of compressed air of uniform density is formed. At the rear end of the car, no, or only a very slight, suction is experienced, and the separate points in Fig. 18 indicate that quite a large space exists back of the car in which neither compression nor attenuation of the air is felt, and where only a very slight air movement is recorded. These



FIGS. 21, 22 AND 23.—ILLUSTRATING FORMATION OF COMPRESSED-AIR CONES

observations are substantiated by the fact that in dry weather the last car in a rapidly moving railway train is followed by a cloud of dust arising at some distance from its end and not directly behind it.

The probable air currents, illustrated by the dotted lines in Fig. 18, agree throughout with the results of the very elaborate tests on the flow of air against interfering surfaces made by Georg Wellner, professor of the Technical High School of Brünn, in his treatise, "Der dynamische Flug," published in the jubilee number of the K. K. Technical High School of Brünn, and issued at the celebration of its fiftieth anniversary in 1899.

Figs. 21, 22 and 23 illustrate several of the effects ascertained by him when the currents of air strike against interfering surfaces. In these experiments, a cone of compressed air was formed in front of the surfaces and behind them was a space filled with this still air.

In conclusion, mention should be made of the observations noted of the resulting air pressure by the passing of the car near a temporary constructed board wall 20 meters long and 5 meters high, located at a distance of 2.2 meters from the middle of the track. The wall was perforated with holes at several points, and into these holes were placed water-stand glasses similar to those fastened on the sides and front of the car for measuring the air pressure. A pressure of 12 to 14 kg on 1 sq. meter of the wall was recorded when the car had a speed of 120 km per hour.

As the air resistance forms the greater part of the total resistance of rapidly moving trains, it is essential to design the outer form of the car so that the air resistance should be reduced as much as possible. According to the results of the tests described above, the best conditions would prevail if the front end of the car had the form of a very sharp parabolic wedge. This is practically impossible on account of the arrangement of the motorman's cab and the placing of the couplings and buffers. The view of the track would also be impaired. It seems, therefore, to be more practicable to give the forward part of the front end of the car a cylindrical form in order to make it possible to arrange for windows. The wall of the cylinder would merge into the smooth surface *ac* and *bd* at the points *a* and *b*, Fig. 24.

According to Fig. 15, the cylindrical surface would be limited by an angle of about 86 degs. The extensions of the sides of the car at the points *c* and *d* must be rounded off. The closing of the top would be made in a similar manner to the present cars. A change in the sides would not be necessary, as a noticeable pressure against them would only be produced by a strong side wind, which would not increase the total resistance of the train very much. If trailer cars are carried, they must be connected to the motor car through the medium of stiff telescoping canvas.

CORRESPONDENCE

THE NEW YORK CENTRAL-NEW HAVEN SITUATION

THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD CO.
New Haven, Conn., Oct. 23, 1905.

Editors Street Railway Journal:

I have read the article in your issue of October 21 by Frank J. Sprague, entitled "An Unprecedented Railway Situation." It is not my feeling that the arguments for and against the respective plans of the New York Central & Hudson River Railroad Company and the New York, New Haven & Hartford Railroad Company for the electrical handling of their traffic into Forty-Second Street can be discussed with profit in the columns of the press, between the engineers of the two companies; neither is it my purpose to reply to Mr. Sprague's comprehensive arraignment of the policy and manners of the New Haven road. However, as the inference may be drawn that the public is to be incommoded, and the prosecution of a great engineering improvement hindered by the action of the New Haven road in declining to absolutely follow the engineering lead of Mr. Sprague and his associates, I cannot let the article pass unnoticed.

On that score it is proper to point out that the locomotives which have been purchased by the New Haven road will handle that company's trains between Forty-Second Street and Woodlawn, receiving continuous current from the third rail in exactly the same manner as it is proposed that the locomotives purchased by the Central Company will handle the trains of that company, and inasmuch as the stub end track facilities of the enlarged Forty-Second Street station will be largely increased over similar facilities afforded by the present station, and inasmuch as these increased facilities will be relieved of a considerable number of the present trains of the Central Company, by transfer to the suburban loop, it is difficult to find reason for alarm at prospective delays or lack of accommodations to the traveling public, or on behalf of the Central Company for inharmonious operation.

That the progress of the art of locomotive design since the purchase of the locomotives adopted by the Central some two years ago has enabled the New Haven road to procure a type which, in addition to operating on the Central's continuous system, is also capable of operating on a single-phase alternating current, thus widening the possible application of electric traction for future extensions on the New Haven's electrical system, should be a source of gratification, rather than of censure or alarm.

Mr. Sprague's unfamiliarity with the up-to-date development of electric locomotives has, perhaps, led him into his dire prognostications of disaster, and while, under the circumstances, an extended argument can be of little avail, I have no doubt that the management of the New Haven road will be quite content to await the practical results which will very soon furnish substantial evidence of the correctness or error of their judgment.

Calvert Townley.

Boston, Oct. 24, 1905.

Editors Street Railway Journal:

It is with great hesitation that the writer undertakes comment on Mr. Sprague's arraignment of the New York, New Haven & Hartford Railroad plans for alternating-current traction. He has played so great a part in the growth of electric railroading, and has so unusual a store of keen common sense in dealing with electrical problems, that the whole engineering profession must hold his views in high respect. Yet, in reading his discussion of the situation, I am impressed by the possibility that he has not entirely taken into account the larger and more remote features of the matter. Personally, I have long believed that, however successful the third-rail direct-current system may be in dealing with purely suburban and terminal work, it has limitations in the matter of the electrical distributions that are forbidding when one comes to consider the larger railway field.

As a practical matter, I consider high voltage on the working conductor a virtual necessity in dealing with the electric railway of the future, and this of itself implies laying aside the third-rail system for conductors placed where they can be adequately insulated. At the time when the decision was made upon the New York Central equipment it was wisely made on the then existing conditions. But we seem just now to be in a transition period in traction, and it would be nothing surprising if that equipment, like many another that has gone before, should prove within a very few years to be obsolescent.

Of the value of multiple-unit control in heavy suburban work there is no doubt, but if anything is to be learned from the great experiments on high-speed electric traction it is that the electric locomotive has there a great and legitimate field. It looks as though the New York, New Haven & Hartford Railroad in this latest move, sensational though it be, is building, not for the terminal service which will soon be inaugurated, but for the far larger work to which the carefully worked out third-rail direct-current system is not even a prelude. Of course, the big alternating-current locomotive is in a measure experimental, involving some very nice questions of engineering, but one can safely assume that the railroad is not buying a pig in a poke. It is up to the contracting company to make good its guarantees and to make a success of those locomotives if possible. No wise railway man is going to assume the responsibility for that part of the work, nor is he likely to be asked to do so. The locomotives can be tried out with the utmost thoroughness, even if a locomotive of the steam persuasion has to trundle along ahead to give its electric brother a tow until such assistance is shown to be needless. And if those electric locomotives are accepted it will be because they have shown themselves able to do the work required of them. If they are successful, then a problem of engineering infinitely greater than even the New York terminal system will have been solved, and the way will be open for very great changes.

In short, I do not think it a sound conclusion to assume that the New York, New Haven & Hartford Railroad has recklessly butted into a huge experiment at the peril of its passenger service merely for the sake of its trains to Stamford. It is after larger game, and game that cannot be brought to bay by any weapon yet discovered in the direct-current armory. If the experimental stage is safely passed with the a. c. locomotives, then the question will be, not how conveniently they can be accommodated by the existing d. c. terminal system, but how long that system can keep up under the new conditions without accommodating its equipment to modern improvements. If the a. c. locomotive system should fail, it would be tough luck for the contractors, but not in any way disastrous for the railroad, which would be at least as well off as it was before. It is pretty evident that the contractors believe that they can make good, and I am glad that some one has had the courage to undertake the very important work of developing, to its legitimate conclusion, single-phase traction upon a large scale.

On the other hand, I believe that it would have been a grave mistake for the railroad to have committed itself to a heavy expense for direct-current apparatus, in view of the present state of the art of electrical traction, for it must be granted, even from the standpoint of conservatism, that if the a. c. locomotive makes a success in heavy traction it will have a wider field of usefulness in big work than can be hoped for by 500-volt or 600-volt or 800-volt d. c. motors, tied up as they are to the third-rail scheme of feeding. As it is, the railroad wins much if the experiment succeeds and loses little if it fails. It can go in for d. c. equipment any time it seems desirable, and with the advantage of the experience that the New York Central terminal system will have paid for. The announcement of the a. c. locomotive contract was a bit startling, of course, but until a certified copy of it is published I shall be disposed to believe that the railroad has not taken the step without adequate assurance that it shall not suffer very severely in case of failure.

LOUIS BELL, Ph. D.

New York, Oct. 23, 1905.

EDITORS STREET RAILWAY JOURNAL:

I have read with interest Mr. Sprague's article in your last issue on the New York Central-New Haven situation and his plea for multiple-unit trains. That this plan, for which Mr. Sprague has worked diligently and faithfully for nearly ten years, has been a marked success and has advanced our knowledge of traction conditions is beyond dispute.

It is well known, however, that there are many engineers experienced in steam locomotive as well as electric operation who believe that multiple-unit trains have their place. But under conditions where comparatively high speed is required without high acceleration—and there are such conditions to be found—and where cost of motive power and maintenance of rolling stock are as carefully watched as is the custom on steam roads, multiple-unit trains stand a chance of coming in second in the race against the electric locomotive hauling a train of coaches. The statement that "it is a fact that the multiple unit has become an accepted tenet of such character as to preclude the possibility of successful criticism," cannot by any reasonable argument be made to apply to the main line service of a steam road, or even to the suburban service of every steam road.

If the New Haven road intends to run its a. c.-d. c. locomotives over the d. c. zone of the New York Central, have not the engineers of the New Haven road sufficient intelligence to design their locomotive to fit a 15-ft. tunnel, even with a trolley bow pulled down flat on the roof of the locomotive? Are not the New Haven people, pioneers as they were in heavy electric railroading, justified now in waiting to see the result of the, to them, enormous experiment of the New York Central? Can they not be permitted, in the meantime, to do a little more experimenting on their own hook, this time with a. c.-d. c. locomotives on their Harlem River branch and the New Rochelle-Stamford section of their main line?

Few persons, if any, outside of the inner councils of the New Haven road know what are its future plans for the development of its suburban service between Stamford and New York. The regular commuter service of this road extends to New Haven, 73 miles from the Grand Central Station. That those in authority realize that this entire section must be equipped with electric traction in a comparatively short time is not to be doubted. Is not that another reason why a. c. locomotives ought to be tested?

Why is the company expending $6,000,000 on the electrical equipment of two additional tracks on the Harlem River branch from New Rochelle to 135th Street? That branch will then consist of six tracks of 100-lb. steel, laid on a splendid, rock ballasted, level right of way. It would serve practically all their suburban district except Mount Vernon, which is also served by the New York Central. Does anyone suppose that the New Haven road is anxious to continue the payment of upward of $35,000 per month rental for the privilege of entering the Grand Central Station when it has another terminal of its own within the city? It is true that the position of this terminal is not so convenient to the center or downtown districts of the city as the other, but the coming subways and other facilities for rapid transit may in a short while make the running time to the business district as short, if not shorter, than the other.

How about the connection to be made in the near future between the Harlem River terminal and the Pennsylvania tunnel in Brooklyn by the bridge over the entrance to the sound near Hell Gate? Would the operation of a. c.-d. c. locomotives over this section be so disastrous to the capacity of the company's power plants? It might be interesting to look back upon this question when in the future the New York terminal of the New Haven road, for both suburban and through service, is found at the great Pennsylvania station at Thirty-First and Thirty-Second Streets, between Seventh and Ninth Avenues.

The officers of the New Haven road, and especially those responsible for the electrical operation, must understand that its suburban business out of New York is menaced by the construction of the four-track third-rail line to be built as far as Port Chester, whatever its name may be. Therefore, its plans are probably formed with a view to compete successfully with this rival, and the establishment of an up-to-date equipment, according to Mr. Sprague's ideas, for handling the suburban business, which dumps out the passengers at Forty-Second Street, would hardly give the company any advantage.

The ability of Mr. Sprague as an engineer is well known, and no one questions it, but to assume that the multiple-unit system is the only one, and that the electric locomotive, which has never been tried in this country under steam railroad conditions, has not a single argument in its favor, is perhaps premature.

The New Haven road has stated that the operation of its suburban service is conducted at a loss with the present steam power. Mr. Sprague criticises the number and movement of the present trains, apparently forgetting that an increase in the number of trains under present conditions would constitute a greater loss. He even appears to assume that the present schedule would remain unchanged under electric operation. It should be remembered that the New Haven road has had a much greater experience in electric traction than any other steam road in the country. While its officers and engineers have been changed, the records of the years of pioneer work are there, and the new men should be given a fair chance to prove themselves equal to the task.

EDWARD C. BOYNTON.

TESTS OF AXLES

New York, Oct. 7, 1905.

EDITORS STREET RAILWAY JOURNAL:

In answer to F. W. Bacon's inquiry in your issue of Sept. 9, regarding tests on axles, I have had to go into this question for several clients of mine. In one case the fracture of the axle between the driving gear and hub was frequent, as the torsion stress is of such short radius that the axle eventually becomes crystallized. The cure for this cause is to extend the hub of the gear to the hub of the wheel and bolt these two together. Narrow-gaging of track also seems to be a prevalent cause for broken axles, with the straight axle necessary for the back support of the motor. We cannot taper the axle as in steam road practice, and so give it the flexibility which would allow the wheels to spring the axle from its true center of rotation and accommodate a narrow gage on curves or warped track surfacing. The important point is to test the axles when new and when they are rewheeled. A crystalline condition or fracture is often not discernible by visual examination, especially as an old axle usually has to be cleaned to show up the surface, and this operation tends to fill up any fissures. I have found that a steel axle increases in electrical resistance when it commences to crystallize, but the specific resistance of the metal used in axles varies so much that this is not a sure test and is not practical to apply in the repair shop, as it requires several thousand amperes and careful measurements and records to give positive results.

The drop test for a 4-in. axle consists of dropping a weight of 1640 lbs. from a height of 20 ft. on the middle of the axle, which has supports 3 ft. apart. Five blows are given, and the axle should be turned at each blow and must not show fracture after this test. One axle in a hundred is submitted to this test, and as the strain is beyond the elastic limit

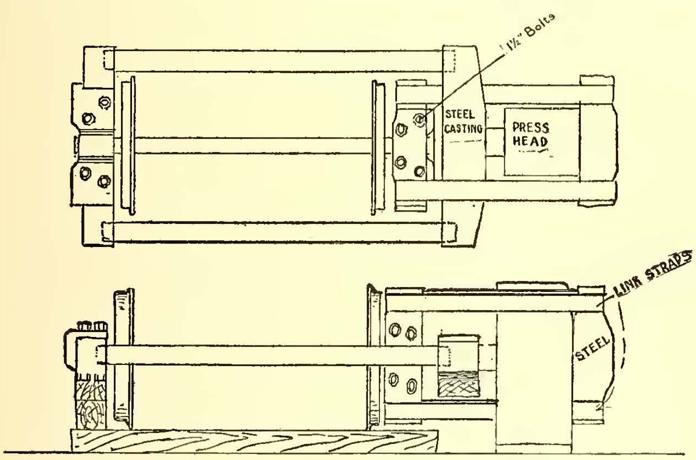


FIG. 1.—ARRANGEMENT OF WHEEL COMPRESSOR FOR TESTING AXLES

of the axle, and the fibrous structure of the axle is broken, it is rendered useless. The test, therefore, is conducted only to determine if the lot of axles will probably stand up in practice.

I believe the following test, which can be readily conducted with the wheel compressor as shown in Fig. 1, will prove out an axle with wheels on or off without affecting the further usefulness of the axle. Advantage is taken of the fact that while the compression value of a crystallized axle is not much changed, the tensile strength is greatly reduced. The tensile strength of good steel for axles should be 80,000 lbs. per sq. in. with an elongation of 20 per cent. This practically gives a factor of safety of 10 under interurban cars, so that if the axle can stand a tensile strain of 8000 lbs. per sq. in. under test it should not show a permanent fracture or a permanent elongation. This requires a test strain of 100,200 lbs., or 50 tons, for a 4-in. axle, which is within the limit of most all wheel compressors. The method of applying this strain on the axle from the compressor is shown in Fig. 1. The bearing is fitted with a clamp conforming to the dimensions of the bearing and made in two halves which can be tightly bolted around the bearing, and arms long enough to span the wheel. These arms are provided with pillars which reach to a yoke against which the piston of the compressor acts. The bearing next the compressor is clamped in the same way with straps around the end of the compressor head having twice the area of the axle to be tested. By this arrangement the compressor can gradually increase the tensile strain on the axle until the test strain has been reached and the physical condition of the axle proven.

Albert B. Herrick.

THE COST OF CARRYING A PASSENGER*

BY C. L. S. TINGLEY,
Second Vice-President the American Railways Company, Philadelphia, Pa.

This is a broad subject and is worthy of the most careful study. Conditions vary so widely that the conclusions of one man may not be of much value to another. Adequately treated, it would require months of study and work. Owing to the limitations of time imposed by our worthy secretary, and the demands of the writer's own business, he was unable to give it the careful study of which the subject was worthy, and must plead this in extenuation of any shortcomings which may be discovered in his handling of the question.

At first sight this would seem to be a very simple question, and one which would be readily answerable by anyone in the railway business. Any manufacturer who can do business in these days of combinations and fierce competition can give you at once the cost not only of every item of his product, but of every stage of manufacture, and one who is familiar with the standard classification of accounts adopted by this association, and with the recommended form of report would say that it would be an easy matter to compute the cost of carrying a passenger. Apparently, however, this is not true, for no less an authority than Edward Dana Durand, of the National Bureau of Corporations, who, in collaboration with T. Commerford Martin, prepared the text of the United States Census Report of 1902 on "Street and Electric Railways," writing in the "Review of Reviews" for February, makes the statement that for the census year the average cost of carrying a passenger had fallen to 3 cents, but this is coupled with the statement in the latter part of his article that "as a matter of fact American street railway companies have almost never made systematic appropriations for depreciation out of their earnings."

This question is further most ably handled by Howard S. Knowlton in the "Review of Reviews" for July, and from both of these articles it is apparent that the question of an adequate depreciation account is the crux of the whole question.

It is contended by Mr. Durand—and in this he is supported by many practical street railway men—that if the physical property is well kept up from time to time as it is worn out or becomes obsolete, and all such replacements charged to operating expenses, that there is little or no need for depreciation charges. But, as a matter of actual practice, it is well known that this is not done, nor is it sound accounting, as in that case each year fails to bear its proportion of the dissipation of capital caused by the wearing out of the property. Take, for instance, the case of track. Ten years ago the road which laid down an 80-lb. girder rail was well abreast of the times, and the track was subjected to the operation of 20-ft., or in some cases a trifle larger, cars, with two 20-hp motors. Now, suppose that this track had been kept in good repair, ties renewed from time to time, joints kept up and everything done for it that was needed; it is to-day subjected to the wear of from 40-ft. to 50-ft. cars, with four 40-hp motors, and is inadequate and must be replaced with 100-lb. to 120-lb. girder rail laid in concrete, the cost of which must be borne either by a depreciation fund or by new capital. The same thing is true of cars, motors and power plant.

Mr. Knowlton quotes from "Electric Railways and Tram-

* Paper presented at the convention of the Street Railway Accountants' Association of America, Sept. 29, 1905.

ways," published by Philip Dawson, an eminent English engineer, in which he gives as the results of an extended study of street railway conditions in this country the following table of allowances for depreciation:

	Per cent
Buildings	1-2
Turbines	7-9
Boilers	8-10
Engines (slow speed)	4-6
Generating units (direct coupled)	4-8
Transformers	5-6
Batteries	9-11
Rotary converters	8-10
Bonding	6-10
Overhead system	3-8
Cars	4-6
Shop equipment	12-15
Motors	5-8
Track work	7-13

And deduces therefrom a fair average allowance for depreciation of from 8 per cent to 10 per cent as a minimum. The latter figure coincides with the writer's own judgment in the case.

The special report of the United States Census Bureau on "Street and Electric Railways" for the year 1902, on page 11, gives the following figures in table 6:

DISTRIBUTION OF THE GROSS INCOME OF OPERATING COMPANIES TO LEADING ITEMS OF EXPENDITURE

	Amount	Percentage
Gross income from all sources	$250,504,627	100.0
Operating expenses	142,312,597	56.8
Fixed charges, total	77,595,053	31.0
Taxes and licenses	13,078,899	5.2
Rentals	25,518,225	10.2
Interest	38,085,911	15.2
Miscellaneous	912,018	0.4
Dividends	15,882,110	6.3
Surplus	14,714,867	5.9

And on page 39 of the same report the average fare is stated at 4.94 cents per revenue passenger. We now have data for all items which enter into our computation except the much-discussed one of depreciation.

From the foregoing we get the following table of cost as shown by United States Census Report, being the average of all the roads in the United States:

	Cents	Cents
Gross earnings per passenger		4.94
Operating expenses per passenger	2.81	
Taxes, licenses, rentals and interest per passenger	1.53	
Total cost per passenger without any allowance for depreciation		4.34
Surplus over cost of passenger		.60

For the purpose of illustrating this discussion, the writer has selected three companies with which he is connected as typical of varying conditions:

First—One which had been originally well constructed, had been well maintained, but had been in operation for over ten years prior to passing to its present ownership and the resultant rehabilitation.

Second—One which had not been so well constructed originally, and which had been in operation less than ten years before passing to its present ownership.

Third—One which had been thoroughly well built and maintained, and had been in operation less than ten years since its reconstruction before passing to its present ownership, but upon which much of the equipment had become obsolete, owing to the advancement of the art and changed conditions of service.

As the Census Bureau has reduced all its figures to the basis of percentage of gross earnings, the writer has taken the amounts expended in the reconstruction of the above properties and reduced them to the percentage of the gross earnings for the year following the completion of such reconstruction, so that in each case the property might have the advantage of any increased revenue due to better service, etc. The average of the three properties has also been taken. The items considered in arriving at the above conclusions are only those relating to the destructible plant. In the first instance the percentage is 21.5 per cent; in the second, 11.7 per cent; in the third, 4.1 per cent; and the average is 12.1 per cent.

If Mr. Knowlton is correct (and the writer believes that he is), that the average life of the destructible plant is ten years, we would have an average yearly charge on the gross earnings of the above properties which should have been taken care of by a depreciation fund of 1.21 per cent of the gross earnings.

From the foregoing we can deduce the following table as an illustration of how a minimum charge for depreciation affects the cost of carrying a passenger:

	Cents	Cents
Gross earnings per passenger		4.94
Operating expenses per passenger	2.81	
Taxes, licenses, rentals and interest per passenger	1.53	
Depreciation per passenger	0.06	
Total cost per passenger		4.40
Surplus over charges per passenger		0.54

In the above figures no consideration has been given to the question of amortization of capital in the case of limited franchises. Many of us are connected with companies which are working under such franchises and know that this is a question which must be met.

The profitable part of a street railway is that which lies in the heart of the city and is of limited extent; it is that upon which you get the short ride. Every progressive street railway —and what street railway is not progressive—must keep extending its lines into the outlying portions of the city where riders are few, the hauls are long and the dead runs are numerous; where for one or two trips, night and morning, the cars are full, but the balance of the day are empty, or nearly so. As the city grows, the street railway—that pioneer of civilization—must push further and further out into the wilderness of vacant lots, and the hauls grow longer and longer, but the nickel gets no larger; wages get higher, and the cost of almost everything which we use advances, so that all of the increased travel goes to keep up that portion of the road which must be run at a loss. The central portions of the system—and this is especially true in the larger cities—have, as a rule, become so congested that no more cars can be operated with safety, so that the profitable short ride has about reached the maximum, precluding the possibility of relief from that source.

In conclusion, I would repeat that an adequate depreciation fund seems to the writer to be the crux of the whole matter. This is a much mooted question, and one which it is not the province of this paper to discuss, but to those who are interested I would commend a careful study of Mr. Durand's article in the February "Review of Reviews," and also of Mr. Knowlton's in the July number, together with the report of the United States Census Bureau for 1902.

After considering the matter for several years, the Northern Ohio Traction & Light Company has instituted limited service between Cleveland and Akron. Fast cars leave Cleveland at 7:50 a. m. and 6:50 p. m., making the run in 1 hour and 40 minutes, as compared with 2 hours and 10 minutes for the regular local cars. About 40 minutes of this time is spent on city tracks in Cleveland and Akron, and the 31 miles between city limits will be made in an hour. A slight excess fare will be charged on these cars.

SOME INTERESTING TRACK CONSTRUCTION WITH TEE AND GIRDER RAILS IN BATTLE CREEK AND KALAMAZOO

DOUBLE TRACKING IN BATTLE CREEK

A description of the new double-tracking done by the Michigan Traction Company in Battle Creek, Mich., should be especially interesting to street railway companies in cities where any trouble is experienced with grooved girder rail. Battle Creek is one of the towns where the city engineer and other municipal officials believe that T-rail construction laid as this is, is better than grooved girder-rail construction. As this track is laid in concrete, the company has had no trouble from low joints, and track laid in this same way two years ago does not show any perceptible wear.

About two years ago this season, when the Jackson & Battle Creek Traction Company entered Battle Creek, the Michigan Traction Company laid double tracks from Postumville to Monument Square of 7-in. 70-lb. T-rail to facilitate the handling of the extra traffic along this route. During the same season it also double-tracked Lake Avenue to Goguac Lake, a very pretty lake resort 2 miles from the heart of Battle Creek. In May, this year, the same company began double-tracking all of its lines in the central part of Battle Creek, and is at the present time about completing the work, so that by the time this article appears it will have about 4 miles of double track.

The track is built entirely of the T-rail mentioned, and the special work was furnished by the Lorain Steel Company and the Paige Iron Works. That furnished by the Lorain Steel Company was of the hard center type and was used for the heaviest traffic. The rails were laid on 6-in. x 8-in. x 8-ft. white oak ties, placed 2-ft. centers, well ballasted with gravel and filled to within 11 ins. of the surface of the finished work, all joints being suspended. Under the two joint ties it was

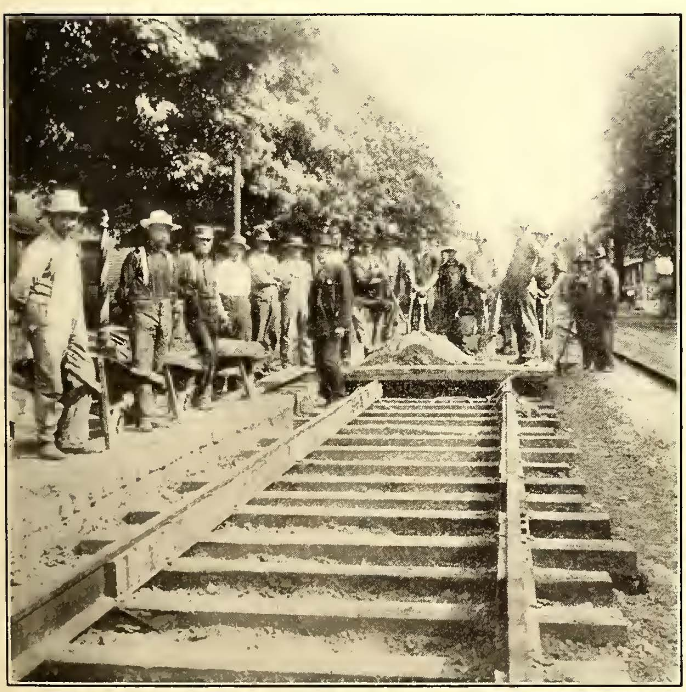


FIG. 2.—VIEW ON MAIN STREET, BATTLE CREEK, SHOWING TRACK WITH FILLER BLOCK IN PLACE PREPARED FOR CONCRETE

excavated to a depth of at least 8 ins. and filled with concrete, as shown in the accompanying illustration, Fig. 1. It was also excavated 8 ins. under the ties at all special work, the space being filled with concrete.

The repaving was accomplished by using 6 ins. concrete, 1 in. cushion sand and Nelsonville paving block as a wearing surface. The groove or flangeway was formed by using the Nelsonville filler block and the Nelsonville stretcher block, which can be seen by referring to Fig. 1 as well as Fig. 3. On the whole, from the street railway standpoint as well as the team traffic standpoint, this style of groove or flangeway is looked upon by all those who have seen this work as superior to the grooved girder rail. By the teamsters it is approved because such vehicles as get into the groove have an easy slope to get out, and thereby a great saving results in

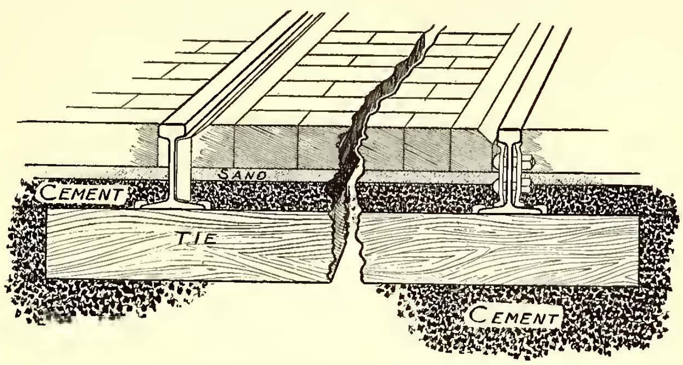


FIG. 1.—CROSS-SECTION OF T-RAIL PAVED-STREET CONSTRUCTION IN BATTLE CREEK, MICH.

wheel wear. From the street railway standpoint it is preferred because it gives the bearing of the wheel squarely over the center of the base, and forms a groove which to all purposes is self-cleaning and does not wear the wheel flanges like grooved girder rail. The work done in Battle Creek during the present season was thoroughly inspected by the Aldermen and city officials of Kalamazoo, who were so well pleased with it that the same rail was adopted for their city, as explained later in this article. It might be said in this connection that Kalamazoo has always stood for the grooved girder rail, and this has been especially the case for the last five or six years.

When the traction company commenced repaving it used

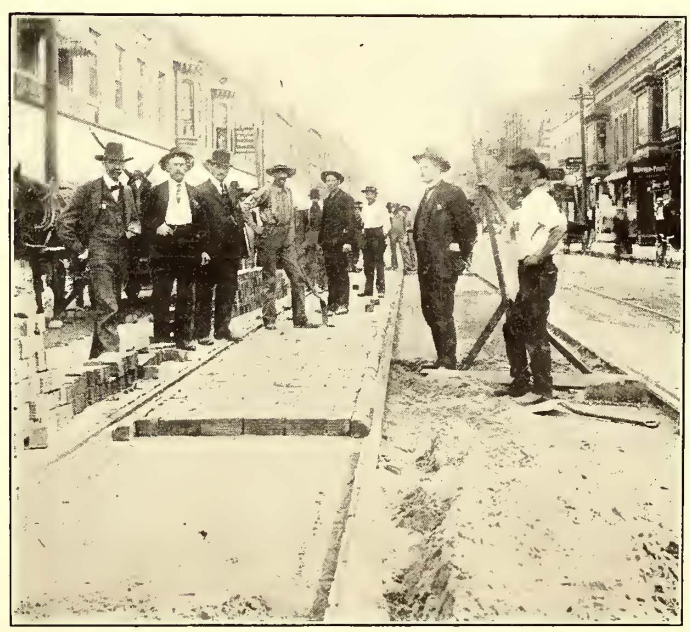


FIG. 3.—VIEW SHOWING COMPLETED RIGHT-HAND TRACK AND LEFT-HAND TRACK WITH THE PAVING IN PLACE READY TO BE ROLLED AND SLUSHED

for the concrete mixture a local bank gravel, free from all loam, and Portland cement in the proportions of eight gravel to one cement, which met the approval of the city engineer of Battle Creek.

The track bonding was done by using two Chase-Shawmut solder bonds of 0000 capacity under the plates at each joint. Fig. 2 was taken on Main Street, just in front of the mixing board, and shows the track with the filler block in place prepared for the concrete with the finished track at the right. Fig. 3 shows the right-hand track finished and the left-hand track with the paving in place ready to be rolled and slushed.

TRACK LAID IN PAVED STREETS, KALAMAZOO

A couple of years ago, when Kalamazoo decided to do many miles of paving, the commissioners of public improvements took up the question of the rail construction where the track had to be relaid upon paved streets. The paving decided upon was monolithic and brick on the shoulders, and the same paving between the rails and tracks as was on the shoulders. In many instances, this paving replaced the old wooden block paving that had formerly been laid on some of these streets. The above style of construction was adopted only after a great deal of controversy between the railway officials and the commissioners of public improvements, mainly on account of the grooved girder rail, as the railway officials wanted to use the high T-rail and the commissioners the grooved girder rail. The above construction was finally adopted and about 3 miles of it were laid. The grooved girder rail is shown in Fig. 4, and is of Pennsylvania steel section No. 240, weight 87 lbs. per yd. The rail was laid upon concrete stringer 18 ins. wide, 8 ins. under the base of the rail. The base of the rail and also the tie rods across the rail were imbedded in the concrete 3½ ins.; then the cement mortar was laid in against the sides of the rail, with paving pitch put in alongside of the cement mortar

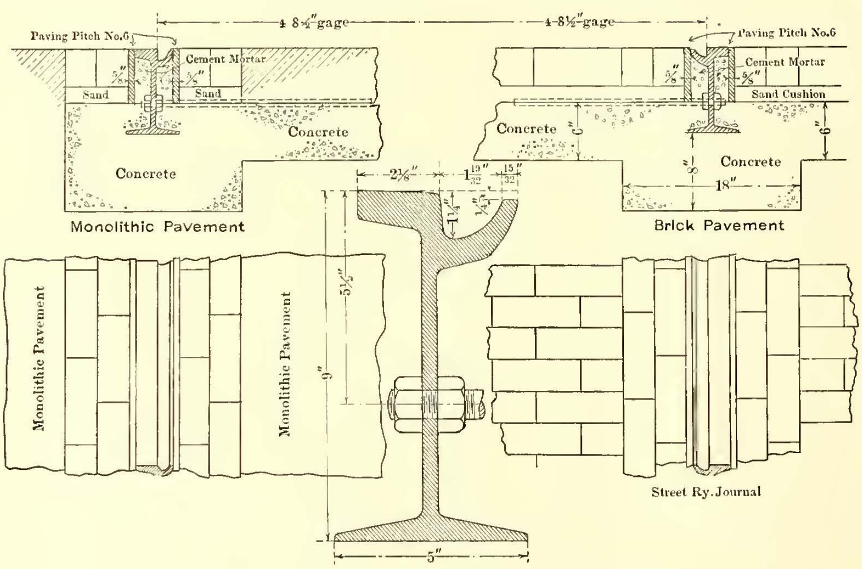


FIG. 4.—TYPE OF GUARD RAIL AND PAVEMENT CONSTRUCTION USED FOR PART OF THE KALAMAZOO LINES OF THE MICHIGAN TRACTION COMPANY

flush with the outside of the rail, ⅝-in. thick; then two rows of blocks were laid longitudinally with the rail on a cushion of sand, against which the regular paving was laid. This construction has stood the test of the traffic very well.

This year, the city paved more of the streets, but the construction is of 70-lb., 7-in. high T-rail, the paving and work on the same being exactly as shown in the T-rail construction for Battle Creek, the officials of Kalamazoo having adopted that style of work and allowed the company to put the same in after an examination was made of the work in Battle Creek. This kind of construction makes just as fine a street from a paving standpoint, and is much better for the wagons to pass over than the grooved girder rail.

This reconstruction, as well as that in Battle Creek, was looked after and carried out under the supervision of D. A. Hegarty, general superintendent of the Railways Company General, which company owns and operates the Michigan Traction Company; R. W. Harris, superintendent of the Michigan Traction Company, and A. L. Marhoff, engineer of the Michigan Traction Company.

ELECTRIC RAILWAY DEVELOPMENT IN THE VICINITY OF HARRISBURG, PA.

Development of the electric railway systems converging in Harrisburg, Pa., is keeping pace with the rapid growth of the commonwealth's capital. Already more than 100 miles of lines

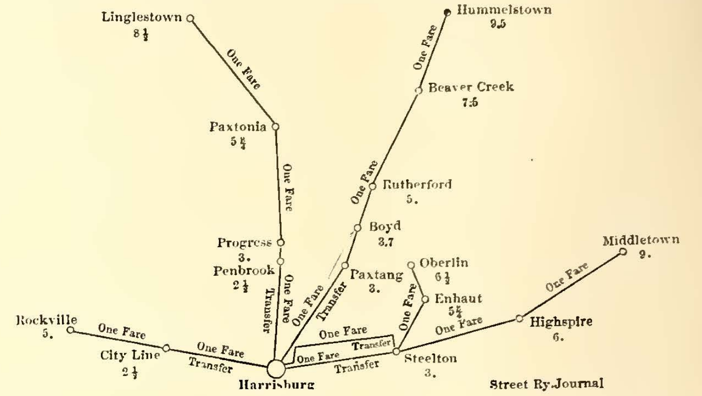


DIAGRAM OF LINES AROUND HARRISBURG, SHOWING APPROXIMATE DISTANCES AND FARE FROM POINT TO POINT

reach out in all directions from the heart of the city. This vast system is under the control of two corporations, the Central Pennsylvania Traction Company, which operates 60 miles of trackage throughout the city and to the towns and hamlets on the eastern side of the Susquehanna River, and the Valley Traction Company, which has 41 miles of line, reaching points on the western side of the river via the Peoule's Bridge, which the company controls.

Both companies have important improvements either under way or in prospect. A pretentious project of the Central Pennsylvania Traction Company was the large car houses and shops, which were fully described in the issue of the STREET RAILWAY JOURNAL of Sept. 2, 1905. This company is building an extension of about 7 miles from Paxtang, 2¼ miles from the city, to Hummelstown, where it will connect with the Hummelstown & Campbellstown Street Railway, which in turn connects with the Lebanon system. This extension is expected to be ready for service by Nov. 15. The line is now in operation to Rutherford Station, and track laying has been completed to a rock cut about 2 miles west of Hummelstown. The Hummelstown end of the line is finished as far as Saratoga Creek. There will be three bridges and one subway on this line. Two of the bridges will span Beaver Creek and the third Swantoan Creek. Bridge No. 1 will be 101 ft. long. The span of No. 2 bridge over Beaver Creek will be 60 ft., but there will be 360 ft. of structure crossing the meadows and resting on concrete piers. Bridge No. 3 over Swatona Creek will have sixteen spans of 41½ ft. each, resting on concrete piers. The span over the creek will be 140 ft. long. These structures are well along toward completion. The subway under the Philadelphia & Reading Railway tracks at Fox's Crossing will be 33 ft. wide and 22 ft. clearance. There are two rock cuts near Beaver Creek Station, each about 300 ft. long, with a maximum depth of 22 ft. As far as possible all sharp curves will be eliminated, there being not one less than 150-ft. radius. The maximum grade along this line will be 4½ per cent, the average being about 2 per cent. Seventy-pound T-rails are being laid.

The company purposes to erect at once a $250,000 power plant on the site of the present plant on South Cameron Street, and, as previously stated in the STREET RAILWAY JOURNAL, has selected Mason D. Pratt, of Harrisburg, to make the plans and superintend its construction. Mr. Pratt designed and built the North Cameron Street car houses and shops. The new plant will have 2400-kw capacity, as compared with the 800-kw capacity of the present main plant and 700 kw in the plant at Steelton. To defray the cost of this plant and to meet other obligations, the directors of the company have called for the payment of a second assessment of 10 per cent on the $2,100,000 capital stock, 5 per cent payable Nov. 1 and 5 per cent Jan. 1. Other improvements to be undertaken by the company are the paving of Front Street in Steelton for a distance of 1½ miles and relaying of the tracks with 60-ft. rails weighing 94 lbs. to the yard. Reily Street, from Reily to Maclay, in Harrisburg, is also to be double-tracked shortly. The rails for this work are on the ground. A subway, 33 ft. wide and 14½ ft. clearance, costing $20,000, is to be built under the Philadelphia & Reading tracks at the entrance to Paxtang Park, which will be enlarged next year by the addition of about 20 acres of adjoining land. E. L. Reeds, of Philadelphia, has the contract for the subway. In order better to meet the demands of traffic, the company plans to increase its rolling stock about 20 per cent. This increase will consist of five semi-convertible cars. At present fifty-seven cars are in use.

The Valley Traction Company, which was organized about a year ago, taking over the properties of the Harrisburg & Mechanicsburg Electric Railway Company, the West Fairview & Marysville Electric Railway Company and the Cumberland Valley Traction Company, is controlled by interests identified with the Cumberland Valley Railroad Company. Under the efficient direction of Superintendent G. H. Bartle, the property has been greatly improved. Still more important work is in contemplation, chief among which is the conversion of the Dillsburg & Mechanicsburg Railroad, a 9-mile branch of the Cumberland Valley Railroad (steam), into a combined steam and electric line. The Riverton power plant is being equipped with step-up transformers to increase the voltage from 550 volts to 2200 volts, at which pressure current will be transmitted to the sub-stations at Mechanicsburg and Carlisle, each of which will be equipped with rotaries. Work on these sub-stations will be started early this fall. They will be one-story brick buildings, each equipped with a 300-kw machine.

The bonding of the Dillsburg & Mechanicsburg steam line, referred to above, has been completed and work on the pole line is under way. In order to overcome the difficulty of operating a steam line with the overhead wire system, Superintendent Bartle has evolved a plan whereby the wire for the car trolley poles will be strung to one side of the track instead of the middle, clearing the cars by about 1 ft. The trolley pole stand on each car will be extended, so as to make the new scheme practical. Electric cars on the Dillsburg & Mechanicsburg line will connect at Trindle Spring with the Mechanicsburg-Carlisle line of the Valley Traction Company, and at Mechanicsburg with the Cumberland Valley Railroad.

The car houses at Lemoyne are to be doubled in size by the erection of an addition about 50 ft. x 120 ft. The company opened a small park at Boiling Springs this year, and is now negotiating for Island Park, a natural beauty spot of 20 acres, adjoining the present park of 5 acres.

Five new cars of the Brill semi-convertible type, the largest in this section, were recently placed in service by the company. They are each 46 ft. long, with a 6-ft. platform, 5 ft. longer than the other cars, and equipped with the most modern improvements, such as arm and foot rests, electric headlight, whistle, heaters and push buttons, and Westinghouse air brakes. Each has four motors of 40 hp. These cars will be used in the regular service between Harrisburg and Carlisle, a distance of 22 miles.

HANDLING OHIO FAIR TRAFFIC

A few years ago there was a marked falling off in attendance at county fairs in Ohio. This year, however, without exception, the reports indicate that the number of people patronizing these fairs was heavier than ever before. This is undoubtedly due in a large measure to the assistance of the electric railways in helping to promote the events and then handling the people in a satisfactory manner. This year the scheme was adopted of advertising the fairs extensively by means of posters, the electric railway companies offering special excursion rates and insuring adequate accommodations by placing in operation special fair cars.

At the Ohio State Fair at Columbus last month, the interurbans simply swamped the city with people, the attendance being far beyond previous records. The seven roads into the city each handled 5000 and 6000 passengers a day. People were carried in all kinds of rolling stock—borrowed cars from distant points, express cars fitted with seats, and in many cases even the roofs of cars were filled. In the city this business was turned over to the Columbus Railway & Light Company, which was forced to extreme measures to handle the people. On the company's High Street line cars were operated on half-minute headway, while other cars were sent to the grounds by circuitous routes.

The Darke County Fair at Greenville was another record-breaker. The Dayton & Northern and Dayton & Muncie lines handled not far from 100,000 people. Ralph DeWeese, general manager of the Dayton & Northern, gave a temporary city service with three-minute headway in Greenville, besides quadrupling his interurban service. He hired about twenty-five cars and crews from various roads, and camped and fed the employees in tents erected opposite the fair grounds. Mr. DeWesse never left the place during the week, and the crowds were handled without delay or accident. Additional power was secured from the Dayton & Muncie station at Winchester, Ind., and a floating battery station was located near the fair grounds.

At the Troy fair, the Dayton & Troy adopted the novel scheme of running special cars to and from each of the important towns along its line, and only people for these towns were carried. At the fair grounds it erected turnstiles with alleys leading to the various cars, and tickets were collected before the passenger got into the car, and then they were run through on limited schedules. The regular limited cars were run through double-headers, but only the second sections carried fair enthusiasts, so that the regular traveling public was not troubled by excessive crowds.

The Western Ohio and Dayton & Troy lines united in making the Auglaize County Fair at Wapakoneta the greatest ever held in Western Ohio. The roads carried advertisements in nearly fifty daily and weekly papers throughout the districts traversed by these lines, besides posting and scattering attractive printed matter in all towns. The plan of running limited cars was carried out in this case also.

The Toledo, Bowling Green & Southern Traction Company gave fifteen-minute headway between Toledo and Bowling Green for the Wood County Fair, and besides filling borrowed cars, it handled hundreds of people on flat cars fitted with seats.

The attendance at the Sandusky County Fair at Fremont was over 100,000, and the Lake Shore Electric handled a very large proportion of these.

The Stark Electric and the Canton-Akron lines combined to make the Canton fair a record-breaker, while the Summit County Fair at Akron proved a small gold mine for the Northern Ohio Traction & Light Company's city and interurban lines.

The majority of the lines not only profited by the tremendous passenger business, but they handled live stock and fair exhibits and transferred the traveling shows and other attractions from one fair to another. And the pleasing part of it is that, so far as can be learned, there were no accidents of any kind at any of these events.

IMPROVEMENTS ON THE DAYTON & WESTERN

The Dayton & Western Traction Company, operating from Dayton, Ohio, to Richmond, Ind., and forming a part of the through line from Dayton to Indianapolis, has been making a large number of improvements, made necessary by great increase of business, which has been due largely to the institution of through service between Dayton and Indianapolis and the great amount of interline business which is developing throughout this entire district.

In its power station at West Alexandria it has installed a 300-kw General Electric d. c. generator, driven by a Hamilton-Corliss cross-compound engine and two water-tube boilers, giving the house a total capacity of 1100 kw. A 140-ft. brick chimney was erected and a track scale for weighing fuel installed. Twenty-two miles of overhead have been rebuilt with flexible hangers, and about 15 miles of track is being ballasted and raised 5 ins. to 6 ins., so that the track will soon be in fine condition. An interesting point is the fact that it has done entirely away with through sidings, and uses nothing but stub switches. The company's schedules are as fast as any in this district, but it is believed that the slight time lost through stub switches is more than compensated for by the decreased liability to accidents and the saving in maintenance. The distribution on this line is direct current, the line being divided into four sections, and the current boosted at approximately 800 volts to the two end sections. To improve the power on these sections and to take care of load variations, storage batteries have been installed. They were furnished by the Gould Storage Battery Company, and consist of 266 cells of 240-amp.-hour capacity, and they are used in connection with shunt-wound boosters in series with the line.

It will be remembered that some months ago this company instituted parlor buffet car service between Dayton and Indianapolis, the trains being known as the Interstate Limited. At that time conservative managers predicted that the chair-car buffet service scheme would prove a losing venture, but Mr. Valentine Winters, president of the company, claims that he is now greatly pleased with the results. The limited cars are averaging forty through passengers a day between Dayton and Indianapolis, and on this road they are earning about 24 cents per car mile, as compared with 26 cents per car mile for all passenger cars. They are making rapid gains, and he believes they will soon be earning more than regular cars. A third car has been fitted up in a manner similar to the others, and it is very probable that some special cars of larger size will be built for the service, because very often at present they are unable to accommodate all the passengers that want to take the fast cars; it will be remembered that these parlor cars have seating accommodations for only twenty-six passengers. The new cars will have accommodations for carrying baggage, as it is found that a great many traveling men will not take these cars unless they can take their trunks with them. While the buffet service in itself is not a paying proposition, it is an excellent advertisement, and the management would not think of discontinuing it. It is now possible to travel on limited cars with chair seats from Logansport, Ind., to Zanesville, Ohio, about 325 miles, with very close connections and only three changes, and as a result the earnings of all of these roads is increasing surprisingly. The Dayton & Western shows a gain of 35 per cent gross in the past year, due largely to the through service. Through freight business is being worked up, and the Dayton & Western is planning to use several trail cars that can be hauled through from Dayton to Indianapolis .

This road was one of the first to install steel-tired wheels, and it is showing some interesting results. It has used the Standard, and those first installed were 2 ins. thick, and they gave from 140,000 to 150,000 miles. They are now using a considerably thicker wheel and expect to get 200,000 miles or more.

It has been reported repeatedly of late that this property had been acquired by the so-called Widener-Elkins syndicate, which is building up an immense through system in this district. While it is admitted that such a consolidation is logical for the future, it is denied that anything definite has taken place. There is no bonded indebtedness on this property, and the small group of stockholders who control it absolutely would prefer to operate the property indefinitely.

SPECIFICATIONS FOR COKE AND CROSS-TIES IN PHILADELPHIA

In the Philadelphia Souvenir issue of the STREET RAILWAY JOURNAL, dated September 23, 1905, reference was made to the value of the testing laboratory of the Philadelphia Rapid Transit Company used in conjunction with the purchasing department in the preparation of specifications covering the various materials and supplies purchased by the company. Two examples of standard specifications adopted by the company are appended in this connection. These cover the requirements for coke and for cross-ties:

SPECIFICATIONS FOR COKE, P. R. T. COMPANY

The coke must consist of large pieces, and be clean, strong, and of uniform structure. It should be of seventy-two hour coking, and conform to the following analysis:

Fixed carbon, not less than	89.00	per cent
Ash, not over	8.00	"
Sulphur, not over	.750	"
Volatile matter, not over	2.50	"

METHOD OF SAMPLING COKE

While the car is being unloaded, pieces of coke should be taken at sufficient intervals as they come from the car at different stages of unloading, so that after the car is emptied there will be in the sample about one-half of a bushel. The pieces taken should not be broken off, but must be the pieces as they come along—whether they happen to be large or small. This coke should be crushed to about 1-inch pieces (the size of hickory nuts). The crushed coke should then be sampled by the method of quartering as follows: After thoroughly mixing the coke, it is spread out in a level pile and divided by two cross-lines into four parts, of which the two diagonally opposite quarters are taken and mixed up again and again spread out and quartered as before; and this quartering is continued until the two last quarters will weigh about 2 lbs. The latter should immediately be sent to the testing laboratory with the date, name of consignor, order number and number of car marked figure on the tag.

SPECIFICATIONS FOR CROSS-TIES, P. R. T. COMPANY

Quality and Manufacture

1. The timber shall be long leaf yellow pine, grown in the interior of Georgia, Florida, Alabama, Mississippi or Texas. The timber shall be cut in the fall and winter, say from Sept. 1 to March 1. Ties ordered for immediate delivery must be made of timber cut at least three months previous to date of shipment. All ties must be cut from good living timber, well manufactured to size and length, straight, free from large, loose or decayed knots, splits, shakes or any other defects that may impair the strength and durability of the timber. They must be sawed square, and not more than 1½ in. of sap, measured on face, will be allowed on one corner; the sap must not show on the opposite face. They must be sawed off square at the ends.

Size

2. The ties shall be 5 ins. thick x 9 ins. face x 8 ft. long. The thickness shall not be more than ¼ in. under or over 5 ins.; the width shall not be more than ¼ in. under nor ½ in. over 9 ins.; the length shall not be more than 2 ins. under or over 8 ft. All ties that are longer than 8 ft. 2 ins. will be taken at a reduction of 5 cents each, to pay for cutting them to standard length.

Inspection

3. This company shall have the right to inspect the ties at point of shipment or at destination.

Stacked

4. Ties when ordered "delivered and stacked" must be stacked up in alternate layers, crossing each other, with sufficient space between ties to allow a free passage of air, or as may be directed by the company's representative.

AMERICAN CAPITAL FOR CHIHUAHUA, MEXICO

It is announced that J. W. Conger, brother of Hon. E. H. Conger, former Ambassador to Mexico, who recently obtained an option on the street railway system and electric light and power plant in Chihuahua, is meeting with success in organizing a company of Americans to take over these properties. It is stated that the transaction will be finally consummated soon and that the work of equipping the street railway lines for electric transit will be started and carried out as rapidly as possible. The street railway system will also be extended by its new owners.

AUTOMOBILES AS RAILWAY FEEDERS

The rapid improvement in the efficiency and reliability of the automobile has brought it into such prominence as a means for transportation that some have hastily concluded that the electric railway has met therein a serious competitor. It is plain, however, that the automobile can do comparatively little to reduce railway traffic on congested city streets, for anyone who has seen a long line of cars make its way through a maze of trucks and pedestrians can imagine how much worse matters would be if a like number of automobiles were free to dash in any direction. Hence, so far as city operation is concerned, the public automobile finds its main value either as a conveyance for sightseers or for transportation on avenues where trucks are not permitted. For use in the country, however, a substantially built automobile should prove a profitable adjunct to electric railways for picking up traffic along routes whose sparse population does not allow the installation of a full-fledged railway.

Whether an automobile would pay for work of this character

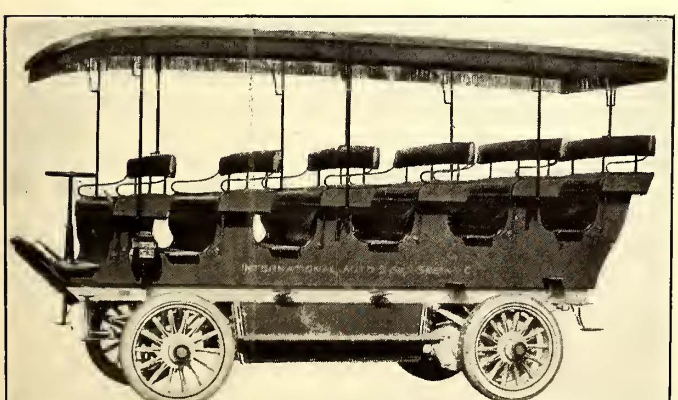


FIG. 1.—ELECTRIC GEAR-DRIVEN AUTOMOBILE FOR TWENTY-FOUR PASSENGERS

should not be difficult to determine, since five factors only need be considered, as follows: First cost of the vehicle; maintenance; wages; cost of power, and the probable traffic income.

At the present time three types of automobiles are in successful use in this country. These are the storage battery, straight gasoline and the gasoline-electric coaches.

The storage-battery vehicle operates under the most favorable conditions when the grades are not severe and it is used for runs covering in all about 25 miles. If an electric railway company employs such a motor car as a feeder, the batteries can be easily charged from the regular railway current supply with little loss. Since all of the apparatus is electrical, an ordinary motorman can run the coach and any repairs required can be made by the same men who look after the regular rolling stock, thus avoiding the necessity of employing an extra machinist skilled in gasoline motor work.

For distances over 20 to 25 miles, the gasoline or gasoline-electric vehicle has sprung into great favor, as it is unnecessary to carry so much dead weight as would be the case if a storage battery were used. Whether the drive be a straight gasoline or

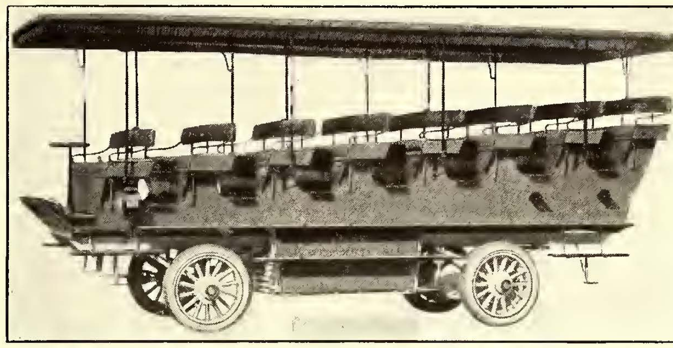


FIG. 2.—ELECTRIC GEAR-DRIVEN AUTOMOBILE FOR FORTY PASSENGERS

gasoline-electric, the cost of labor must be higher than for the simpler storage-battery equipment, as the use of a complex gasoline engine requires a higher grade of labor. A gasoline-electric equipment may simplify the work of control, but it introduces greater losses in transmission and additional dead weight. The double equipment is also more expensive in first cost and maintenance.

Some representative types are shown in the accompanying cuts, which illustrate a number of auto-coaches built by the Vehicle Equipment Company, of Long Island City. Figs. 1 and 2 show electric gear-driven automobiles, such as have proved very popular for sightseeing purposes. The smaller coach seats twenty-four passengers and the larger seats forty passengers. An excellent example of a storage battery outfit is that shown in Fig. 3, which is a view of one of six cars in regular service at Lima, Peru, for over eight months. It will be noted that the body, which was built by the J. G. Brill Company, conforms to

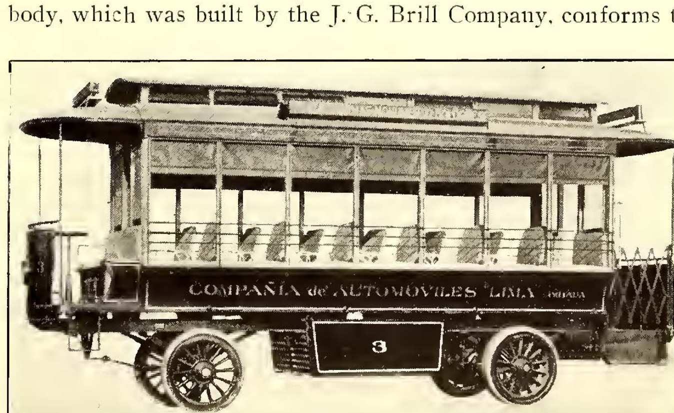


FIG. 3.—ELECTRIC AUTO-CAR USED IN LIMA, PERU

that builder's type of convertible car. It has a center aisle, entered from the rear, and has cross seats for accommodating thirty-two passengers. The operating equipment comprises two GE 1008 motors, General Electric controller, foot brakes, etc. On one charge this vehicle can run for 25 miles at 8 m.p.h., and can climb an 8 per cent grade at 4 m.p.h. The total weight of the entire equipment without load is 10,000 lbs. It is significant that the company purchasing these cars had enough confidence in this type of vehicle to warrant installing one so far away from first-class repair facilities.

The vehicle shown in Figs. 4, 5 and 6 is one of a number being built to replace the horse stages on Fifth Avenue, New York, on which no track laying is permitted. It is of the gasoline-electric type with chain drive. The power equipment consists of two GE 1012 motors and a 40-hp Speedway gasoline engine direct connected to a General Electric generator. The

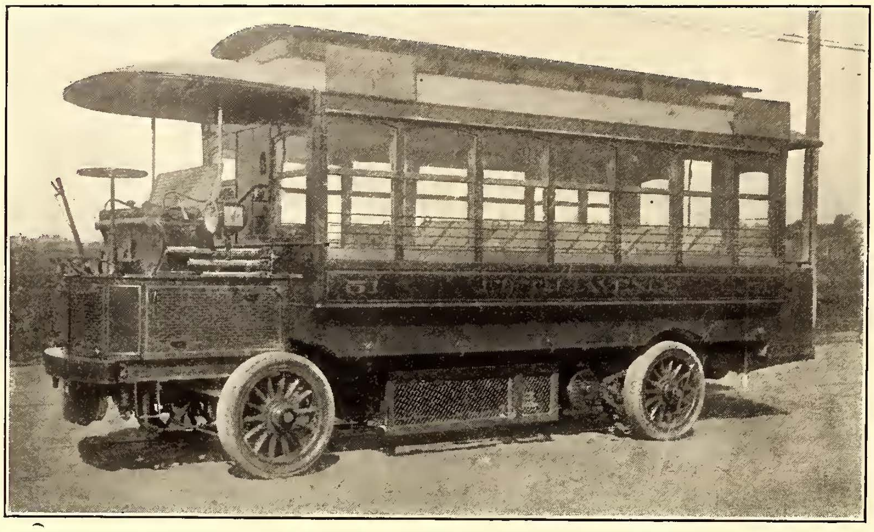


FIG. 4.—VIEW OF THE GASOLINE-ELECTRIC CAR NOW RUNNING ON FIFTH AVENUE, NEW YORK

coach runs 15 m.p.h. on the level and about 8 m.p.h. on an 8 per cent grade. Lighting current is obtained from two ten-cell Exide batteries. The engine can be conveniently started by

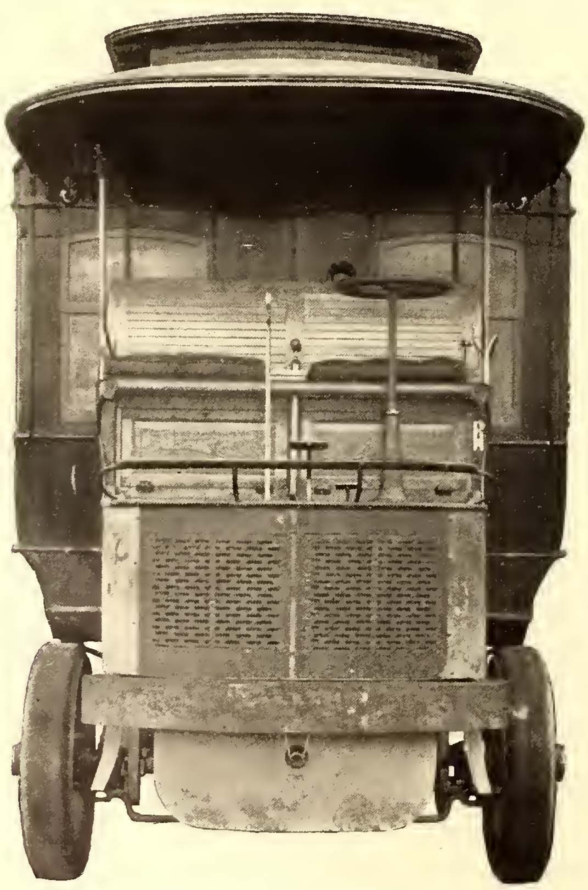


FIG. 5.—VIEW OF THE FRONT END OF THE NEW FIFTH AVENUE GASOLINE-ELECTRIC CAR

furnishing battery current to the generator for a short time, but the batteries are not used for helping the generator out on heavy loads. One daily charge is all that is required. The body of this coach was built by the J. G. Brill Company, and includes that builder's grooveless-post semi-convertible window system. The car body is similar to that used on a single truck in regular trolley service, and has a transverse seating arrangement, accommodating twenty-nine passengers. As the car is operated in one direction only, the seats have stationary backs and the platform has an entrance at one side only. The transverse seats will be very welcome to the patrons of the line, as they, of course, secure greater comfort than with the old arrangement of longitudinal seats, and the seating capacity is largely increased. The ability to transform the car from closed to open at any time, or to raise the windows to any desired height, is another feature that will prove attractive. It is not intended to allow passengers to stand upon the platform, and therefore the platform is but 3 ft. from the end of the car body to the end of the body over the dasher. The platform is enclosed at one side, and thus provides a convenient place for the conductor to stand and watch the movement of passengers in and out without obstructing the way. The body is carried on a large chassis, which is mounted on wheels with solid rubber tires. Located at the forward end of the chassis is the motor, enclosed in a substantial case, the top of which serves for the motorman's platform. The arrangement is an excellent one for economizing space and securing convenience. The general dimensions of the car are as follows: Length over the body, 16 ft. 9½ ins.; width over the body sills, 6 ft. 5 ins.; width over the posts at the belt, 7 ft. 5 ins.; distance between the centers of the posts, 2 ft. 5 ins. The complete weight of the car is about 7 tons.

CHANGES IN THE CONSOLIDATED CAR FENDER COMPANY

The Consolidated Car Fender Company has issued a statement saying that owing to the death of A. C. Woodworth, who was the general manager of this company since its organization in 1895, it has been deemed wise to move the main office to and

FIG. 6.—SIDE VIEW, SHOWING LOCATION OF GASOLINE MACHINERY UNDER DRIVER'S SEAT

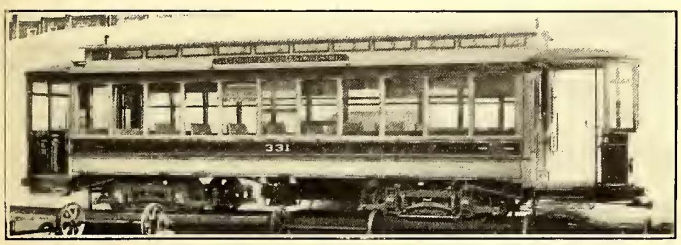
hereafter conduct all correspondence and sales from the works at Providence, R. I. The company believes that this move will be conducive to better, prompter and more efficient service for all with whom it does business. It should be noted, however, that a branch office for the demonstration of fenders and the convenience of patrons will be continued at 39 Cortlandt Street, New York, until further notice.

A. J. Thornley, who assumes the management of the company, has been identified with the manufacturing end of the business since its organization, and all the company's patrons may feel assured of prompt and courteous treatment at his hands.

It is unnecessary here to call attention to the merits of the Providence fender. Its long and successful service on hundreds of street railways throughout this country, as well as abroad, has demonstrated beyond question that it is one of the best forms of insurance a railway company can carry. The company now has fenders in use on over 265 electric railways, which use in all more than 18,000. In addition to its large business in this country, the company is sending fenders abroad, a shipment to Japan being among the recent foreign orders.

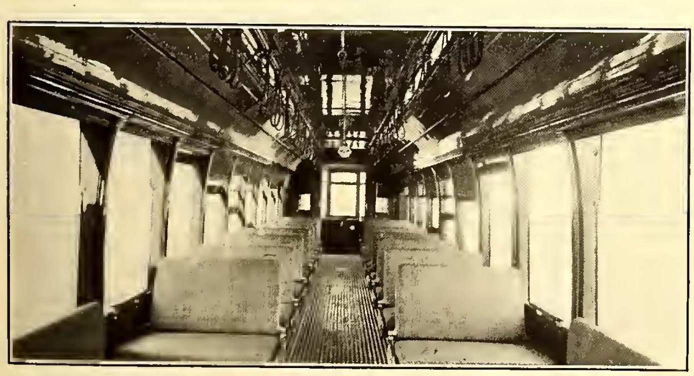
GROOVELESS-POST SEMI-CONVERTIBLE CARS FOR BALTIMORE UNITED RAILWAYS

The car illustrated herewith is one of an order for 200 which are being delivered to the Baltimore United Railways by the J. G. Brill Company and the John Stephenson Company.



SEMI-CONVERTIBLE CAR FOR BALTIMORE

Reference to this order was made in the July 1 issue of the Street Railway Journal. The Brill Company is building 160 of the cars, which are mounted on No. 27 G-1 truck, a short base double truck with solid forged side frames; the remaining forty cars are being built by the John Stephenson Company, and are mounted on Brill Company's No. 27 E-1 truck, the high-speed type, which also has solid forged side frames. The 160 cars mounted on short-base trucks are intended for city service, and are provided with portable vestibules; those mounted on the high-speed trucks are for service on a division



INTERIOR OF BALTIMORE CAR

extending for some distance out of the city. In other respects the cars are identical, and are of the "grooveless-post semi-convertible" type. The bottom framing of these cars is made extra strong by the use of 3¾-in. x 7¾-in sills, with 15-in. x ⅜-in. plates on the inside, which extend in a single piece the full length of the sills.

An interesting and novel device of the Baltimore United Railways which has been included in these cars is a means of oiling the truck center plates by a pipe leading from the floor of the car through the upper plates. This obviates the common difficulty of getting the oil into the central portion between the plates. The opening of the pipe in the car floor has a cap neatly contrived to fit into the floor, and yet can be readily opened by inserting a finger into a slot.

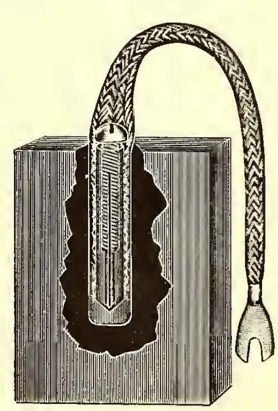
The outside platform timbers are reinforced with deep angle irons, and the outside bolt of the stirrups, which support these timbers, is secured to the side plates. This is an unusual method, but is considered an excellent one, because it takes part of the strain from the timbers. The angle irons which reinforce the knees at the center of the platforms are brought 4 ft. 8 ins. back of the center of the body bolsters, a cantilever arrangement peculiar to the builder, which brings a large portion of the platform load directly to the trucks without strain to the bottom framing. The extra wide inside sill plates take the place of upper and under trusses and add stiffness to the posts, to which they are secured with bolts and screws. The trap doors are amply long to give free access to the oil wells at the ends of the motors.

The flooring of the platforms is composed of ¾-in. x 2¼-in. boards, with a space of ¾ in. between each. These boards are placed transversely, and the flooring underneath is raised slightly at the center, so that water runs off either side through the spaces. This feature is also one of the railway company, and has the advantage of keeping the platforms free of water in wet weather. The platforms measure 5 ft. from the end panels over the crown piece. The step heights of the cars mounted on short-base trucks are as follows: From the rail to the platform step, 15¾ ins.; from the step to the platform, 14 ins.; from the platform to the car floor, 9 ins. The height from the rail to the platform step of the cars mounted on the high-speed trucks is a trifle greater.

The seating consists of seven transverse seats on each side, and longitudinal corner seats, each accommodating four passengers. The total seating capacity is forty-four. The interiors are finished in cherry, with ceilings of decorated three-ply birch veneer. The length over the end panels is 30 ft. 8 ins.; the width over the sills, including the panels, 8 ft. 2 ins.; extreme width over the water tables, 8 ft. 5 ins.

EXPANSION CONNECTION BRUSHES

A recent improvement in carbon brushes, called the expansion connection brush, which is being introduced by the National Carbon Company, of Cleveland, Ohio, consists of a carbon brush, of any size, having a hole drilled into it, penetrating about one-half of the length of the brush. A piece of plaited flexible wire, terminating in a cable shoe, is unraveled at the end opposite to the cable shoe, and this miniature wire net is formed cylindrically around a little brass sleeve. This sleeve is of the same length as the hole in the carbon brush, and is slotted over two-thirds of its length. The slot is tapped so that the closing screw fitting into the slot is forced into a tapering hole. The resistance with which the screw meets on account of this tapering is overcome by the sleeve expanding, so that the whole appliance acts as a wedge when the screw is inserted, making a very close and rigid contact between the flexible wire and the interior of the brush, which is even increased through expansion of the metallic parts should the brush become slightly heated while in use. This flexible connection is very easily detached, and can be connected to a new

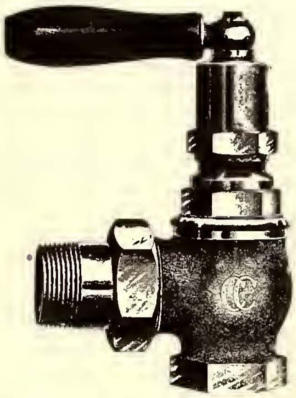


EXPANSION CONNECTION BRUSH

brush simply by the use of a screw-driver, obviating the necessity of attaching by means of the soldering process. This connection is so arranged that the distance between the commutator surface and the terminal connection is reduced to a minimum, thereby reducing the carbon resistance between these points, resulting in obtaining a higher efficiency and a lower loss between the commutator surface and the end of the connection.

A NEW QUICK-OPENING, SELF-PACKING STEAM RADIATOR VALVE

The users of radiator valves will be interested to learn that the Crane Co. has just brought out the valuable self-packing, quick-opening steam radiator valve shown in the accompanying illustration. The self-packing feature precludes any possibility of valves of this type leaking at the stuffing boxes. By a special device placed in the stuffing boxes, the packing is automatically kept tight and will last for years without renewal. The device is very simple, consisting only of a vulcanized washer located at the top of stuffing box and kept in position by spring compression, which fully compensates for the wear on washer. These valves open and close by turning the lever handle one-half turn. To open, turn to the left; to close, turn to the right. The quick-opening and closing feature will no doubt be appreciated by users who have operated old-style radiator valves. The lever handle can be operated by the foot as well as by the hand.



SELF-PACKING STEAM RADIATOR VALVE

The construction of these valves is such that when closed the discs bear on the seats very tightly, and the valve is locked in place until released. The bonnets of these valves are interchangeable with the bonnets of Crane regular radiator valves. This is of great advantage to the user, as he may, at any time, equip his old valves with these new and important improvements. These valves are artistically designed and add much to the appearance of a nicely furnished office. The lever handles are made from cherry wood, painted a deep rich black color, which contrasts very nicely with the nickel-plated trimmings of the valves.

"UNIT TYPE" OIL FILTER

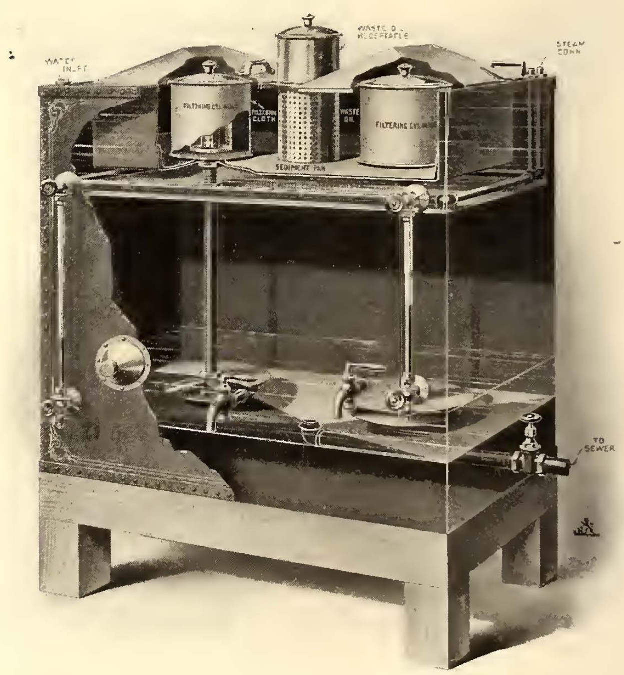
The Burt Manufacturing Company, of Akron, Ohio, has recently brought out a system of filtering oil in which a number of separate units may be connected to filter the oil used in a large plant. Each unit is independent in itself, and new units may be added as the plant grows, thus keeping the capacity of the oil filter system up to the size of the plant.

A sectional view of a single unit is shown in the accompanying illustration. The dirty oil enters the waste oil receptacle and passes through the small perforations, flowing thence horizontally to the two filtering cylinders, and in passing into these cylinders, the heavy impurities fall by gravity into the sediment pan. They are thus disposed of and do not clog the filtering cloths or filtering material. The filtering cylinders are wrapped with cloths through which the oil passes before entering the cylinders. The cylinders are filled with a quantity of animal bone-black, through which the oil must flow before entering the two tubes which lead from the cylinders to the bottom of the filter. Two plates are attached to the bottom of the tubes and the oil is spread out in a very thin film by means of these plates. It is thus thoroughly washed by the water in the filter, and any remaining impurities in the oil drop to the bottom of the filter and can be flushed out at any time desired by simply opening the gate valve, which connects with the sewer.

A hot-water chamber surrounds the upper part of the filter, which contains the filtering mechanism. The water in this chamber is heated by a small steam coil which is fed with live or exhaust steam from any convenient source. The oil is thus heated before filtering and flows more freely, thereby increasing the speed of filtration and the filter capacity. When the dirty oil is heated it spreads out, and most of the dirt and grit then falls into the sediment pan. The bulk of the sediment in this type of filter is at the top, where it can be readily removed without interfering in any way with the supply of pure oil for the oiling system. The maker guarantees that the filter will handle successfully the heaviest grades of oil, such as lard, gas engine and cylinder oil.

In the construction of the unit type of filter heavier iron is used than in the regular type of filter, and the body is riveted to a heavy wrought-iron frame. All seams are lap riveted and soldered. The upper and lower parts of the filter cylinders are made of cast iron, nickel-plated on the top. The tubes leading from the filtering cylinders to the bottom of the filter are of wrought iron. The filter is painted dark blue, decorated with gold, and is an ornament to any first-class power plant.

The filters are so constructed that they may be used with or without an oiling system. They can, if desired, be installed and operated at first without being connected with an oiling



BROKEN SECTION OF UNIT OIL FILTER

system, and later on, if an oiling system is added to the plant, pipe connections can readily be made to the filter at slight expense. It is not necessary to shut down a system and disconnect pipe connections to clean the filter. If more than one unit is used, it is only necessary to shut off the flow of oil to the filter to be cleaned, the other units being able to handle easily the extra amount. When only one filter is installed, the cloth around one cylinder can be removed instantly, and if the filtering material also needs to be removed, one cylinder is unscrewed and a plug which is furnished for the purpose is screwed into the tube, so as to keep the dirty waste oil from flowing into the filter. The other cylinder continues in operation while the first is being cleaned.

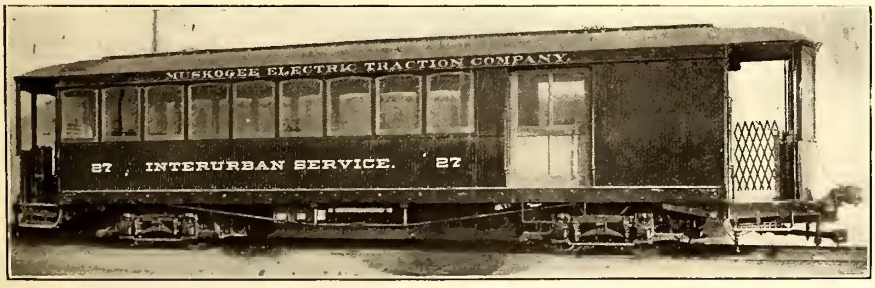
Any type of filtering material can be used in the cylinder, such as white waste, sponges, excelsior, raw wool, etc. The manufacturer recommends the use of animal bone-black, which is in use in all oil refineries for purifying oil. This material can be washed with hot water or gasoline and used many times. Filtering cloths may also be used to purify the oil. As any number of cloths may be wrapped around the filtering cylinders, and in changing them nothing but the cloths need be removed, the cloths can be removed while the filter is in operation without changing or touching any pipe connections.

This type of filter is recommended by the maker for use with gas engines of large capacity, as the hot water from the engine cylinders can be used for the purpose of heating the oil. It is also recommended for use in gas or steam turbines, for the reason that an exceptionally large quantity of oil is used on these machines, and the oil being very thin will flow rapidly through this type of filter, owing to the effect of the hot-water chamber at the top. This filter has been installed by a large number of prominent manufacturers in the United States. It has been largely adopted for use in the United States Navy, and also the Japanese and other navies.

A USEFUL TYPE OF CAR FOR MUSKOGEE, I. T.

An interesting car from the standpoint of economical construction is the one shown in the illustration, recently furnished to the Muskogee Electric Traction Company, of Muskogee, I. T., by the American Car Company. Although the car is a passenger and baggage combination type, the use of folding seats in the passenger compartment enables it to be used entirely as a baggage car. The arched roof with carline finish is not particularly attractive to look at, but is stronger than the usual monitor deck, and for the purposes for which the car is intended is very suitable. The bottom framing is powerful to permit heavy loads to be carried, and includes inside and under trusses, 8-in. x 5/8-in. sill plates and 4½-in. x 7¾-in. side sills. The sashes are composed of single lights, and are arranged to drop into pockets in the side walls. The incandescents are placed singly at intervals along the top plates of both compartments.

INTERIOR OF MUSKOGEE COMBINATION CAR, SHOWING PART OF SEATS FOLDED UP



COMBINATION CAR FOR THE MUSKOGEE ELECTRIC TRACTION COMPANY

It is unusual to mount so long a car as this on short-base trucks, as the speed required is not over 30 m.p.h., and the load to be carried will not exceed 20 tons. The builders' type of No. 27-G truck is well adapted to this service. Four 50-hp motors are used, which enable the car to be employed as a locomotive, and for this purpose it is equipped with steam car couplers, so that freight cars from sidings of the Missouri, Kansas & Texas Railway, with which the company's lines are connected, may be hauled to the various manufacturing plants in the vicinity. The car measures 37 ft. over the body and 45 ft. over the crown pieces; width over the side sheathing, 8 ft.; distance from center to center of the side posts, 2 ft. 9 ins. The truck wheel base is 4 ft., and the wheels are 33 ins. in diameter.

Muskogee is one of the most important trading centers in the eastern part of Indian Territory. It is situated in the fertile valley of the Arkansas River, and is on the line of the Missouri, Kansas & Texas Railway. The Muskogee Electric Traction Company operates fifteen cars, with 10 miles of trackage, and own Benson League and Hyde Park, popular amusement resorts in the neighborhood of Muskogee, reached by the company's cars.

THE MISSOURI VALLEY ELECTRIC RAILWAY

One of the most important electric railway projects arranged for some time is the Missouri Valley Electric Railway, concerning which brief mention was made in the Street Railway Journal of Oct. 21. The road will extend from Kansas City, Mo., to St. Joseph, and will be financed by Denison, Prior & Company, of Cleveland, and Thomas Nevins & Sons, of New York. To manage the property during construction a committee of five will be chosen, of which the members already selected are Warren Bicknell, president of the Lake Shore Electric Railway Company; L. W. Prior, of Denison, Prior & Company, and George B. Blanchard, of Thomas Nevins & Sons. According to information not available when the previous article was published, the line will be 58 miles long between terminals. In addition to this there will be 8 miles of spurs and 29 miles of double track.

Following the line out of Kansas City, it will bend to the northwest with the river and pass through Waldron and Farley, a little north of which place a spur will be built west to Leavenworth. Cars will be operated out of Kansas City in trains, which will split at the spur mentioned and operate in sections to St. Joseph and Leavenworth.

The main line, after passing the junction, will run through Beverly Station, Weston, Iatan, Bean Lake, Sugar Lake, Armour Station and Rushville. At this last-named point a spur will run southwest through Winthrop, across the Missouri River to Atchison. From Rushville the main line will follow the general bend of the river through Eveline and Kenmoor to St. Joseph, passing the famous summer resort of Lake Contrary on the way.

The road will be located on private right of way for the entire distance with overhead crossings of all railways, and will have an easy grade with few curves, permitting a schedule speed of 45 m.p.h. outside of city limits.

To secure entrance to Kansas City, a bridge will be built across the Missouri River, which will terminate at some place, yet to be decided, in the business district. At Leavenworth options are held on the Leavenworth Bridge & Terminal Company's property, which gives an entrance under favorable conditions to that city. At Atchison the present railroad bridge will be used, and at St. Joseph it is likely the company will operate over the city lines, as an offer has been made by the local company of 3 cents per passenger for all persons carried within the city limits, the Missouri Valley to man the cars and the local company to supply power.

Construction will follow closely the standard set by the latest interurban practice. Seventy-pound rails will be used and the track will be ballasted with crushed rock. From Kansas City to Leavenworth, where a 30-minute service will be necessary, a double track will be laid. The power house and the car houses will be located at Beverly, midway of the line, where a site has already been secured, and where are located several coal mines. The power house will be built of stone and brick with slate roof, and will be equipped for the generation of 3000 kw. The rolling stock will be in keeping with the high character of the construction. The motor cars will be equipped with the multiple-unit system for operation in trains, as previously stated. Freight equipment has been planned to care for the large coal traffic already offered. The general freight business in garden truck, milk and merchandise also promises to be large.

As to the cost of construction, the total is estimated as $4,446,393. It is estimated that the bridges, terminals, etc., will cost about $1,350,000. The 95 miles of single track, including power house, car stations, telephone line, block signal system and car shops, at an estimate of $29,962 per mile, will aggregate $2,846,393. The interest during construction is placed at $250,000, making the total to approach $4,500,000.

The total capital liabilities will be $15,000,000, consisting of $7,500,000 common stock and $7,500,000 5 per cent 30-year bonds. Of this total, $5,000,000 of bonds and $5,000,000 of stock will be issued at once.

AN IMPROVED CAR JOURNAL BEARING

That cool running and durability should be the essential

FIG. 1.—BRONZE SHELL FOR JOURNAL BEARING

FIG. 2.—SHOWING BABBITT WORN TO LINE OF BRONZE

qualities of a bearing goes without dispute, but the fact that so many different compositions have been and still are being tried, proves that these two conditions have not yet been ful-

FIG. 3.—SECTIONAL VIEW OF CAR JOURNAL BEARING AFTER RUNNING 72,000 MILES

filled to the satisfaction of the railway companies. One of the latest inventors in this line is A. C. Stiles, whose fourteen years' experience, first as a locomotive engineer and then as a foreman of railroad foundries, has given him a most valuable practical knowledge of bearing troubles and their correction. Mr. Stiles has invented a locomotive driving journal bearing and a car journal bearing, both of which are now manufactured by the A. C. Stiles Anti-Friction Metal Company, of New Haven, Conn. As the car journal bearing is of special

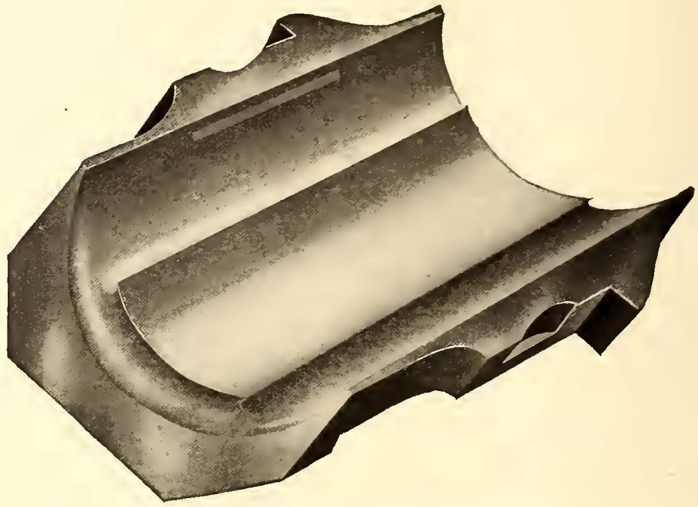


FIG. 4.—INSIDE VIEW OF CAR JOURNAL BEARING BEFORE BABBITTING, SHOWING THE CROWN OF BRONZE FITTED TO THE EXACT SIZE OF THE JOURNAL

interest to electric railways, it is described and illustrated herewith.

The accompanying Fig. 1 illustrates the bronze shell, made according to a formula insuring exceptional durability. The bearing point is of the same curvature as the journal, so that should the babbitt be melted out from any cause, the journal would find a perfectly fitted body in which it could run safely.

The method of babbitting is certainly new and interesting. Where most roads use a plain lead lining of about 3-16 of an inch tinned to a shell bored to the circumference of the journal, Mr. Stiles plans for a much thicker coating of babbitt which is interlocked to the shell by the ingenious method shown in Fig. 4. As the journal wears the babbitt lining, it rests in a bed fitted to it at all times. Fig. 2 shows how the babbittt has worn to the line of the bronze. As it continues to wear down, even after the bronze shell has begun to wear, the journal is at all times fully protected. Even when worn down to a point, the journal is so protected at the sides by the babbitt that it cannot wedge. The journal cannot at any time touch the bronze, except at the

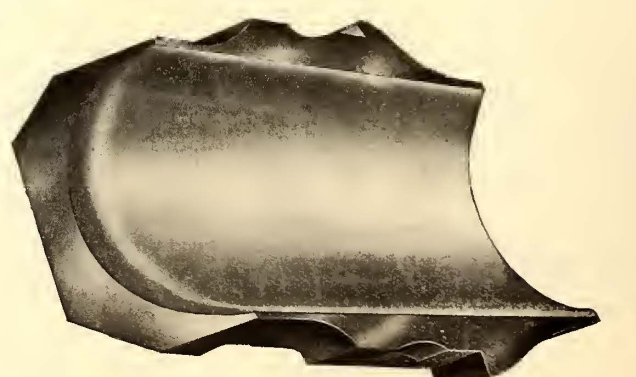


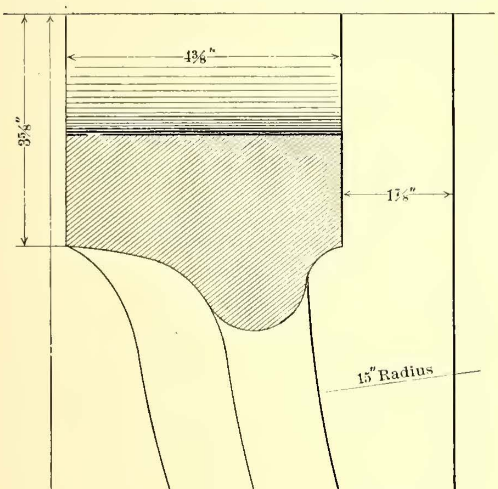
FIG. 5.—INSIDE VIEW OF CAR JOURNAL BEARING AFTER BEING BABBITTED AND READY FOR USE

point prepared for its reception. Fig. 3 is a reproduction of a bearing which ran 72,000 miles.

The babbitt prepared by the company naturally plays an important part in the satisfactory work of this bearing. It has been the manufacturer's aim to produce a bearing hard enough to carry the necessary weight and to be durable, yet sofe enough to readily conform to the wear caused by the revolution of the journal. The value of such an anti-friction metal is inestimable. The longer a bearing will run, the cheaper it becomes, of course, as the frequent hauling off of a car is expensive. Fig. 4 shows the inside of the car journal bearing before babbitting, and Fig. 5 is a view of the same journal bearing after babbitting and ready for use. This bearing is extensively used on the Consolidated Railway Company, of New Haven, Conn.

A NOISELESS CAR WHEEL

To avoid the necessity of taking a car wheel off the axle after the flange and tread have worn out, C. W. Haight, of Dayton, Ohio, has brought out the Hoagland noiseless car



SECTION OF NOISELESS CAR WHEEL

wheel, which is made in two pieces. One piece of this wheel forms the center, which is provided with an exterior flange, and bearing surface. In this flange are cored bolt holes for 14¾-in. bolts. The bearing surface is made on an incline of ⅛ in. in 2 ins., which makes it possible to form a joint and get the necessary pressure required from the bolts. The outer ring or tire is provided with an inverted flange which has cored bolt holes to match the holes in the center part; it also has a bearing surface to meet the one on the inner part of the wheel. The flange on the center part is on the inside, projecting outward. The tire flange is on the outside, projecting inward. Between these two flanges is a space of about 1¾ ins.; in this space is the bearing surface. Between the two castings there is sufficient room for a 3-16-in. paper packing. No parts of the two castings come in connection with one another; no bolt holes are drilled, and the only machine work which is necessary is the grinding of the inside sides of the flanges and the bearing face, only to grind off rough spots and lumps, thereby avoiding lathe and drill press work. It is not necessary to grind to a polished surface.

The taper on the bearing face forms a wedge, which presses the paper packing between the two castings, and the pressure is secured by twelve or fourteen ¾-in. bolts and a wrench 20 in. long. In putting one of these wheels together the center and tire can go together about one-third of the bearing face before it comes to a solid bearing, and two-thirds is thus pulled up with bolts, furnishing with a suitable wrench from 12 tons to 15 tons pressure, and thus avoiding a hydraulic press.

The bolts and nuts used in the construction of these wheels are secured by nut locks. One nut lock is placed between the bolt head and casting, and another between the nut and casting. The bolts, nuts and the nut lock under the bolt head can be used over and over again, but the nut lock under the nut will split in two or more pieces in taking off the nut.

Among the advantages claimed for this wheel are the following: The paper packing between the two casting acts as a cushion; no ringing sound in the wheels; great reduction of noise when running; prolongs the life of the roadbed and truck apparatus; cheapness of the wheel after once placed in service, as it will cost little over one-half of an ordinary car wheel to renew the tire, which is the only part of the wheel that wears out; the wheel has a deep uniform chill all around, and no soft spots can form in its tread, as the tire is of uniform thickness with no spoke in it; no possible chance for this wheel to break in running over railroad crossings, frogs or by frost in cold weather, as the cushion in them prevents cracking; the tire on solid wheels is only supported at each spoke, but in this wheel it is equalized—a fact of great value.

It is interesting to note that this car wheel has been used for four years on the Chicago & Milwaukee Electric Railway, and that several of this company's officials have expressed themselves as being highly pleased with the results that this wheel has given in practice.

BROOKLYN POLYTECHNIC RAILWAY LECTURES

It may be remembered that last year the Polytechnic Institute of Brooklyn, N. Y., instituted a series of evening lectures on various branches of engineering by distinguished specialists. This innovation proved very successful, and was therefore continued this year on a broader scale than before. In the special transportation course, covering fourteen two-hour lectures and five extensive tests, the first lecture was given on October 17 by Prof. Lardner.

Mr. Lardner's subject was "How to Route the Line and Determine the Most Suitable Service." Not only did he consider the layout of entirely new lines, but also the methods that should be followed in arranging a more profitable routeing of an existing system. In taking up some recent census statistics covering track mileage and population, the lecturer called attention to the interesting fact that a strong relation exists between the size of the city and the number of times each passenger is carried annually. Going further into the government figures, Mr. Lardner took up the cities of different classes, and pointed out the special transportation conditions existing in various localities. He then went into the question of fares and their relation to earnings, concluding with a clear and concise explanation of schedule making.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 25, 1905.

The Money Market

Increased ease characterized the money market this week, rates for all maturities ruling somewhat below those recently quoted. The lower rates were due in part to the further substantial gain in bank reserves, as shown by the statement of the Clearing House banks, published on last Saturday, and to some pressure of funds by the near-by out-of-town institutions. Local lenders were inclined to regard the present ease as only temporary, and displayed no disposition to place their funds upon the market. A noteworthy feature of the market was the continued scarcity of cotton bills, which resulted in a further sharp advance in the price of demand sterling to 4.8685, or within a half cent of the gold export rate. Further advances in sterling are expected, and should the outward movement of the yellow metal begin, money rates in the local market would probably advance to a point which would make such operation unprofitable. The much talked of Russian loan was announced during the week. It amounts to $240,000,000, which is less than had been generally expected. Of the total amount Paris will take $130,000,000, Berlin $70,000,000, and London and New York $20,000,000 each. It is understood that payments will be so made as to relieve the international money market of any unnecessary pressure. It is expected that as soon as the Russian requirements have been satisfied, Japan will place a loan, which, with the other demands for funds, will be sufficient to hold money rates firm until currency begins to return from the interior. The foreign markets have remained firm, but discount rates at the principal European centers have not changed materially.

The statement of the Clearing House banks, published on last Saturday, was very satisfactory. Loans decreased $3,594,200, while there was an increase in cash of $1,797,200. The reserve required was $575,550 less than in the preceding week, which, together with the increase in cash, resulted in a gain in the surplus reserve of $2,371,750. The surplus is now $12,583,150, as compared with $17,853,925 in 1904, $17,944,450 in 1903, $17,781,475 in 1902, $14,713,175 in 1901, and $6,031,825 in 1900. Money on call loaned at 5 and 3 per cent, the average rate for the week being about 4½ per cent, as against 5 per cent last week. Three and four months accommodations were obtainable at 4¾ per cent, while six months maturities brought 4½ per cent. Commercial paper ruled extremely quiet but unchanged, at 5 per cent for the best names.

The Stock Market

Monetary considerations have again dominated the general share speculation during the past week, although in a somewhat different manner than has been the case of late. Heretofore the tendency for both time and call money has been upward, and in consequence of their speculation for the rise has been considerably restricted, while at intervals bearish aggressiveness has resulted from the same cause. In the week under review, however, rates for both time and call loans have shown a distinct declining tendency, largely because of a pronounced let up in the demand for currency from the interior, and the continued liberal offerings of funds here from out-of-town institutions, and this has led to more or less buying of stock for the bull account, and a general, if somewhat irregular, upward movement iin prices. The irregularity alluded to was occasioned mainly by a pronounced hardening in sterling exchange rates to a point which would seem to foreshadow early exportation of gold from this country. This was the one disturbing element in the situation, but apart from creating some hesitancy among buyers on different occasions, its effect was practically nil, as while speculation continued chiefly professional and the outside public refrained from coming in to any considerable extent, the buying of stocks generally was certainly better than the selling and of a very confident character. That this is so is evidenced by the fact that several stocks have, during the week, reached a higher level than for a long time past, a notable case in point being United States Steel common, which touches the highest figure in two years, while several made new high records, chief among them being the anthracite coal stocks and those of some of the railway equipment manufacturing concerns. Specific reasons for the buoyancy developed in the individual instances cited are to be found in the continued unprecedented prosperity of the steel industry, which promises to bring the earnings of the Steel Corporation to the highest point ever attained, the exceedingly heavy tonnage now being transported by the hard coal roads, and the unequalled business at present being carried on by all those companies having to do with the equipment of the railroads. Abundant evidence of this is afforded by the fact that in practically all cases these corporations now have on their books a very much larger amount of unfilled orders than ever before. In general, and apart from monetary conditions, the situation has been, and still is, in favor of higher prices in the stock market. The crop situation remains unchanged. Railroad earnings generally continue to show gratifying increases over those for the corresponding period of last year, and trade in practically all of the branches is still on a thoroughly satisfactory basis.

The varying phases of the local political situation have, to some extent, affected the market for the local traction stocks, and at different periods of the week these shares have been inclined to run off, a marked exception to this rule being Brooklyn Rapid Transit, which, in response to revived rumors of buying for control by Pennsylvania Railroad interests, developed pronounced strength and activity and sold at higher prices than for a long time heretofore. Therefore the rumors in circulation concerning this property have not been confirmed, and there are many who doubt their authenticity. However, the buying of the shares has been very good, and participated in largely by Boston and Philadelphia, which centers have become more than ever impressed with the immense earning capacity of that system.

Philadelphia

The dullness prevailing in the general securities market this week was reflected to a great extent in the local traction group. Dealings included an unusually small number of issues, none of which developed activity, and although prices generally ruled firm, the net changes were insignificant. Philadelphia Company, which has furnished the active feature for several weeks past, was extremely quiet, less than 5000 shares changing hands. From 48⅞ at the opening the price ran off ⅜, but subsequently it rose to 49, and closed at the highest. The preferred stock was almost entirely neglected, only twenty shares selling at 49. Philadelphia Traction ruled firm, about 300 shares changing hands at prices ranging from 100 to 100¼. Philadelphia Rapid Transit sold in small amounts at from 28⅜ to 28. Rochester Railway & Lighting preferred brought 96 for 155 shares, and 110 shares of United Traction of Pittsburg preferred brought 50. Union Traction was dealt in to the extent of about 400 shares, at from 63¼ to 62⅞.

Baltimore

There was a further sharp falling off in the dealings in the local traction issues, and apart from United Railway incomes and the stock, the price fluctuations were confined to extremely narrow limits. United Railway free stock sold to the extent of about 2000 shares, at from 16½ to 15½. The deposited stock sold at 16¼ and 16 for 1000 shares. The income bonds brought prices ranging from 66⅝ to 65¾, and back to 66¼, upwards of $65,000 changing hands. The 4 per cents were quiet, $34,000 selling at 93 and 92⅞. The investment demand was extremely quiet; $6,000 Norfolk Railway & Light 5s brought 97, and $5,000 City & Suburban 5s sold at 114¾. Other sales included $1,000 Baltimore City Passenger 5s at 107, $3,000 of the 4½s at 103¼.

Other Traction Securities

The feature of the Chicago market was the sale of a small lot of Chicago City Railway stock at 204, or 4 points above the price at which the present owners acquired control. North Chicago sold at 85 for 100 shares, and 300 Chicago Union Traction brought 11¾ and 11½. Metropolitan Elevated fluctuated between 26¾ and 28, 697 shares changing hands between those prices. The preferred stock brought 70¼ and 71 for 104 shares. In the Boston market, Boston Elevated declined a full point to 153, on the exchange of about 300 shares. Boston & Worcester common sold at 26 for a small lot, and odd lots of the preferred sold at 73 and 72⅞. Massachusetts Electric common was weak, transactions taking place at from 14⅝ to 13¼, while 100 preferred brought 56 to 56½. Other sales included West End common at 99½, West End preferred at 105¾, and $2,000 of the 4s of 1914 at 105¾. The feature of the New York curb market was the activity and strength in New Orleans Railway issues, all of which sold at the highest prices attained since the reorganization. The strength was based upon the belief entertained that the preferred stock will be placed upon the dividend-paying list in the near future. Of the common, 3400 shares were dealt in, at from 36 to 38¼, while 2100 shares of the preferred brought 79⅜ to 84¼. The 4½ per cent bonds brought prices ranging from 90⅛ to 90¾ for $62,000. Interborough Rapid Transit was fairly active, 2100 shares selling at from 215½ to 212. Other transactions included $1,000 Washington Railway 4 per cent bonds at 91¼, 300 Public Service Corporation stock at 101, $25,000 5 per cent notes at 96 and interest, and $50,000 certificates at 63 and 62, $20,000 North Jersey 4s at 76 and interest, and $20,000 Jersey City, Hoboken & Paterson 4s at 74 and interest.

Cincinnati Street Railway had a fractional decline on the Cincinnati market last week, selling at 146 to 146½, Cincinnati, Newport & Covington common had an upward movement, over 1000 shares selling with a range of 41½ to 45, the latter the close; the preferred sold at 95 for several lots. Cincinnati, Dayton & Toledo made a fractional advance to 24¼, and there were important sales in the 5s of this company, with an advance from 98¼ to 98½. Detroit United sold at 92, a decline of 2½ points from last sale. Toledo Railways sold at 34; Ohio Traction, preferred, sold at 107½.

The strong bull movement still continues on the Cleveland market and the heaviest week in tractions on that market was recorded. Nearly every issue shared in the advance. Western Ohio Railway was the strongest card, over 3000 shares selling up from 18½ to 20⅝; strong talk of leasing the property and the approaching completion of the through Cincinnati-Toledo connection being responsible for the movement. Western Ohio bonds came into great demand for the same reason, over $125,000 worth selling up from 85½ to 90. Northern Ohio Traction & Light re-entered the active list on hint of a stock dividend, about 300 shares selling with a range of 25 to 27⅞. The 4 per cent bonds sold up from 73⅜ to 76½, and the 5s from 87 to 90; $112,000 worth changing hands. Magnificent gains in earnings were responsible for the advance of Lake Shore Electric common from 15⅞ to 17⅜, sales about 1500 shares. The old preferred stock moved up from 60½ to 63, and the new preferred from 56 to 57; few sales however, as holders were inclined to hang on. Fifty thousand worth of the general 5s of this company sold up from 85½ 87½. Cleveland Electric sold at 84 to 84⅜. Aurora, Elgin & Chicago common had another sharp advance from 32 to 35 and the preferred from 91 to 94, but the sales were fewer in numbers than on previous weeks, as holders look for still higher prices. Thirty-five thousand worth of the 5s sold at 98 to 98½. Inside-pool buying and talk of consolidation with Lake Shore Electric was responsible for the advance of Cleveland & Southwestern common from 16½ to 19, and the preferred from 60 to 65. The early part of this week it became evident that the crest of the boom had been reached and there were fractional declines on nearly all issues, with fewer and smaller exchanges. Lake Shore Electric common sold at 16; Aurora, Elgin & Chicago at 33; Western Ohio at 19½.

Security Quotations

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

	Oct. 18	Oct. 25
American Railways	52	52
Boston Elevated	153	153
Brooklyn Rapid Transit	72¼	78
Chicago City	199	200
Chicago Union Traction (common)	11¾	11¼
Chicago Union Traction (preferred)	—	—
Cleveland Electric	75	—
Consolidated Traction of New Jersey	82	82
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	92	92
Interborough Rapid Transit	214	212½
International Traction (common)	39	36½
International Traction (preferred) 4s	73	74
Manhattan Railway	166	166
Massachusetts Electric Cos. (common)	13¾	13
Massachusetts Electric Cos. (preferred)	56	56
Metropolitan Elevated, Chicago (common)	25½	28½
Metropolitan Elevated, Chicago (preferred)	70½	71
Metropolitan Street	125⅝	125½
Metropolitan Securities	80⅝	80½
New Orleans Railways (common), W. I.	36	38
New Orleans Railways (preferred), W. I.	79¾	83½
New Orleans Railways, 4½s	89½	90¾
North American	97	97½
North Jersey Street Railway	28	28
Philadelphia Company (common)	48⅝	48⅝
Philadelphia Rapid Transit	28⅛	27¾
Philadelphia Traction	100	100
Public Service Corporation 5 per cent notes	96	96
Public Service Corporation certificates	64½	64
South Side Elevated (Chicago)	96	96
Third Avenue	124½	124
Twin City, Minneapolis (common)	116	117¼
Union Traction (Philadelphia)	62½	62½
West End (common)	99	99½
West End (preferred)	114	114

W. I., when issued.

Iron and Steel

The "Iron Age" says the bookings of finished iron and steel continue on an enormous scale, and thus far this month are nearly up to the record-breaking rate of September. The pressure in many quarters is enormous, and the plants are provided with work for long periods. There is a most intense activity in all directions. In the Eastern steel trade there has been another outburst of buying of basic pig iron for delivery during the winter, and fully 75,000 tons have been taken at advancing prices, with negotiations pending for at least half as much more. A scarcity of pig iron and steel is developing in the Chicago district, and it is likely that iron may be shipped from lower lake ports to that district by water before navigation closes. The United States Steel Corporation has secured options, at $16 and $16.50, on practically all the Bessemer pig available in the Mahoning and Shenango Valleys to the end of the year, the only exception being one lot of 10,000 tons held by a merchant. In the steel trade a number of fair orders have been booked, and some additional tonnage is looming up. Inability to make prompt deliveries of structural material continues to be the only serious phase of the situation in that branch. A large business has been done in bars, and sellers are holding back. The cast iron pipe shops are very busy. The reports from foreign markets are excellent.

ANNUAL MEETING OF THE MEXICO ELECTRIC TRAMWAYS, LTD.

The eighth annual meeting of the Mexico Electric Tramways, Ltd., was held Sept. 27, at the office of the company in London, under the chairmanship of Sir Chas. Euan Smith, president of the company. An abstract of the operating report for the year ending Dec. 31, 1904, follows. The Mexican account represents the report of La Compania de los Ferrocarriles del Distrito Federal de Mexico, and is in Mexican dollars. The London report is that of the holding company and is in English currency.

MEXICAN ACCOUNT

Traffic income		$3,236,549
Miscellaneous		38,199
Gross earnings from operation		$3,274,748
Operating expenses		2,046,073
Gross income less operating expenses		$1,228,675
Interest on funded debt	$600,000	
Dividends	175,000	
		775,000
Profit transferred to London		$453,675

LONDON ACCOUNT

Balance ($453,675, @ 22¾d.)		£43,004
Interest and dividends on Mexican securities ($415,000)		41,338
Transfer fees		6
Gross earnings		£84,349
Operating expenses	£1,812	
Interest and commissions on advances	7,263	
Interest on debentures	20,000	
Miscellaneous	1,377	
		30,452
Balance transferred to balance sheet		£53,897

In his report, the chairman explained that the company has now 234 km of track, of which about 149 km are equipped with electricity, 16 km by steam and 69 km by animal traction. The line has recently been put in very good mechanical condition and will have to be extended before long. The chairman spoke in the highest terms of the present manager, W. W. Wheatly, under whose direction the system has been rapidly developed during the past two years. He also stated that arrangements had been completed with the Necaxa Company for the supply of power from its water-power plant. The chairman had recently returned from a trip to Mexico.

AN EXTENSION OF RIGHT TO LIMIT TRANSFERS GRANTED MASSACHUSETTS COMPANY

The railroad commissioners have issued an order granting the Newton & Boston Street Railroad Company, controlled by the Boston Suburban Electric Companies, an extension of time for the withdrawal of certain free transfers in the city of Newton. A year ago the board sanctioned the discontinuance of these transfers for an experimental period. The commissioners are of the opinion from the operations of the company for the past year that the company should be allowed to continue the withdrawal of these transfers until the first of January, 1907, when the question may be taken up again.

SINGLE-PHASE LINE FOR MAINE

Plans are making by the Eastern Traction Company for building a 38-mile electric railway between Bangor and Dexter, Me. The company was incorporated in December, 1903, and its plans are sufficiently well advanced now to warrant it in stating that construction will be begun early next year. The road will start in Bangor at a point on or near Buck Street, and proceed to Hermon, crossing the Northern Seaport Railway at a point some 800 feet from the city limits of Bangor. From Hermon it will continue to Levant, from which place it will swing to the west, touch South Levant and continue up the valley of Black stream to a point a mile distant from West Levant village. From here it will extend westward to East Stetson, thence to South Exeter and to Exeter. From here the course is westerly into West Garland. After passing West Garland the road will follow the northern shore of Pleasant pond, thence through the valley to Dexter. It has been decided to equip the line with the single-phase system. The officers of the Eastern Traction Company are: H. Franklin Bailey, of Old Town, president; Edgar B. Weeks, of Old Town, treasurer; Forrest J. Martin, Esq., of Bangor, attorney and clerk. These officials, together with Charles W. Mullen and Fred T. Dow, of Bangor, and William H. Waterhouse, of Old Town, compose the board of directors.

MASSACHUSETTS COMPANIES MUST APPLY TO COURTS BEFORE ABANDONING ANY PART OF ROUTE

The Railroad Commissioners of Massachusetts have issued a decision which is important in all parts of the State as a precedent, though the case in question is in Essex County. In this case the Selectmen of Merrimac and Amesbury, making common cause with citizens along the Pleasant Valley line of the Citizens' Electric Street Railway Company, asked the Commissioners to approve their order that the company reopen the line, which had been abandoned for many months, so that the roadbed, for lack of repair, had become unsafe. The Pleasant Valley line was built in 1889 as an extension of a horse railway. Afterward the Haverhill & Amesbury Street Railway was built, making a shorter route and leaving the former route one side, so that it was run at a heavy annual loss. Then the company stopped running cars over it. The selectmen tried to compel the company to restore the service. After reciting the facts and the law relied upon by the selectmen and the company, respectively, in opposition to each other, the commission continues and rules as follows:

The company claims that it has lawfully abandoned this line, and asks for a ruling that the right to do so is recognized in section 36, chapter 112, Revised Laws, which authorizes Boards of Aldermen or Selectmen to order the removal of tracks from the streets in case their use has been discontinued for six months. The Board declines to make that ruling, being of the opinion that the statute in question provides a punishment for the discontinuance of a service rather than recognizes a right to discontinue it.

On the other hand, chapter 376, acts of 1905, the statute under which the Selectmen have acted, in our opinion has no application to a railway out of repair, out of use, and abandoned in fact if not in law. That statute originated in the days when horse cars threatened to encroach upon other uses of the streets. To protect such other uses the Legislature empowered Boards of Aldermen and of Selectmen to limit the number and routes of cars and the extent to which they should occupy public ways.

The question is whether or not the Citizens' Electric Street Railway Company may properly or lawfully refuse to operate its Pleasant Valley line and at the same time retain the right to operate the rest of its railway. To determine this, appeal should be had to the Legislature or to the courts, which can alone effectually deal with the situation. That has been the course taken to determine the rights of parties in cases of a kindred character in this and other States.

ELECTRIC-STEAM COMPETITION IN ENGLAND

United States Consul Murat Halstead, of Birmingham, England, in a recent report, speaks of the steam-electric traction competition in that country. He notes that the chairman of the Great Eastern Railway, at its eighty-sixth half-yearly meeting, complained of the competition of electric railways. The Great Northern seemed to have suffered more than any other company by electric street car competition. It carried 350,000 fewer passengers in York, and though it carried 400,000 more in the London district, they had received less money for doing so. Of the adverse influences from which the British railways have been suffering, increased taxation demands from local authorities, war abroad, and new forms of competition, the latter the "Times" considers the most serious because, in order to correct it "a graduated transformation of existing methods of haulage seems inevitable. The future is with electricity as an agent of transportation, although at present its application to long-distance traffic has not become practical. In the meantime a beginning will probably have to be made with short-distance business by providing electrical power on sections of the various systems. Several companies have been experimenting, with more or less success, with motor cars on short lengths of line, a measure which may be regarded as a half-way house to the use of electricity. It seems to us that in large cities served by more than one company whose directors are turning their minds to this problem it would be well, if possible, to work together, by erecting joint power houses, the cost of supplying current on a large scale being less than when it is produced in smaller quantities. No difficulty has been found in erecting joint stations in Nottingham and elsewhere with capital guaranteed by the companies concerned, and the principle could surely be applied to joint electrical works."

EXTENSION OF POLICE TRAFFIC SQUAD IN NEW YORK

A further extension is proposed of the work of the New York police traffic squad. The new application has to do with the Brooklyn Bridge, but this time with the Brooklyn terminal, as the solution of the regulation of traffic at the New York end was worked out satisfactorily some time ago, greatly to the betterment of street railway travel and the safety of pedestrians. Turning off the bridge roadway at Sands Street, Brooklyn, cars of various lines branch to the west toward Fulton Street and to the east toward Washington Street. Mixing with the cars now is traffic from Sands Street, Washington Street and Liberty Street, to which vehiclar traffic is diverted from lower Fulton Street. On Nov. 11, the date set for putting into use the plans adopted by the police, no teams of any kind will be permitted to pass on Sands Street between the north and the south roadways of the bridge, but all those desiring to reach the north roadway from the direction of Fulton and Liberty Streets, will be turned through High Street to the easterly curb of Washington Street, so that they will parallel the New York bound line of cars. Those approaching from the easterly direction will be diverted to Sands street, following the northerly curb and paralleling the cars on that street.

A mounted policeman will be stationed at the point where the two lines converge to enter the bridge roadway, who will hold up one line of cars and trucks while others enter the roadway. While the Washington Street cars and trucks are waiting to allow the Sands Street division to proceed, the crossing at High Street and Washington Street will be kept open to permit the trucks waiting on High Street to cross over to their proper place on Washington Street. During the rush hours no cars will proceed east on Sands Street from below Adams Street. All lines using either of those thoroughfares being diverted around the Prospect Street loop, so that under no circumstances will there be any crossing either by teams or cars of the Manhattan bound line of travel. Teams coming down Sands Street and not destined for the bridge will be turned down Washington Street to Prospect or any other convenient street. Coming off the bridge, all teams will be sent directly over the tracks to the Plaza between rope railings to Liberty Street, there to distribute themselves as required.

Only four lines of cars will turn east from the bridge roadway on Sands Streeet, toward Washington Street, namely, DeKalb Avenue, Smith Street, Vanderbilt and Park Avenue lines. As these will turn north along Washington Street, they will not cross the incoming line of travel until they reach High and Concord Streets, respectively, where there will be a better opportunity for turning off.

THE RIGHT TO LAY GUARD RAILS

An interesting case has just been decided in Wheeling, W. Va., which defies the rights of a railway company to use certain construction in the streets, even when this construction is opposed by the road commissioners. An injunction was secured recently by the County Commissioners, of Marshall County, against the Wheeling Traction Company, because it laid a guard rail on one side of its track where the roadway lay along the bank of a dangerous hill. The authorities claimed that the franchise of the company provided that the rails should be laid on a level with the roadbed; that the guard rail constituted a nuisance to vehicles, and that in spite of a notification to the company not to lay the rail, it did lay the rails. The decision which was rendered by Judge Hervey, of the County Court, dismissing the injunction declares that the franchise of the company does not state what kind of rails should be used, but that the company was under an obligation to make its road as safe as possible. The evidence did not indicate that the guard rail was a serious obstruction to vehicular traffic on the road, or that there was any better way of protecting the location. The court held, therefore, that the guard rail was as much a part of the road as the running rails or the wire and poles and must be held to be included in the original grant of right of way.

MEETING OF NEW ENGLAND STREET RAILWAY CLUB

The monthly meeting of the New England Street Railway Club will be held at the American House, Boston, on Thursday evening, Oct. 26. Dinner will be served at 7 o'clock sharp, and at 8 o'clock the regular business meeting will be held, followed by a talk by A. H. Armstrong, engineer of the railway department, General Electric Company, Schenectady, N. Y., on "Electric Locomotive in Heavy Haulage Work." The lecture will be illustrated by the use of a stereopticon.

KANSAS GAS, WATER, ELECTRIC LIGHT & STREET RAILWAY ASSOCIATION

The eighth annual meeting of the Kansas Gas, Water, Electric Light & Street Railway Association was held in the Mercantile Club Room, Kansas City, Kan., on Oct. 13 and 14. The secretary's report showed that the total membership on Oct. 13 was 94, including honorary, active and associate members.

Papers on the following subjects were read and discussed: "The Tantalum Lamp," by Prof. B. F. Eyer; "Public Utilities and Municipalities," by Prof. E. H. Bailey; "The High Efficiency of High Candle-Power Lamps," by J. F. Shaefer; "The Need of Sewage Disposal in Kansas," by R. E. McDonnell; "Co-operation in Management of Gas, Water, Electric Light and Street Railway Companies," by C. R. Maunsell; "Relative Heat-Producing Values of Natural Gas, Oil and Coal," by Prof. Erasmus Haworth.

Of especial interest to street railway interests was the paper by Prof. Bailey on "Public Utilities and Municipalities." In presenting his paper Prof. Bailey gave a summary of the waterworks, gas plants and electric light stations owned by the cities in which they are located. In proceeding he said frankly, that the present demand for municipalization of public utilities was due, in part at least, to the fact that private corporations have not in the past done their best to supply these necessities at a fair rate of compensation, and of good quality. He then quoted from an editorial in the "Kansas City World" dealing with government regulation of the railroads which closed with these words as a note of warning: "Those who deplore government ownership, or the agitation of it, should be foremost in encouraging all reasonable steps to avoid it. The present policy of the railroads is directly in line with the promotion of extremely radical agitation. The people, once they are aroused, must be met with fairness or they will go to extremes. That is not a matter of conjecture. It is a matter of human nature, demonstrated by abundant precedent."

Prof. Bailey said that in the case of street railways there are so many things that go to make what is called "good service" that they cannot be enumerated. The fact is that the supply of gas, water and electric lights to the people must be upon a different basis from the supply of potatoes, furniture or neckties. In the latter field, if the goods are inferior, we take them back or get a rebate, or patronize some other house, but when we do not find the gas or water or electricity satisfactory, we are told that "we can go without"—when the company knows that usually we cannot go without. Since the corporation that has these necessities to sell has the advantage, it would be the best policy to meet the public half way, even at the temporary loss of a little revenue.

The following officers were elected for the coming year: President, W. E. Sweezy, Junction City; first vice-president, S. W. Sterrett, Kansas City; second vice-president, F. B. Aley, Wichita; third vice-president, C. L. Brown, Albine; secretary and treasurer, James D. Nicholson, Newton. The next meeting will be held in Lawrence, Kan., the latter part of October, 1906.

THE MILAN EXPOSITION

It is the opinion of United States Consul Dunning that American manufacturers have considerably underestimated the relative importance of the Milan Exposition of 1906, which will continue from April to November in celebration of the opening of the Simplon Tunnel, and which will be a world's fair. Since the constantly increasing correspondence of the consulate at Milan seems to indicate a growing desire on the part of American exporters to sell their goods in Italy, Mr. Dunning believes the Milan Exposition affords an unusual opportunity for firms whose products naturally meet with the sharpest kind of European competition. If present tariff movements in more than one country in Europe may be taken to mean anything definite and significant toward American trade, it seems that our manufacturers will require a better representation of their goods on the Continent in future than ever before.

The exposition is to be on the grand scale with which visitors to Chicago, Buffalo and St. Louis are familiar. Every branch of art, science, agriculture and the industries will be given ample space and adequate opportunities for exhibition. The entire fair will cover more than 1,000,000 sq. m (10,764,200 sq. ft.), of which one-quarter will be covered by buildings which are already rapidly approaching completion. Japan, Germany, France, Mexico, Belgium, Switzerland, Austria, Great Britain and Italy will be officially represented at the fair; and nearly every other country in the world, including China, and the most active of the South American nations, will be largely represented as to their trades and evidences of their progress in every line of endeavor.

25,000-MILE RUN OF ELECTRIC LOCOMOTIVE

The New York Central locomotive No. 6000, which is being tested at the Schenectady experimental track and which was built by the General Electric Company and the American Locomotive Company, made its 25,000th mile at 1:15 p. m. on Oct. 20, 1905, thus completing the first half of the 50,000-mile test to which it is being subjected. The motors on the locomotive to-day are those with which the test began; the commutators are perfectly smooth; the brushes have run the 25,000 miles with a wear of only 3/8 in., and appear fit to complete the 50,000-mile run.

During these tests, the locomotive has been in service regardless of weather, running light or with trains up to twelve cars in length. A speed of 85 miles an hour has been indicated, and in competition the electric locomotive has easily beaten the fastest steam trains on the New York Central

The total cost of all repairs on the locomotive, excluding the injury caused when the shed in which it was housed was burned, has been $428.17 for 25,000 miles. This is an average of $0.017 per mile run, and every indication is that there will be a material reduction of expense on the second half of this run.

CONSOLIDATED GETS ANOTHER COMPANY

The Springfield Street Railway, one of the properties acquired by the Consolidated Railway Company, has leased the Springfield & Eastern Street Railway, a line operating 30 miles of track east of Springfield, Mass. For a number of years there has been keen competition between the two companies for the right to enter new territory. The statement of the terms upon which the lease is made has not been made public. What is considered important in the acquisition of the Springfield & Eastern Railway is that, by the construction of a line from Palmer to Fiskdale, as is proposed, a connection will be established between the New Haven trolley system of Western and Central Massachusetts. From Fiskdale, connection is made with the Worcester & Southbridge Street Railway, another New Haven property, and that connects with the line reaching from Worcester through Webster into Connecticut. The last annual report of the Springfield & Eastern filed with the Railroad Commission shows that the company is capitalized at $370,000, that it has a funded debt of $330,000, and gross liabilities of $756,994.87. During the fiscal year reported upon, the company earned $109,626.31, of which $108,949.41 was from passenger service. The total operating expenses for the year were $77,378.24. The line between Fiskdale and Palmer will be built by Fred T. Ley & Company, of Hartford, Conn., who built the Springfield & Eastern lines.

THE CAMBRIDGE SUBWAY

The officials of the Boston Elevated Railway Company and Mayor Daly, of Cambridge, have decided that two-track subways will be built between Harvard Square and Boston. One of these will be through Massachusetts Avenue and Main Street to the new Cambridge bridge, and the other through Cambridge Street to the new Charles River dam. The last legislature passed a bill for a four-track subway in Main Street and Massachusetts Avenue, but the railway company declined to accept it on account of the expense. The company still has the right to build an elevated road in Cambridge, and the two two-track subways, if authorized by the legislature, will take the place of that. Mayor Daly, in a statement issued a few days ago, said: "I have reason to believe that a bill which will provide for a new two-track subway from Harvard Square through Cambridge Street to the Craigie bridge, with the right of the city of Cambridge to purchase at the end of 20 years, will be acceptable to the elevated company."

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED OCT. 17, 1905

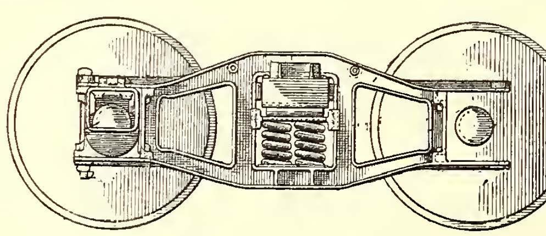
801,863. Car Brake; George Gremm, Chicago, Ill. App. filed July 22, 1905. Segment-shaped cams adapted to engage the rails and through frictional contact therewith are caused to turn on their axis and lift the car, thereby increasing the pressure upon the rails.

801,999. Trolley Wheel; George Loffi, Norwalk, Ohio. App. filed Jan. 7, 1905. The inner faces of the harp are cupped to provide a longitudinal bearing, and a hollow axle provides lubrication therefor.

802,067. Car Truck; William O. Bettendorf, Davenport, Iowa. App. filed Feb. 6, 1905. A car truck comprising a side frame consisting of an upper and lower arch-bar, guide columns and integral brake-beam lugs projecting inward from said side frame, all cast in one piece.

802,093. System of Overhead Electric Conduction for Vehicles; Ettore Bauco, Rome, Italy. App. filed Aug. 20, 1902. A small carriage adapted to travel upon and take current from the conducting wires, and a flexible connection between the carriage and vehicle to be driven.

802,160. Trolley Base; Charles E. Gierding, Newark, N. J. App. filed Jan. 30, 1904. A stud vertically mounted on the top of the car, a cap or sleeve, to which the fixtures for supporting the pole are attached, fitted over the stud, and roller bearings between the stud and cap.



PATENT NO. 802,067

802,168. Sand Box for Cars; David B. Keeports, Philadelphia, Pa. App. filed July 12, 1905. The bottom of the hopper slants from the center toward the sides, where slots are provided through which the sand may flow into an exit pipe, which is normally held closed by spring means.

802,173. Trolley Harp; Edward D. Rockwell, Bristol, Conn. App. filed March 11, 1905. The trolley wheel spindle is removable from the trolley harp in substantially the same way as an ordinary spring-shade roller is removed from its fixtures.

802,361. Car Fender; George F. Taylor, Randolph, Mass. App. filed Feb. 13, 1905. Relates to friction devices for holding the fender elevated from the track, and brake mechanism for the car controlled by the fender.

802,351. Brake Shoe; Charles F. Bingham, Buffalo, N. Y. App. filed June 2, 1905. Consists of a cast body and a reinforcing-rod completely wedge-locked in said body.

802,350. Brake Shoe; Charles F. Bingham, Buffalo, N. Y. App. filed May 25, 1905. A reinforcement for brake shoes consisting of an elongated plate having a series of upwardly extending projections arranged in staggered relation.

PERSONAL MENTION

MR. L. W. LEAHY has resigned as superintendent of maintenance of way of the Public Service Corporation, of New Jersey.

MR. F. A. AUSTIN, who was superintendent of the Erie Traction Company, at Erie, Pa., has taken a position with the Erie Foundry Company, of Erie, Pa., as manager of the machinery sales department.

MR. PERCY R. TODD, vice-president of the Consolidated Railway Company, controlling the electric railway lines in New England, owned by by the New York, New Haven & Hartford Railroad, has been granted a year's leave of absence by the directors.

MR. P. N. JONES, for some years employed by the Westinghouse interests at Pittsburg, has resigned to become mechanical engineer of the Pittsburg Railways Company, operating the electric railway lines in that city. He will have direct supervision over the power houses and machinery of the company.

MR. G. W. M'CLURE, who for some time has been connected with the Illinois Traction system at Danville, Ill., on Nov. 1 becomes master mechanic of the Lansing & Suburban Traction Company, at Lansing, Mich. He will have charge of the equipment of the new shops which that company is building.

MR. C. A. COFFIN, president of the General Electric Company, and Mr. E. C. Converse, director of the United States Steel Corporation, president of the Liberty National Bank and of the Bankers' Trust Company, of New York, have been elected directors of the American Locomotive Company to succeed Mr. George W. Hoadley and Mr. W. Seward Webb, resigned.

MR. J. R. CURTISS has resumed the position of superintendent of the Cleveland, Painesville & Ashtabula Railway, with headquarters at Geneva, Ohio, which he left some months ago to go with a Philadelphia company. Mr. C. B. Green, who has been acting superintendent of the company during Mr. Curtiss' absence, has accepted the position of superintendent of the Philadelphia, Lancaster & Christiana Railway, which is owned largely by Cleveland interests.

MR. ALBERT GALLATIN, for many years vice-president and manager of the Sacramento Electric, Gas & Railway Company, died very suddenly on Oct. 14, at his home in San Francisco. Mr. Gallatin was born in Switzerland. In 1859 he entered the employ of Huntington, Hopkins & Company, at Sacramento, Cal., and later was taken into the firm. Subsequently, Mr. Gallatin became interested in the development of electric power, and mainly to him is due the credit for putting through the Folsom Power Company's scheme for supplying power to Sacramento.

MR. R. D. JONES, foreman of car-building department of the United Railroads, of San Francisco, died suddenly on Oct. 16, 1905, of appoplexy. Mr. Jones spent practically all of his life in the car-building business, having been employed by the J. G. Brill Company, Jackson & Sharp Company, North Jersey Street Railway Company, and for the last three years by the United Railroads, of San Francisco. He possessed peculiar ability in his line, being an expert mechanic, as well as an able manager of men, capable of handling a large force in a manner that was pleasing and profitable to both his employer and the employees.

MR. PHILIP P. BARTON has been appointed general manager of the business and operations of the Niagara Falls Power Company and the Canadian Niagara Power Company. This appointment also includes that of general manager of the Niagara Junction Railway Company, and of the Niagara Development Company. Mr. Barton graduated from Cornell University in 1886 with the degree of Ph.B. After two years of post-graduate work in electrical engineering, he received from the same institution, in 1888, the degree of M. S. His professional career was begun in the electrical department of the Cambria Iron Company, at Johnstown, Pa. After several months of practical experience there and with the Allegheny County Light Company, of Pittsburg, Pa., he entered the engineering force of the Westinghouse Electric & Manufacturing Company. For some years he was engaged in installing electric lighting and power plants in various parts of the country, mainly in the South and the West. In 1892 he entered the service of the Brush Electric Company, of Cleveland, Ohio, in charge of engineering and sales at its Pittsburg office. After the closing of that office in February, 1898, he was connected for some months with the Pittsburg office of the General Electric Company. In September, 1890, he became assistant superintendent of the Niagara Falls Power Company, at Niagara Falls, and two years later was made superintendent of the operating department of the same company. In July, 1905, he was appointed superintendent of operation of the Niagara Falls Power Company and of the Canadian Niagara Power Company, which positions he has held until his present appointment. Mr. Barton is an active member of the American Institute of Electrical Engineers.