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

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1905, *to date,* 98,950 *copies—an average of* 8246 *copies per week.*

Competition with Suburban Steam Service

Although electric traction has had things its own way as regards local transportation in the majority of cities of this country, there are a few of the largest centers where, on account of the great distances to be covered between the city limits and the downtown district, steam suburban service has retained nearly all of the regular suburban travel. The principal reason for this has been that in our greatest cities none but the steam railway companies have any facilities for reaching the heart of the city from the suburbs quickly. The surface and elevated lines are too much taken up with business inside the city to make way for through suburban traffic. In Chicago, however, it begins to look as if serious competition for the steam railroads is in sight. As noted in our last issue, the Aurora, Elgin & Chicago Railway, which has attracted considerable attention the country over as a high-speed road, has now completed arrangements whereby its trains are running over the Metropolitan Elevated tracks into the very heart of Chicago, delivering passengers some blocks nearer than the competing steam railroads, and in spite of the handicap imposed by the presence of local elevated train service on the same tracks, is to make fast enough schedule so as to leave the balance, if anything, in favor of the electric service. Running north from Chicago, arrangements are likely to be made soon whereby cars from the northern suburbs along the lake shore can come in over the Northwestern Elevated Railroad tracks, which will mean active electric competition for the excellent steam suburban service in that direction. Is it any wonder that rumor has it that the Chicago & Northwestern Railway Company, whose suburban service is directly affected by both these developments, is inquiring earnestly into the feasibility of electrifying its suburban service?

Breaks on Interurban Trolley Wire

One of the most exasperating sources of delay on an interurban electric road is the breaking of a trolley wire. The breaking of an interurban trolley wire on a modern high-speed interurban road may be an interruption of minor importance which can be patched up so that the road can be put in operation in a few minutes, or it may mean the paralyzing of that section of the road for some hours. Thanks to trolley catchers and retrievers, it seldom happens that the trolley pole, in leaving the wire, does damage to the overhead work, but if a trolley pole ever does get a good chance at the overhead line in running 40 m.p.h. or 50 m.p.h. something happens. Several hundred feet of trolley wire are likely to get down before the trouble is stopped. So much goes down that it cannot be got clear of the track by the crew of the offending car except by a long continued effort. In the meantime all that section of the road is shut down, and no overhead line repair car, except one furnished with independent motor power, can reach the scene of accident. Of course, breaks occur which are not as serious as this and can be got clear by the train crew in a short time, so that the car can drift past the break and proceed, but the most aggravated cases are almost certain to cause a long delay on the average interurban road. We recently heard the chief despatcher of a large interurban road relating how he had boasted to his general manager one day over the fact that the road had operated 321 consecutive trains into terminals on time, during which period forty-eight freight trains had also been operated. Within a few minutes of his reference to this record word came in of ½ mile of trolley down, with a resulting delay of traffic on that end of the road for hours.

While the tools carried on the ordinary interurban car may serve to cope with ordinary breaks of trolley wire where the overhead line is damaged but little, both the tools and train crew are inadequate to cope with such wrecks of the overhead line as sometimes occur. The use of the double trolley wire, which is very common, adds much to the stability of the line in case one trolley breaks. If the catenary construction is to become common it should improve the strength of line construction very much. As conditions are now, however, about the only safe way for the interurban road is to maintain some kind of a trouble car not dependent on electricity for its supply of current. It may also be practicable to teach interurban train crews enough about line work so that they can clear up dead grounds more promptly than the average crew does at present. Of course, with the ground once removed, the ordinary repair car can usually get to the scene of action or very near to it.

Free Baggage

One of the liveliest topics among interurban railway traffic men at present is the checking of baggage. Some roads follow the steam road precedent and check baggage free, while others make a charge for each trunk, the charge being usually 25 cents. Some roads are equipped with cars which permit the carrying of baggage on all passenger cars, and others are not. Those who advocate the free checking of baggage believe that considerable traffic, especially that of commercial travelers, goes to steam railroads which would patronize the interurban cars if baggage were checked free on them. While the interurban rates between two points may be lower than the steam railroad rate, the interurban rate plus the charge for baggage may be more than the steam railroad rate. It is argued that an interurban road can better afford to carry baggage free for the few passengers that have it than to lose the traffic which would go to the steam roads if the interurban does not carry baggage free. On the other hand, it can be argued that interurban roads are now carrying considerable baggage from which they receive an income which would have to be carried free if free checking of baggage was enforced. As a matter of fact, the number of interurban passengers carrying other than hand baggage is very small. It might be larger if baggage were carried free, but even then it would be a small proportion of the total business. But it must be recognized that commercial travelers with trunks and sample cases afford a steady source of revenue to any transportation line prepared to handle them. Such regular commercial travel is the backbone of the transportation business, as it is steady, month in and month out, and is practically independent of the weather and other local conditions which influence the balance of the traffic. That this class of traffic should be catered to goes without saying. If any considerable portion of it is going to the steam railroads it is time to investigate.

We do not think the mere matter of a few cents difference in rates between two points makes much difference with commercial travelers. Frequency of service does make a great difference, and because of the frequency of the interurban service, the interurban road has a great advantage over the steam road at the outset. If this advantage is not counterbalanced by too great a charge for baggage or too much inconvenience about baggage, the interurban road will have the best of the game, and here again it is a matter of convenience and time rather than price. It is evident in this connection that if an interurban road is not in a position to take trunks on the same car with the traveling man, the business is likely to be lost. Furthermore, if there is much inconvenience about checking baggage on the interurban, the interurban will be avoided. Interurban lines not having worked out the system of receiving and checking baggage as thoroughly as the steam railroads, are at a disadvantage, and it is well to give full recognition to this at the outset and remedy it rather than shut the eyes to it.

This whole matter of the checking of baggage and through connections is sure to work itself out, or rather to be worked out, but it will take the co-operation of interurban roads to do it. It is just such a co-operation that is being especially fostered by the associations of Ohio and Indiana, which are holding such frequent meetings these days. Conditions differ decidedly on different interurban roads, and this is probably responsible for many of the differences in practice. In Ohio and Indiana, for example, interurban lines, connecting as they do all the important manufacturing centers, are naturally in a position to get a large amount of commercial traveler business calling for the transportation of trunks on each passenger car. Where lines are more of a suburban character, connecting numerous small towns with some large city, there is no such demand for the carrying of baggage, and on such roads we rarely find such provision for carrying baggage. It is undoubtedly true that the carrying of any large amount of baggage on each passenger car is a source of delay and annoyance, and many managers, having found this to be true, have been inclined to abandon the idea of carrying baggage on each passenger car altogether, allowing it only to be carried on express cars. As soon as cars which have no provision for carrying baggage have been adopted, the road at once shuts off any possibility of doing much with the class of commercial travel spoken of until a point is reached where very frequent service is given by the baggage and express car.

It seems as if there might be a golden mean between no baggage whatever on passenger cars and so much baggage as to delay the passenger traffic. We are inclined to think that a compromise of this kind is the best thing that can be adopted where any considerable travel is to be secured from commercial men who must always have their baggage accompany them on the same train.

Overalls for the Motormen

The question of the kind of clothes that motormen on interurban cars shall wear is one often difficult of solution and can rightly be solved only by considering many local conditions. The men themselves when compelled to furnish and care for their own clothes naturally favor a standard of dress lower than is desired by the company. They argue that this work is akin to that of the locomotive engineer, and therefore they should be allowed to wear overalls. In reality the motorman's position is quite different from that of an engineer. He is more or less before the eyes of the passenger, while very few of the patrons of a steam road ever see the engineer. So long as no trouble occurs, the motorman is not any more in contact with dirt than are the passengers. Occasionally, however, it may be desirable for him to get into the dirt somewhat, and he may even be compelled to get down underneath the car and loosen the brakes, repair an open circuit in the headlight resistance or do some similar task that ruins a decent suit of clothes. The duties of an interurban motorman in this respect may differ considerably from that of a city motorman, because, in the city, there is not the necessity for making such repairs on the road that there is on long interurban runs with cars on one-hour headway. The motorman usually pays for the clothes,

and often the margin between his living expenses and earnings is so small that he hardly feels justified in ruining his apparel for the good of the company. The result is that he is often very reluctant about doing any dirty work, and if it is possible to do so, he will operate the car the remainder of the day, or at least until a new one is given him, with things out of order rather than get down and fix them.

The only alternative is to permit him to wear overalls. When clean, it must be admitted that these look much more business-like in a motorman's cab than do the conventional blue uniforms. The motorman feels and moves much more freely in them, and so long as they are kept clean they are preferable from every standpoint. But they will become dirty. One trip under the car usually suffices. When in overalls the wearer is not as careful of avoiding grease as when in a more expensive uniform, and he usually emerges with dirt and grease very much in evidence. If compelled to care for his own garments, the dirty ones are likely to be worn until the end of the week. If the company bears the laundry expenses a change will be made at first opportunity. The reduced expenses, brought about through better care of the equipment, will usually warrant it doing so; or, if not this, at least in insisting on reasonably clean suits when men go on duty. To the interurban manager it is simply a question of whether or not the company shall adopt overalls and jumper as motorman's uniform and have the car equipment better cared for, or whether the motorman shall be compelled to wear the conventional uniform and the several expenses connected with the maintenance of cars and delays on the road be permitted to creep up to a much greater figure than is necessary.

Light and Fresh Air

We take especial pleasure in bringing to our readers' notice Mr. Fox's description of some of the methods employed on foreign roads for lighting and ventilating cars. They make our own American practice seem very crude in these particulars. Properly shaded lamps and good ventilation would go far toward increasing the comfort of passengers in those longer runs that are now becoming common. For the raw lighting methods now commonly followed there is really small excuse, for the change to good practice is easy, cheap and, in the end, as we have before now shown, highly economical.

It is not necessary to use costly globes or elaborate ceiling structures. Lamps of moderate candle-power, well distributed and worked with frosted bulbs, greatly improve the illumination. If thus shaded, two rows, one at each edge of the monitor roof, can be used without inconveniencing standing passengers, or with the addition of downward reflectors a single liberal row in the roof does good work. Such a row should, however, be staggered to give the best distribution, as the light from a central row is much interfered with by the standing passengers, always an important part of the load in our American cars. Each year electric cars grow more and more comfortable and commodious in their design, and some of these little refinements in lighting should certainly be introduced, particularly since they tend toward reduction of the energy required for proper illumination.

The ventilation problem is far more difficult and serious. It is a subject now forcibly before the public, and of late there have been some efforts at general or municipal regulations touching it. From a hygienic standpoint, ventilation is far more important than lighting. We fancy that if samples of air were taken from many of our street or steam cars at the close of the rush hours, or from a large proportion of our popular theaters or churches, for that matter, and were subjected to chemical and bacteriological examination, they would disclose some startling conditions. It is fortunate, indeed, that the human eye cannot, unaided, detect the ubiquitous microbe. Unhappy indeed would be our lot if we could see them as we see flies and mosquitoes. Respirators would be at a premium, and nervous prostration, superinduced by trying to side-step dangerous bacilli, would become epidemic.

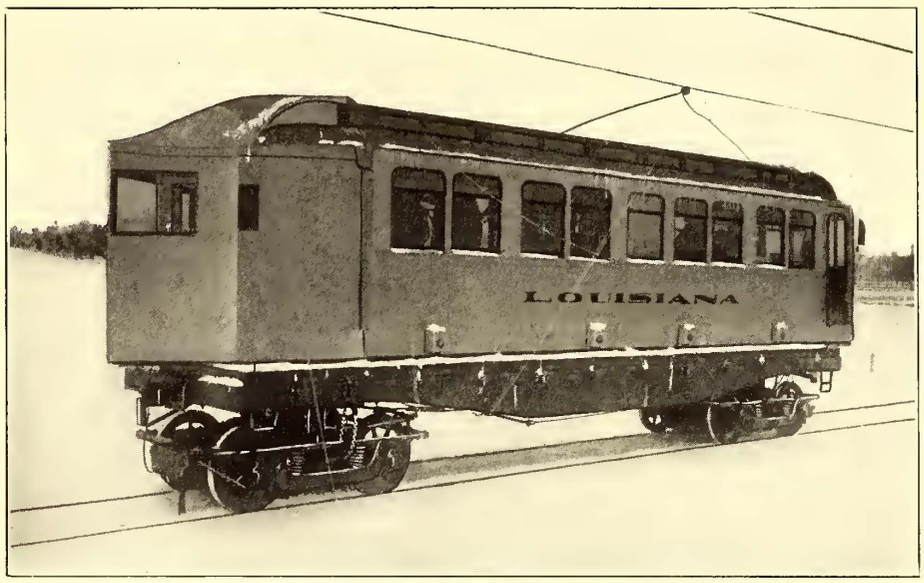
Seriously, car ventilation is a very troublesome matter indeed, and there is more excuse for defects in the case of cars than in that of a public edifice. We do not wish to discourage invention or to pose as alarmists, but we are strongly of the opinion that to ventilate adequately a closed street car without grave danger from drafts is impossible during the rush hours. The condition of affairs is this: In a car less than 8 ft. high and containing, say, 1500 cu. ft. of space when empty are from fifty to eighty human beings with breathing apparatus in full action. The only chance for ventilation is through apertures in or near the roof within 2 ft. of the heads of the standing passengers, or else to take the air in through the heaters. With the latter method the amount of air that can be introduced when the car is full is very limited, and at best it comes from near the surface of the street. The correct principle is perhaps thus to draw in air over the heaters and to discharge it from the top of the car, but as a matter of practice we do not believe it can be made really effective when the car is full, as it is at certain hours of the day. It can do something, but not very much, in view of the very limited air space in the car and the obstruction to air flow offered by the passengers. Pure air gets in through the doors when they are opened, and that is about all. Roof ventilators take in air rather than let it out, and thus impede circulation over the heaters.

Doubtless something could be done by forced ventilation from fans, preferably driving out air at the top of the car, but only by using blowers of considerable power, and ventilation by their aid would be effective principally at the time when it is least needed—that is, when only a moderate number of passengers is aboard.

Some time since we suggested the use of forced draft to blow out cars at the end of the trip. This would not, of course, furnish fresh air in transit, but it would at least enable the cars to start in thoroughly ventilated and would relieve some of the very unpleasant features of overcrowding. Two or three minutes vigorous use of a 2-ft. hose would freshen up a car and clear it of bad air and dust in a wonderfully effective manner, and even though the process could not be repeated at every trip, it would be of real service to apply it as often as opportunity offered. The fact is that when cars are as crowded as they usually are at the rush hours, the most that can be done is to help the ventilation a little, to apply remedial measures, and to look forward hopefully to weather when the windows can be opened. One has only to ride in a crowded, closed car, even with the windows put down, to realize the difficulties of effective ventilation. There is no panacea at all available. We should like to see the use of ventilating fans to keep the air moving tried, but we are not over sanguine as to the practical results. If the air is changed fast enough to be of much use, half the passengers will kick over the drafts about their necks, and the other half will complain of air about their feet. The space is too small and the people are too many for thoroughly effective ventilation.

RECENT WORK OF THE ELECTRIC RAILWAY TEST COMMISSION

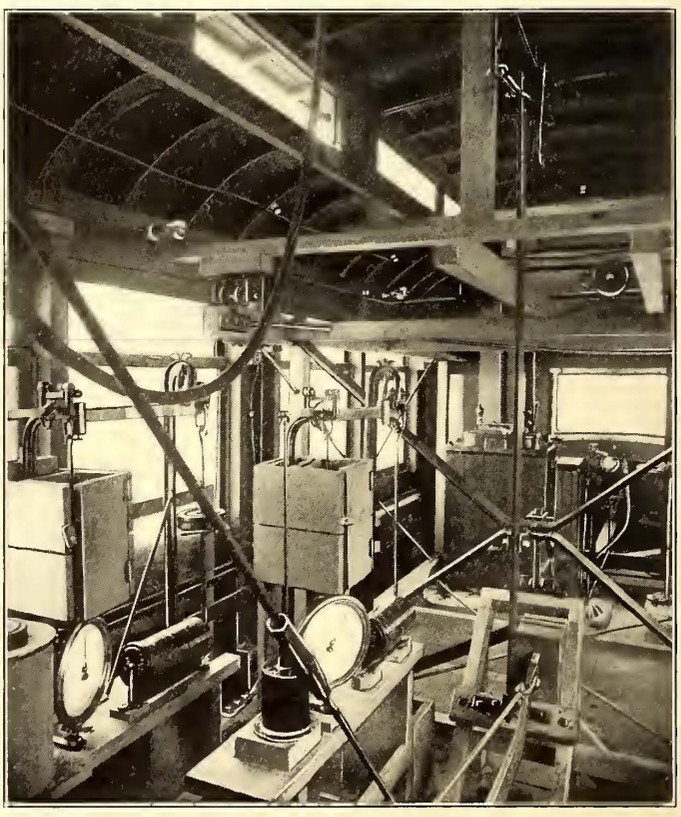
The field work of the commission approaches completion, the test corps now being at work upon the lines of the Indiana Union Traction Company investigating the problem of air resistance in the motion of car bodies. As will be remembered, the commission, consisting of J. G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and G. F. McCulloch, was appointed over a year ago by President Francis, of the Louisiana Purchase Exposition, in consultation with Prof. W. E. Goldsborough, chief of the Department of Electricity. The commission immediately began preparation for tests at St. Louis and elsewhere, and early in the summer actual testing was begun. A test corps of ample size, selected from various technical schools, has been at work making such tests as were recommended by a number of engineering committees appointed by the commission to act in an advisory capacity. The tests have comprised studies of the alternating-current losses in rails; of the efficiency of various methods of braking and accelerating, both for city and interurban cars; of the energy consumption in cars with different kinds of service, and of the resistance offered by the air to the motion of cars at high speeds.



WIND TEST CAR WITH WEDGE-SHAPED VESTIBULE

While the earlier part of the work has been described in some detail in the technical press, but little has been said regarding the special dynamometer car designed and constructed for the purpose of measuring directly the head and rear pressures and the side and roof resistances of car bodies. This car was recently completed at the shops of the Indiana Traction Company at Anderson, Ind., this company having co-operated heartily in the rather tedious work incident to an experiment of this sort. The equipment for the car was secured partly by loan and partly by purchase of supplies through funds donated to the work by various electric and steam railway companies and by engineers interested in the investigation of important railway problems. The Indiana Union Traction Company, in addition to the facilities offered in its shops and offices, placed at the disposal of the commission a pair of high-speed Baldwin trucks and a set of four Westinghouse No. 85 motors, rated at 75-hp each. The Baldwin Locomotive Works made the changes in the center plates and side bearings of the trucks necessary to enable them to turn freely under the frame of a steel flat car loaned by the Pressed Steel Car Company. A motor-compressor of ample size, with governor and brake cylinder, was furnished by the National Electric Company, and the test corps designed and constructed the special brake rigging necessary to adapt these to the steel car frame. A powerful hand-brake rigging was also constructed, with the Peacock brake drums supplied by the National Brake Company. Special bumpers were constructed to prevent damage to other cars in coupling, and heavy chains were used to prevent excessive motion of the car frame with respect to the trucks. As the frame was raised considerably above its usual height by the changes mentioned, this was considered desirable.

The dynamometer equipment, consisting of an interurban car body, 32 ft. long, without vestibules, rolls freely upon rails screwed to the flat car floor. This body, with a special steel vestibule and a standard vestibule, was supplied by the J. G. Brill Company. Under the side sills of the dynamometer body are mounted eight Chapman double-ball bearings, and these carry four axles of 3 7-16 ins. diameter, 9 ft. long. Upon the axles are specially chilled wheels, 12 ins. in diameter, with ground treads. The rails are also ground where they come into contact with the wheels. By this method of mounting there is, for practical purposes, no friction between the body and the flat car floor. The body is restrained from excessive motion by various effective safety devices. The pressure of the air upon the body is measured by means of scale beams, constructed for the tests by Fairbanks, Morse & Company and loaned by them. The beams are supplied with dash pots, and the weighing mechanism consists of the regular beam with weights and poise, and, in addition, a spring balance with dial is employed to render easier the manipulation of the machine.



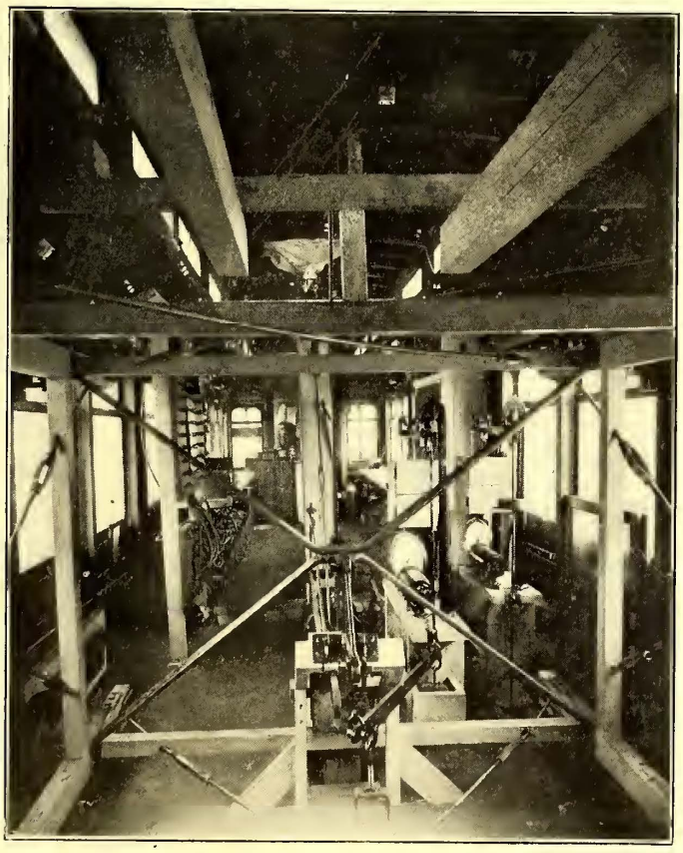
INTERIOR OF WIND TEST CAR LOOKING FORWARD FROM THE MIDDLE

A successful plan has been carried out on this car for the

purpose of separating the head and rear resistances from the total. The vestibule is independent of the body, but is carried therefrom by means of a link suspension. In order to guide the vestibule and to transmit the pressure to the weighing device, a steel-trussed oak frame, attached to the vestibule, projects into the car a distance of 8 ft., and it is guided on all sides by small Chapman bearings. This method of suspension has proven very satisfactory. In order to secure stability of the vestibule and body, each of these is held against the scales by counterweights, the forces of which are transmitted through bell cranks and levers, all equipped with knife-edge contacts.

In order to eliminate from the measurements all forces but those due to the air, the controllers are mounted upon iron stands carried upon the flat car floor and projecting into the car body, thus removing the effect of stiffness in the controller cables, a serious matter in a car of this size. Similarly, the trolley base is inside the car, carried upon the top of an oak post which projects upward from the flat car. No error is possible, therefore, from the resistance between trolley wheel and line wire. While the forces mentioned are small in amount, the sensitiveness of the apparatus is such that the precautions taken are necessary.

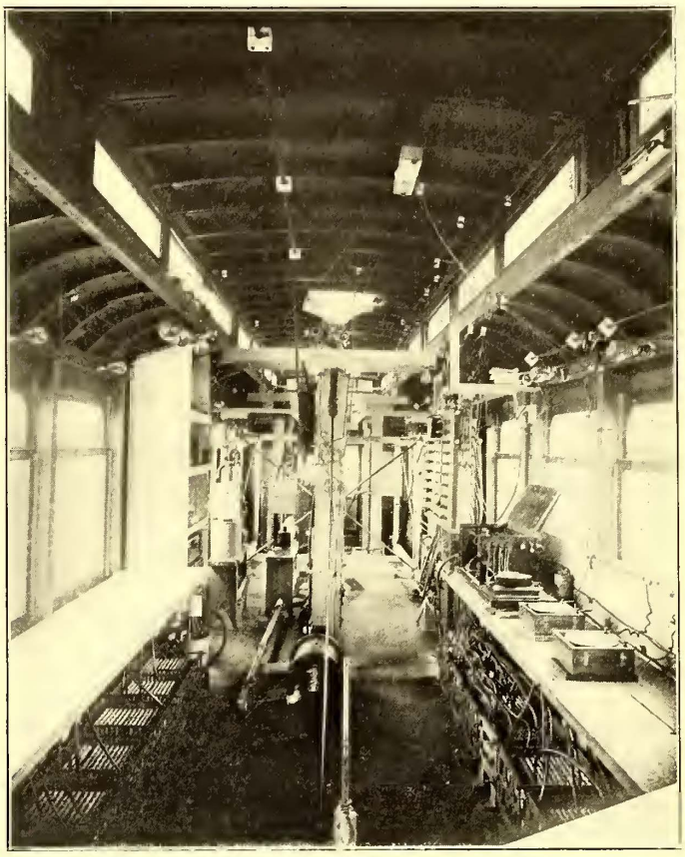
The construction of the air resistance car was carried out by the test corps, which put in about three months in the actual detail work. This included the assembling of the equipment, the construction of the special brake rigging and other equipment, with the exception of the heavy steel and woodwork,



VIEW OF INTERIOR OF WIND TEST CAR FROM THE FRONT PLATFORM

which was done by outside parties from the funds of the commission. The corps also wired the car for a double-end controller arrangement, one controller of the Westinghouse "L-4" type being loaned by the traction company, the other by the Westinghouse Company, the latter also supplying a pair of circuit breakers and a large number of resistance grids for controlling the running speed of the cars.

The commission has realized the necessity of making exact measurements of all of the quantities involved in these tests, especially in regard to the matter of speed. For this purpose two independent plans are employed. The test track, somewhat over 25,000 ft. in length, is divided in sections of 1000 ft. each. The sections are marked by large signs plainly numbered. The instant of passing each sign is indicated on the graphical record of a General Electric recording ammeter, which is also used for the current record. This ammeter records upon a strip of paper regular intervals of five seconds each. Upon this record is superimposed the time of passing each of the



VIEW OF INTERIOR OF WIND TEST CAR FROM THE REAR PLATFORM

section signs, this being accomplished by closing a switch for an instant as each of these signs are passed. Thus the time of passing through a section of 1000 ft. is accurately recorded.

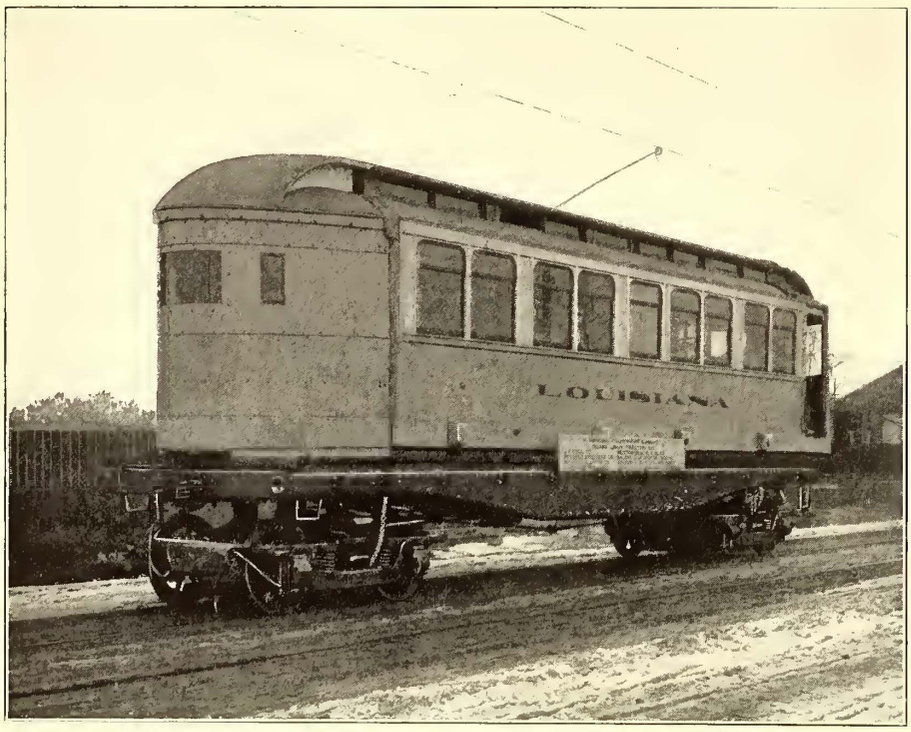
The second speed device consists of a small dynamo carried upon the truck frame and geared to the car axle by sprocket wheels and chain. This dynamo is an Apple igniter of the Dayton Electrical Manufacturing Company. It has permanently magnetized field poles, but these also carry exciting coils through which the field current of the recording ammeter is also passed. As this current must be maintained accurately at a value of 1 amp. for current measuring purposes, it is admirably adapted for the purpose mentioned. The electromotive force generated by the dynamo is read upon a Weston voltmeter specially arranged for this purpose. The electromotive force at 60 m.p.h. is about 7 volts. The readings are directly proportional to the speed. This apparatus has now been in operation for some weeks, and has demonstrated its accuracy and convenience.

In addition to the speed measurements, accurate readings at five-second intervals of motor electromotive force are recorded, and the current record is continuously checked by means of a direct-reading ammeter in the same circuit. The direction and velocity of the wind are also taken at frequent intervals, accurate anemometers having been supplied by Queen & Company for the purpose.

The tests on the "Louisiana," as the air-resistance car has been named, will continue until sufficient data are at hand to determine the resistance to the motion of different shapes of

car front at all speeds reached by modern interurban cars up to 70 m.p.h., this limit being set by the line and motor capacities. A speed of 72 m.p.h. has been reached for a short period.

During the past few days another important investigation has been completed by the use of a car exhibited by the Cincinnati Car Company at the Exposition. This car is supplied with the same motor equipment as the "Louisiana," but it has, in addition, the latest type of Westinghouse electro-pneumatic control. The tests made upon this car were designed to supplement those previously made, and to supply important data, not only in regard to the control system, but having reference in general to heavy interurban car operation problems. An interesting feature of these tests was that all records were taken autographically, a special recording table having been constructed along the line of the experience gained at St. Louis. A wide strip of paper is carried by motor power across a glass table, on opposite sides of which the observers are stationed with their instruments. Opposite each is a guide and pencil carriage, the latter of which is operated by a cord carried over a drum attached to a pointer over the instrument needle. The observer simply follows the motion of the needle with his pointer and the result is recorded. The base line for each record is traced by a separate pencil carried by an electromagnet through which passes the current from a time-marker recording five-second intervals, thus synchronizing all of the records. While somewhat similar to other recording apparatus in use, this equipment was designed independently and has some features of its own.



WIND TEST CAR WITH PARABOLIC VESTIBULE

The results of all the work of the commission will be published in full in a report to be issued as soon as practicable after the completion of the work.

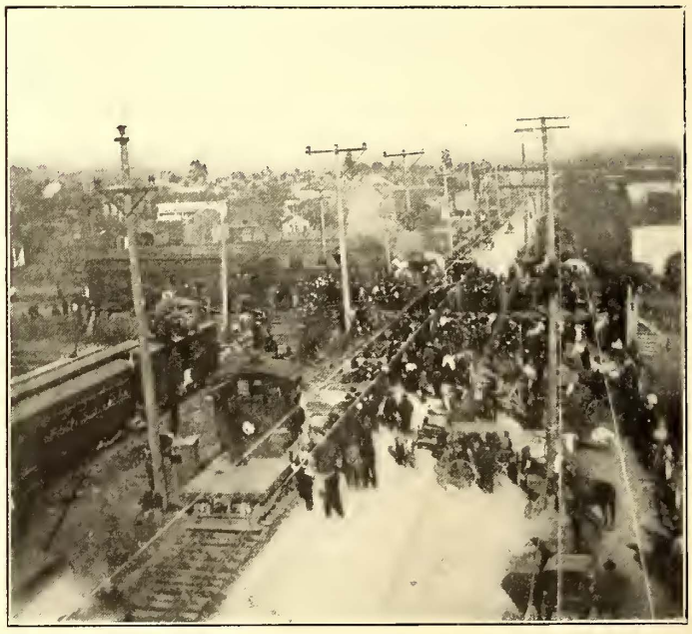
The Fort Wayne & Wabash Valley Traction Company, in connection with the Indianapolis Northern Traction line, has begun through service between Fort Wayne and Indianapolis, with Peru the connecting point. The company will run three limited cars between Fort Wayne and Peru daily, and these are to connect with the limited service now in force between Peru and Indianapolis. The distance of 130 miles is being covered in five hours. The fare for the trip is $2.20.

TICKETS AS A PRIZE IN A GUESSING CONTEST

The West Pennsylvania Railways Company, of Connellsville, Pa., has inaugurated a novel guessing contest. To the first passenger guessing nearest the number of miles run by the passenger cars of the company during the month of March, 1905, will be given a book of tickets good for 100 rides on any line of the system. Guesses must be made on coupons cut from "Trolley Talk," properly filled out and in the company's hands on or before April 1. Employees of the company are not to compete. Announcement of the winner will be made in "Trolley Talk" for April.

DRAMATIC CROSSING FIGHT

There was a struggle at Santa Rosa, Cal., on March 1 over a railroad crossing that lasted several hours and was dramatic in the extreme. An injunction had been obtained by the California Northwestern Railroad to prevent the Petaluma & Santa Rosa Electric Railway from crossing its tracks on Sebastapol Avenue, Santa Rosa. In deference to this order, the electric railway company postponed building the crossing until the case had been disposed of in the courts. On March 1 an order was handed down doing away with the embargo. The electric railway company proceeded to carry out the work, but met with opposition from the Northwestern, which drew up locomotives on either side of the crossing and so harassed the laborers of the electric railway that they had to desist many times. Hand to hand encounters between the contesting interests were not infrequent. The view herewith shows how effectually all operations were blocked by the steam locomotives, and gives an idea of the intensity of the interest shown by the public. Finally, President Foster, of the Northwestern, informed of the action of the court, ordered the locomotives and the flat cars to be withdrawn.



LOCOMOTIVES AND FLAT CARS OF THE CALIFORNIA NORTHWESTERN RAILROAD BLOCKING THE CROSSING

CAR LIGHTING AND VENTILATION

BY JOHN P. FOX

The recent editorials in the STREET RAILWAY JOURNAL on car lighting and car ventilation are very timely, and improvements along the lines suggested would seem well worth trying as added inducements to make people ride. It seems curious that the naked incandescent lamp is still the rule. But it is one of those survivals that go with an early developed industry, which the newly sprung up English roads have avoided. Economy often limits the English interior lighting in the number of lamps, but the colored shades, pear-shaped globes and prism or cut-glass globes tend to increase the efficiency of the light, as the editorial points out. Fig. 1 shows the interior of a Manchester car; Fig. 2 of a Leicester car. Recent City & South London cars present very attractive lighting, as seen in Fig. 3, colored photographs of railway scenery being the only advertisements used. Fig. 4 illustrates the interior of a prism globe with two lamps; Fig. 5 shows the exterior. The lowness of English ceilings, as required in double-deck cars, has led to a common use of white millboard or lincrusta. This has the effect of lightening up the interior very much and adding to the effective illumination.

FIG. 1.—INTERIOR OF CAR IN MANCHESTER, SHOWING PRISMATIC CEILING GLOBES

On the Continent bare electric lights are the rule, as in the Berlin surface car, Fig. 6, which has a white ceiling. The cars of the Berlin Elevated and Underground Railway have admirably placed lights over the longitudinal seats, with cut-glass globes, as already illustrated in the JOURNAL, June 4, 1904, pages 845-846. Berlin surface cars have an ingenious arrangement for detecting burned out lamps, consisting of a test lamp with two projecting rods, which can be quickly slipped into holes in the base of each lamp, making all unscrewing unnecessary till the broken filament is discovered.

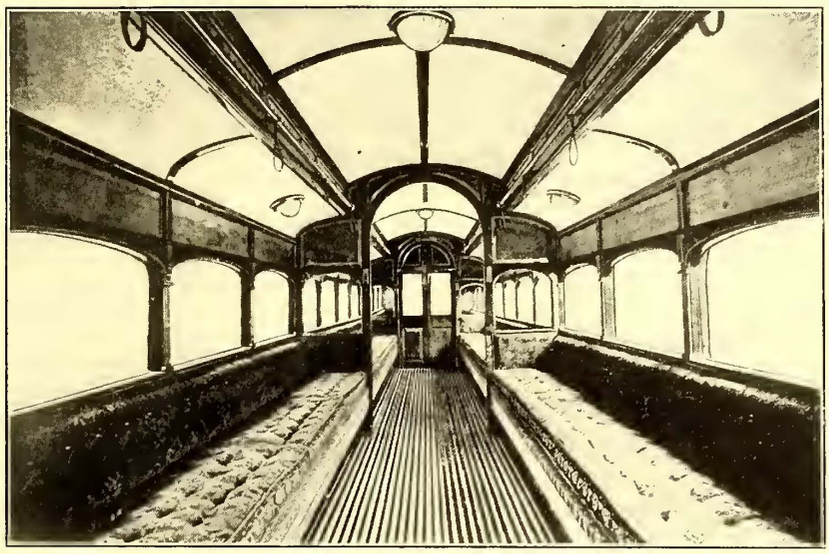


FIG. 3.—INTERIOR OF CITY & SOUTH LONDON TUBE CAR, WITH PRISMATIC CEILING AND DECK GLOBES

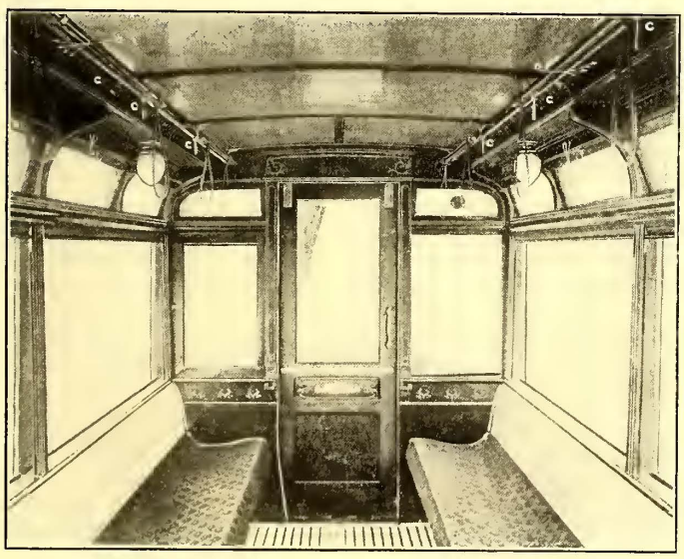


FIG. 2.—INTERIOR OF CAR IN LEICESTER, SHOWING PEAR-SHAPED GLOBES AND VENTILATION DUCTS

For an example of lamps with frosted globes, a very effective treatment is shown in Fig. 7, representing the interiors of the King's and Queen's compartments of a London & South Western royal saloon car. The elliptical ceiling, in spite of certain advantages and attractions, has never gained a foothold in this country on steam or electric roads, perhaps because it has not been thought consistent with sufficient ventilation. But the Pennsylvania Railroad has permanently closed its deck sashes to keep the rain out effectively, using globe ventilators in the ceiling for air outlets. It would be a great improvement if

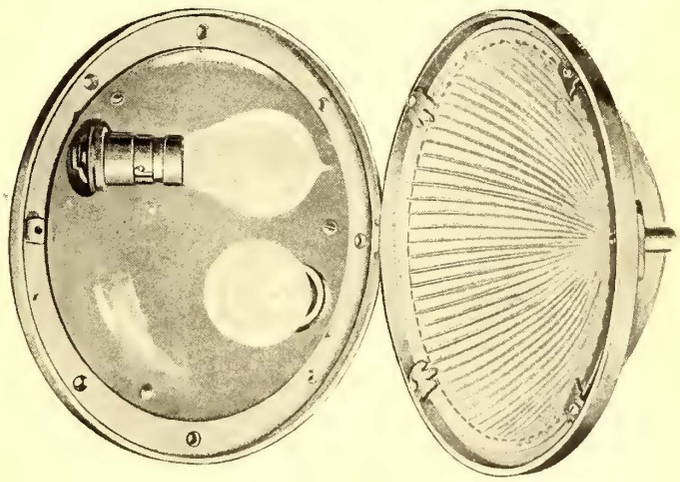


FIG. 4.—PRISM GLOBE, OPEN, WITH TWO LAMPS

something as effective as the Pennsylvania ventilating system, illustrated in Fig. 8, were applied to electric cars. In this well-known system, the motion of the train forces air down a duct in two corners of a car, then horizontally in ducts along the floor, where the air is heated by steam pipes, passing out under every seat toward the aisle and avoiding drafts. There are no exposed steam pipes, all being enclosed in the ducts, and the system is always effective, except with a standing train in summer, when the spring balanced windows can be easily opened. Moisture entering would drip out at *A*. It may be doubted whether this system would furnish enough air with electric cars, except where the latter are run at high speeds with few stops. Car air is usually the worst at rush hours, when the speeds are the lowest and when the direction of the wind might prevent all ventilation if it was the same as the car. Electric fans seem the only sure device, especially if downward ventilation is desired, and the addition of one or two fans would hardly seem to add much to the necessary complication of a modern car. According to a test made by a street railway company several years ago, it took 35 per cent less current to heat a car if some of the current were diverted to a fan blowing outside air through the heaters; and further experiments along this line would be very interesting. Even with present arrangements, the most crowded city cars can be kept satisfactory to most passengers if a little trouble is taken, as is the case in Boston, where various deck ventilators have been tried in the elevated trains, and tests for carbon dioxide in both surface and elevated cars have shown good and improving conditions, due to the care of the management.

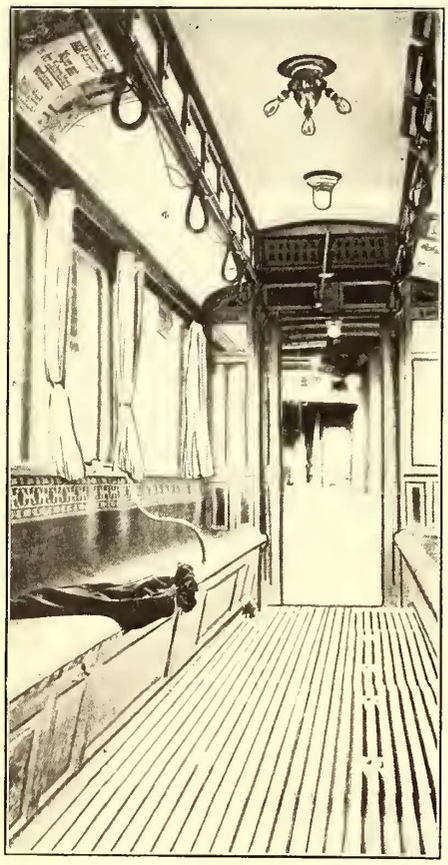


FIG. 6.—INTERIOR OF BERLIN ELEVATED AND UNDERGROUND CAR, WITH VENTILATING DUCTS IN END MONITOR PANEL

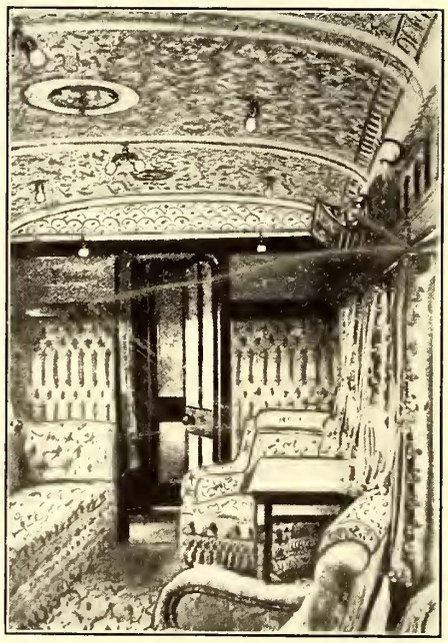


FIG. 7.—COMPARTMENT IN ROYAL PRIVATE CAR, LONDON & SOUTH-WESTERN RAILWAY, SHOWING EFFECT OF ELLIPTICAL CEILING AND FROSTED GLOBES

As to foreign ventilating methods, the latest English practice was described in the JOURNAL for June 4, 1904, page 838, and for Aug. 29, 1903, page 388. The ventilator sashes, as shown at *A*, Fig. 2, are usually hinged at the bottom so as to prevent downward drafts from the incoming air and to exclude rain. The fresh air then passes into the car through the inlets marked *BB*. The outlet for the foul air is provided by a recess made in the roof of the car marked *CC*, which is just above the hinged window referred to. The circulation of the foul hot air through this recess to the outside is shown by the arrows marked *DD*. Some double-deck cars, as in Manchester (Fig. 1), and also on the Continent, have monitor roofs under the upper floor. The forward sashes of the Liverpool cars are pivoted vertically in the middle, so as to open out and force air in, the rear ones drawing air out, besides which there is a sliding panel in the top of the doors. Many of the Berlin cars have ventilators in the ends of the monitor roofs, as in Fig. 6, controlled by a long handle to allow easy adjustment. The surface cars of the Berlin elevated road, besides the end ventilators in the roof, have the side sashes hinged vertically and open out, so as to force air in at the front end and out at the rear, just as with the elevated cars.

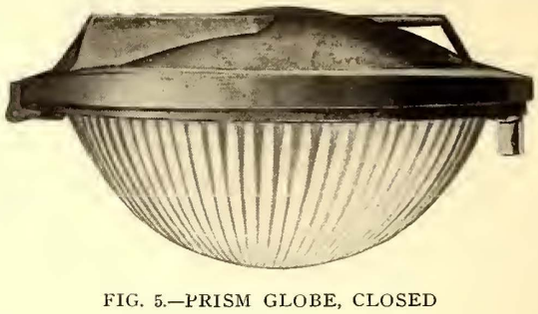


FIG. 5.—PRISM GLOBE, CLOSED

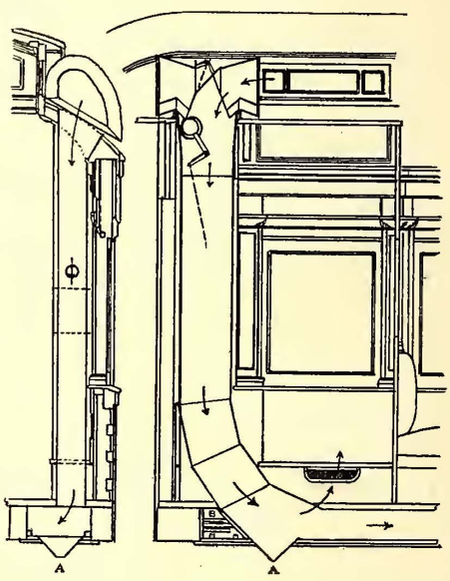
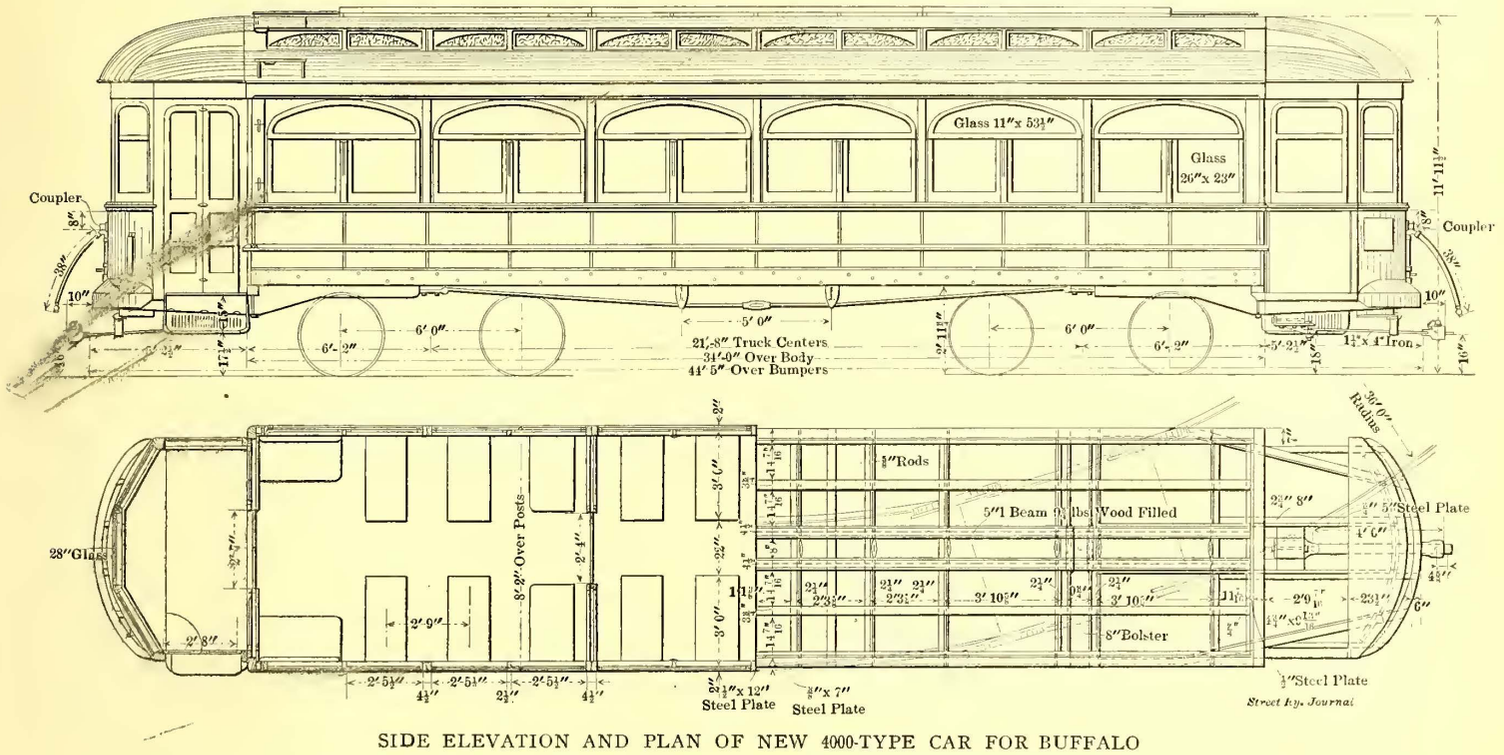


FIG. 8.—SECTIONS SHOWING METHOD OF VENTILATION ON PENNSYLVANIA RAILROAD CARS

New mileage books have just been issued by the Indiana Northern Traction Company, the line between Wabash and Marion, which are interchangeable with those of the Fort Wayne & Wabash Valley Traction Company. The new books, like those on the east and west interurban roads, retail at $8 for each 200 5-cent rides, making a reduction of 20 per cent. So far there has been no further move in making interchangeable mileage on all Indiana interurbans. This has been discussed, and at a recent meeting was recommended, but has not yet been done. The movement of the two roads means that they are ready to be the pioneers in the interchangeable mileage plans.

NEW 4000-TYPE CAR FOR BUFFALO

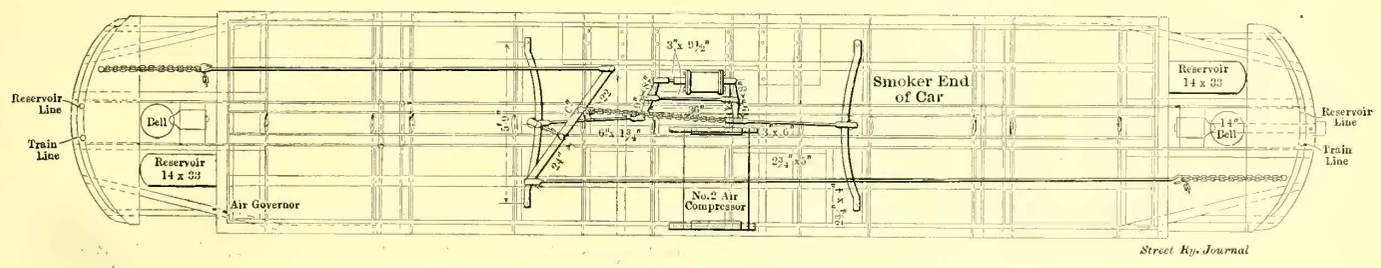
The International Railway Company, of Buffalo, has recently placed in service between Buffalo, Niagara Falls and Lockport a new type of car, known as the "4000-series," embodying a number of new ideas in car construction. The cars were built at the shops of the J. G. Brill Company, the order as placed calling for twenty-three motor cars and twelve trail



SIDE ELEVATION AND PLAN OF NEW 4000-TYPE CAR FOR BUFFALO

cars, the details of design for the motors and trailers being similar, with the exception of the electrical equipment.

The following are the general dimensions for this type of rolling stock: Length over body, 34 ft.; length over vestibules, 43 ft. 5 ins.; length over bumpers, 44 ft. 5 ins.; width over posts, 8 ft. 2 ins.; width over sill plates, 7 ft. 11 ins.; height from bottom of sill to top of roof, 8 ft. 11½ ins.; height from



ARRANGEMENT OF BRAKE RIGGING FOR HAND AND AIR BRAKES

rail to top of roof, 11 ft. 11½ ins.; width over guard rails, 8 ft. 5¼ ins.

The conspicuous features of the design include the following: The body has six sets of windows on each side, the two lower sash and one stationary transom sash extending the full length of two lower sash in each set, giving a wide window similar in general appearance to that known as the Pullman type of window. The bottom sash of each window is designed to be raised into the upper part of the side of the car, there being 4 ft. 3 ins. clear from top of floor to lower edge of bottom rail of sash when window is raised. The space below the sash rail is paneled with 7-16-in. whitewood, the upper panel being convex and the lower panel concave. There is an enclosed vestibule at each end of the car, with double folding doors at diagonal corners of car, the vestibule having four windows, three of the sash being designed to drop. The roof of the car is of the monitor type, with steam coach hoods, the hoods being detachable and covered with No. 18 steel plates. There are twelve ventilator sash on each side. The glass in each pair of sash forms a half-ellipse to correspond in appearance with the transom sash in side of body.

BOTTOM FRAMING

The outside sills are of long leaf yellow pine, 3¾ ins. x 7¾ ins., running full length of car body. The sills are plated on the outside with a ⅜-in. x 6-in. plate of steel, full length of body, kept flush with bottom of sill, and on the inside with a ⅜-in. x 10-in. plate of steel running full length, but kept up 1 in. from bottom of sill. There is also an inner or sub-sill of yellow pine, 1¼ ins. x 5 ins., to receive tenons in cross framing, all securely bolted together with ½-in. button-head bolts. Both plates and wood were painted with one heavy coat of mineral paint before they were bolted together. There are two stringers of yellow pine, 2½ ins. x 3¾ ins., gained into the cross framing.

END SILLS

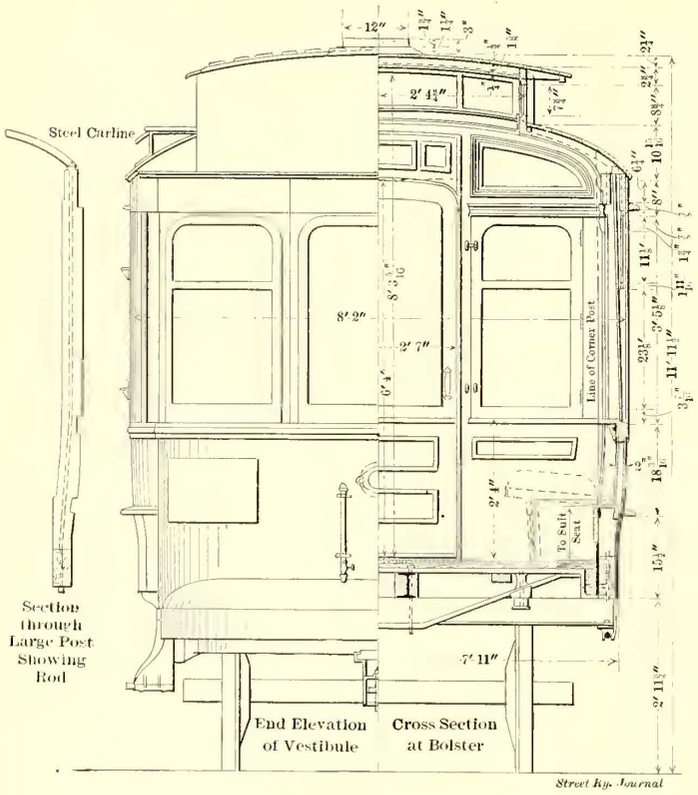
The end sills are of white oak, 4¾ ins. x 8 ins., with sub-sill, 4¾ ins. x 2 5-16 ins., extending full width of bottom frame and double mortised at ends to receive ends of side sills. There is a ½-in. x 5-in. steel plate extending to each side sill and turned 8 ins. at ends, and securely bolted with four ½-in. bolts at each corner to inside longitudinal plate, the two bolts nearest angle passing through the steel plate only, the other two bolts passing through side sill and longitudinal plates, with head on outside. There are short sub-sills, 1¾ ins. x 5 ins., bolted inside, to receive ends of stringers and flooring.

CROSS FRAMING

The cross framing is 2¼-in. x 5-in. oak timber, double tenoned into the sills. A space ½ in. deep and just wide enough to allow brake rod to work over needle beams is cut in part of cross framing.

CENTER SILLS

The center sills consists of 9¾-lb. I-beams, filled on each side



CROSS SECTIONS, BUFFALO CAR

with yellow pine or oak to make up a total width of 4½ ins. Each end of each I-beam is fastened to end plates with two angle plates, ⅜ in. x 4 ins. x 6 ins. x 6 ins., riveted to I-beams and bolted through the end plates and sills, there being a ⅝-in. cross tie-rod passing through bottom frame at each cross bar with button-head on outside and turnbuckle in center. The center sills were kept down ⅝ in. and have a ⅝-in. nailing strip on top. The I-beams and filling space were given a good coat of mineral paint before being put together.

BODY BOLSTERS

The upper plate of the bolsters is ⅝-in. x 8-in. steel. The lower plate is I-in. x 8-in. steel. The depth of truss was governed by height of truck center plate so as to give a clearance of 36 ins. from top of rail to under side of sill, with weight of car body on trucks.

NEEDLE BEAMS

The needle beams are of 5-in. I-beams, weighing about 12 lbs. to the foot, with suitable malleable cast struts on ends to receive truss rods. The needle beams are placed 5 ft. center to center.

UNDER TRUSS RODS

There are two under truss rods, consisting of 1⅛-in. round rods placed under side sills, extending from bolster to bolster, with 1¼-in. turnbuckle centered between needle beams, the distance from under side of sill to top of the truss rod at its lowest point being 7½ ins. The ends of truss rods are connected with a ⅞-in. pin to a ¾-in. x 3-in. wrought-iron strap, which is securely fastened to the bolster and side sill.

INSIDE TRUSS ROD

There is also a ⅜-in. x 2-in. inside iron truss rod with ⅞-in. round ends, supported at the bolsters by suitable wrought-iron straps fastened to post by gaining and screwing. The ⅞-in. round ends pass through side sills near the end sills and through a suitable malleable cast-iron washer, with bearing for nut at right angles to rod, this rod being kept up as high as possible on inside of car.

BODY FRAMING

The corner posts are 3¾-in. x 6-in. white ash, tenoned into end sill and fastened thereto with a strap bolt. The door posts each have a vertical ⅜-in. round rod grooved into it and passing through end plate and end sill.

A unique feature is the method of strengthening the side posts. The large side posts, which, as will be seen from the drawing, occur between each set of windows, are of white ash and consist of two halves, each half 2¼ ins. thick, the halves being grooved on the inside to take a ½-in. square rod which passes vertically through the center of the posts and is bent at a slight angle, as shown on one of the detail drawings. This rod is to prevent side of car becoming bulged out after being in service for a time. These vertical rods have round ends and pass through the side sill at the bottom and through the steel carlines at the top. There is a nut at the bottom of each rod, so that if the side of the car gives evidence of getting out of line the nuts can be screwed up. It will be evident that the slight angle of these vertical rods gives them the effect of a truss rod, and by tightening the nut at the bottom the sides of the car can be drawn inwardly. The two halves of these large side posts are glued and screwed together, with the square rod between them. The small or intermediate side posts are of white ash, 2¼ ins. thick, tenoned and fastened to sill with strap bolts.

BOTTOM FRAMING OF VESTIBULES

The vestibule platforms are carried on platform knees made

NEW 4000-TYPE BUFFALO CAR

of white oak, 2¾ ins. x 8 ins. The outside knees are reinforced by 3-in. x 4-in. x ½-in. angle iron, extending, as shown in one of the drawings, and bent to the shape of under side of knees. The two inner knees are of white oak, 2¾ ins. x 8 ins., each knee reinforced by a steel plate, ¾ in. x 5 ins., bent, as shown on detail drawing, and securely bolted to center sills of car and knees. Each knee is hung with two ¾-in. bolts passing through end sill and through a plate of iron placed transversely on under side of platform knees, of sufficient strength to carry weight of vestibule without bending. A ⅜-in. x 2½-in. plate is sunk into

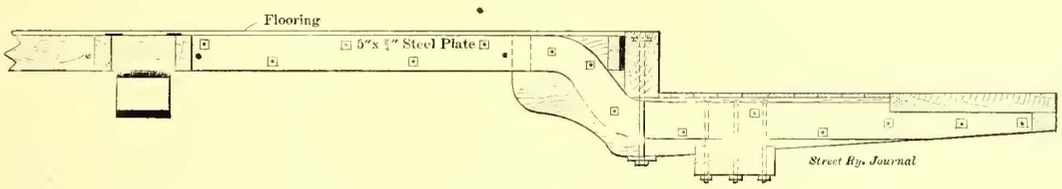
the upper edge of end sill under heads of bolts, and of sufficient length to form a bearing for both bolt rods at the same time. Across the under side of both center knees is fastened a piece of white oak, 4½ ins. x 11 ins., to which is fastened the company's standard draw-bar pocket of wrought iron, especial care being taken to make this strong enough to stand the strain of pulling a loaded car weighing 25 tons without breaking.

The end platform sill is white oak, 2¾ ins. thick. The buffer is ⅜-in. x 3½-in. x 6-in. angle iron, bent to shape of vestibule. The round side of the vestibules below the sash rail are covered with No. 14 steel plate. Each vestibule has one folding door arranged to fold back against the front of vestibule.

The end doors to the interior of the car are single sliding doors with drop sash. In each case the door is arranged to slide away from the open side of the vestibule, so that the door when open does not interfere with a clear vision of the step from the inside of the car.

The car has a smoking compartment divided from the main compartment by a double partition having a single sliding door.

The windows are fitted with the O. M. Edwards sash fixtures. All side and end windows have curtains of pantasote, mounted on Hartshorn spring rollers and fitted with the Curtain Supply Company's fixtures. The seats are the Hale & Kilburn 3-ft. cross seats, with high roll-back and finished in dark green, giving a 22-in. aisle down the center of the car. At each of the four corners there is a short longitudinal seat. It will be noticed from the drawing that advantage is taken of the slight bend in the side posts to gain all the advantages of a wider car, inasmuch as the cross seats fit into the angle of the posts, thus permitting a full-sized seat without encroaching upon the aisle space. The car is fitted with electric heaters of the Consolidated Car Heater Company's manufacture. The heaters are of the truss plank type, extending full length of car on each side, with the exception of under the end seats, where panel heaters were used.



MANNER OF APPLYING REINFORCING PLATE ON PLATFORM KNEES

The car is equipped with General Electric type M multiple-unit control, with four GE 74 motors to each car, giving an aggregate of 260 hp in motor capacity. The body is mounted on Brill 27 double trucks of the M. C. B. type, with 6-ft. wheel base. The axles are forged iron, 5½ ins. in diameter in the body and 6-in. wheel and gear fit. The journals are 4¼ ins. x 8 ins., with M. C. B. boxes, using oil and waste for lubricating the bearings. The cars are geared to 60 m.p.h. The truck is fitted with steel-tired wheels, 33 ins. in diameter, supplied by the Railway Steel Spring Company.

Each car is equipped with brake rigging for both hand and air brakes. The air-brake equipment consists of the Christensen straight-air system with motor-driven compressors.

Another unique feature is in the arrangement to prevent persons from securing a foothold on the buffers. There is a piece of No. 14 sheet steel fastened to the buffer and dasher, as shown in the half-tone engraving, this sheet steel forming an angle of 45 degs. with the dasher. It is fastened to the buffer and to the dasher with ¼-in. stove bolts about 3½ ins. apart. It will be seen that it is practically impossible for a mischievous boy or other person to stand or sit upon this incline. The plans and specifications for this new type of car were prepared at the company's shops.

GERMAN IMPRESSIONS OF AMERICAN RAILWAY PRACTICE

During May and June last year, General Manager Koehler and Chief Engineer Peiser, of the Grosse Berliner Strassenbahn, visited the United States to see the St. Louis Exposition and inspect the railway systems of the large cities of the Eastern and Central States. The following are some of the comments on American street railway systems which they make in the February number of the "Zeitschrift für Kleinbahnen."

After referring to the principal railway exhibits at the Exposition, the writers praise in the highest terms the arrangements made by the two St. Louis companies for handling the World's Fair traffic. The writers, in describing the working of the American method of cash fares and registers, express the opinion that the American public would not submit to the annoyance of the European method of fare receipts, although they consider the American system open to numerous possibilities of fraud. The visitors were also greatly impressed by the elaborate transfer system.

In St. Louis a careful inspection was made of the shops of the St. Louis Transit Company. Messrs. Koehler and Peiser found many excellent devices in use, but criticise the arrangement of the buildings. As the woodworking shop is entirely separate from the main shop, which contains twenty-eight tracks, cars under repair must frequently be transferred from one building to another, causing inconvenience and delay. So far as the writers could judge, there was nothing in the shape of the property to make the present layout necessary. The paint shop is also badly located with reference to the other buildings. The car painting, which seems to have been of a superficial character, impressed them very unfavorably.

In Chicago nothing of special interest was found, but the travelers note that, despite the great size of its generating station, the Chicago City Railway Company's power costs 1¼ cents per kw-hour, not including interest and depreciation, a large amount compared with other American cities. They were greatly impressed with the general features and management of the Boston Elevated Railway Company's system. Comparing the latter with the Grosse Berliner Strassenbahn, they find that the operating expenses of the Boston company are nearly double that of the Berlin corporation, although the Boston mileage is only 9 per cent greater. The larger income per passenger, however, which the American company receives (4.99 cents, as against 2.31 cents) makes the payment of dividends possible.

The writers consider the conduit system used in New York to be very satisfactory, ascribing its success to the central position of the slot and the fact that the current collectors are always in the conduit.

The receipts of the Sheffield (England) tramways in 1904 were $1,148,197, an increase of over $34,065 over 1903; 62,579,866 passengers were carried and 5,658,926 car-miles were run during the year. The total number of cars is 247, an increase of 29 in the year. The average number of ordinary cars running daily is 139 and 58 special cars. There are over 64 miles of single track (excluding depots), and the total number of employees is 1386. The question of running motor omnibuses from some of the present outside termini to outlying districts has been considered, but as the corporation has not the power to run such vehicles under the existing acts it has been decided to apply for the necessary authority in the next Parliamentary bill.

FUSES VERSUS CIRCUIT BREAKERS FOR PROTECTION OF RAILWAY APPARATUS

BY EDWARD TAYLOR

There is probably no ordinary piece of electric railway equipment so commonly misunderstood as the fuse. It is doubtful if even one out of ten railroad men, except among the engineering staff of the company, really knows what is meant by a 200-amp. fuse. It is the popular opinion among the more intelligent classes of street railway employees that a 200-amp. fuse is one which will carry but 200 amps., and that when the current of the circuit in which it is placed exceeds that amount the fuse will immediately "go out," or "blow," thereby opening the circuit. As a matter of fact, all standard fuses should carry a current 5 per cent higher than their rating indefinitely, without excessive heating or "blowing out" taking place. This very important time element of a fuse is not usually understood to be a function in the calculation of the size of fuse that would be best adapted to a given circuit.

The general confusion among railway men upon this point probably arises from the greater familiarity of the average street railway man with circuit breakers and their action. A circuit breaker being set at any given amperage should, upon the current reaching that point, blow out instantaneously. The fact that the circuit breakers on street railway cars are set at a certain definite point, and that when the current of the car, for any reason, reaches this figure, the circuit breakers go out at once, is well known by practically all men connected with the operating or mechanical departments of street railways. The comparatively recent use of enclosed fuses, and the similarity of their purpose to that of circuit breakers, therefore naturally leads one not familiar with the subject to assume that the action is the same—that a fuse has merely, as a circuit breaker, a maximum current capacity and that any excess will open the circuit.

As a matter of fact, however, the action of the two protective devices is radically different. Not only does the blowing of a fuse depend upon the length of time a given current is carried, while the circuit breaker depends only upon the amount of current, but their performance in opening a circuit shows a marked difference. The circuit breaker in dropping out breaks the arc caused by opening the circuit almost instantaneously, causing often a severe inductive kick on motor circuits, while the fuse, in opening, allows the current to fall off gradually, owing to the fact that the arc which is formed burns itself out, with a constantly increasing resistance.

THE CIRCUIT BREAKER

To properly understand the action of both devices a knowledge of their construction is necessary. All circuit breakers used in equipping present railway cars are of the magnetic blow-out type, and have, essentially, a switching mechanism for breaking the contact in a magnetic field. This magnetic field is supplied by an electromagnet which is in series with the arc which it must break; consequently when a heavy arc is to be broken, there is a strong current and correspondingly powerful magnetic flux to disrupt it. When the arc is dissipated, the current, of course, ceases. The electromagnet used for blowing out the arc is also made use of to attract the moving armature attached to the trigger which holds the breaker in, or, in other words, which normally keeps the contacts of the switch together.

The operation of the breaker is therefore practically as follows: When the current passing through the breaker rises above a predetermined point, sufficient magnetism is set up to attract the armature, which carries with it the trigger, releasing the switch covering the contacts, which tend to fly apart, owing to the action of a spring. The point of opening is determined by the tension of a spring attached to the moving armature and acting against the pull of the electromagnet. Upon the switch opening, arcing ensues, but, as an arc cannot, as is well known, be maintained in a comparatively strong magnetic field, it is dissipated by the current passing over it and energizing the blow-out coil, whereupon current ceases to flow and the circuit is open. The quickness with which this takes place is best understood when it is remembered that in closing a circuit of 800 amps., where the circuit breaker is set at 600 amps., the needle of a deadbeat ammeter would have scarcely time to reach a point between 75 amps. and 100 amps. before the breaker blows and the needle drops back to zero. Consequently it is reasonable to assume that the action of the circuit breaker is instantaneous, as only a fraction of a second is lost in the operation.

FUSES

The inductive effect of this sudden opening of the circuit may be quite injurious to insulation or, on a motor circuit, cause trouble at the controller, especially if the motors are not designed to obviate or dampen this inductive kick. It is in this respect that a fuse has a great advantage over the circuit breaker. Upon the fuse going out the current tapers off gradually, reducing this inductive effect. This is true on either the enclosed or the open type of fuses, the essential difference between the two being that an enclosed fuse gives no outward manifestations of the action of blowing except on the indicator, while the open fuse in blowing displays various signs of disturbance, namely, violent discharge of vapor and volatilized metal, causing a pyrotechnic display, and in some cases letting go with a loud report. In street railway work it is of frequent occurrence for open fuses in going out to ignite adjacent woodwork, or for the arc to come in contact with the truck or iron frame work of a car, causing a short-circuit, with resultant burning and damage. They are also subject to deterioration from weather conditions. Notwithstanding these disadvantages, and the fact that the National Board of Underwriters has decided against bare copper wire for fusing purposes, owing to its relatively high point of volatilization, it is being used to a considerable extent in railway equipment, and consequently deserves discussion as to its particular advantages or disadvantages.

The principal reason for the use of the copper-wire fuse is its convenience, copper wire of various sizes being always at hand in the shops and upon cars. Being soft, it readily conforms to various positions and is easily handled, and as it has a high conductivity a comparatively small diameter can be used. The objections to its use, however, are many. In addition to the faults of all open fuses mentioned above, the high fusing temperature of copper is apt to give considerable trouble when it is used as a fuse, as copper melts at 1090 degs. C., while zinc fuses at only 418 degs. C. and lead at 320 degs. C. The high temperature of the molten copper is almost certain to ignite any inflammable material with which it comes in contact, while it also causes a more severe flash and report when, as usually occurs, the metal is heated to the point of volatilization. Copper, moreover, while it does not oxidize under ordinary conditions in the atmosphere, when heated in the presence of moist air, a condition repeatedly met with when it is used as an open fuse, oxidizes readily, and rapidly deteriorates in reliability.

THE ENCLOSED FUSE

For all of these reasons enclosed fuses of the type I shall describe are rapidly supplanting the use of the open fuse in almost every line of street railway work. The enclosed fuse has the advantage of being noiseless in its action, in having no display of flame or vapor, of being more reliable than the open, of being protected from the effects of weather and the atmosphere, and finally of being much safer to replace upon a live circuit, after one has been blown.

The construction of all standard types of enclosed fuses is essentially the same. One or more strips of zinc, or other metal with a low temperature coefficient, are held by suitable brass or

copper contacts, fastened to and enclosed by a fibre encasing tube. This tube (in fuses of recent construction) is lined with a thin sheet of asbestos paper to protect it from the heat and arcing that will occur on its interior; this sheet prevents the fibre from being burnt so that a great number of refillings can be made, which is an important factor, as there is a wide difference between the cost of refilling a fuse and its original selling price. Surrounding the fuse metal, and, in most cases, completely filling the tube, is a material composed of some insulating, heat-conducting substance, such as calcium sulphate, calcium carbonate, sand, etc. This filling is usually powdered or granular, and serves the threefold purpose of absorbing the heat generated within the metal, of retaining the molten particles, either by uniting chemically with them or by simply extracting the heat therefrom, and of destroying either the continuity of the line of molten metal, thus opening the circuit, or the conductivity of the same, which gives the same result.

Zinc is the most commonly used metal for the fuse strip, as it more completely volatilizes at a comparatively low temperature and its vapor is more easily absorbed by the filling material. These zinc strips are usually cut away or made weaker at the center, so as to centralize the arc, keep it away from the terminals, etc. The cutting away or notching of this strip is a considerable factor in the time element of the blowing out of the fuse, in the temperature of full load, etc. The end structure of the fuse is usually bored or sawed in such a manner as to permit free egress of the gases generated at the time of blowing.

These holes for ventilation, above mentioned, have until quite recently tended to produce a condition which has in a number of cases called down upon this type of fuse severe criticism of its deportment, inasmuch as these apertures have formed a passageway to the interior of the fuse for moisture, which is collected and held in mechanical suspension by the necessarily absorbent nature of the filling. Where the filling has been found to contain large amounts of moisture the performance of the fuse has been found to be unsatisfactory; in some cases it causes the emission of sparks and vapor at the terminals, and in others causes a burning of the tube, while, if the moisture is excessive, the fuse may be completely short-circuited and its usefulness destroyed. This difficulty will in the future be, in a measure, done away with, for the manufacturers have experimented with a view to lessening this trouble, and find it advisable to cover the holes for ventilation with a thin piece of glazed paper. This serves to exclude moisture from the fuse interior while still maintaining the ventilating features; when gas is generated on the interior of the fuse during blowing, its pressure easily ruptures the paper and blows it out laterally, leaving a ready path for the egress of gas or vapor.

The general construction and arrangement of all types of enclosed fuses is thus seen to be very similar, but until very recently there has been no effort made to secure uniformity of different makes as to styles of terminals, sizes, ratings, etc. Each manufacturer had his especial type of terminal, which fitted his own fuse block, and no others; each one had an arbitrary rating for the various sizes of fuse used. It can, of course, be understood that the latter point is one on which it is indeed difficult to secure uniformity, or even a definite standard for classification or rating. This is due to the aforementioned time element of a fuse, which is one of the main functions of the calculation—a fuse that will carry a certain maximum current indefinitely will carry from 150 per cent to 200 per cent of this current for varying lengths of time; for instance, a 200-amp. fuse of a certain standard make will carry 300 amps. for five minutes, 400 amps. for one minute, 550 amps. for fifteen seconds, etc., and would carry 210 amps. continuously. The characteristics of the enclosed fuse are illustrated in the diagram, Fig. 1, which traces the performance of a 200-amp. enclosed fuse under test. The size and shape of the zinc strip, the amount of surface it exposes, the amount of cutting away or notching at the center, the heat conductivity of the surrounding filling, have all an important part in the question of the shape of the fuse curve upon which all calculations must be based.

The uncertainty and indefiniteness on this point has mitigated against the use of enclosed fuses, as has also the lack of uniformity on other points between the various makes. But within the last year a move was made which will materially affect the future use of enclosed fuses for overload protection. This was the action on the part of the National Board of Fire Underwriters in standardizing the classification, rating and style of terminals of enclosed fuses. The rules and specifications along this line laid down by the board will have a far-reaching and much desired effect, inasmuch as the manufacturers will be required to furnish a fuse of a much finer quality than was heretofore likely. Under the old system a superior style or size of fuse block might lead to the adoption of a certain fuse. Then, once adopted, the purchaser would be almost compelled to continue its use, even though the quality of the fuse deteriorated, as each manufacturer had his own size and shape of fuse to correspond with his own fuse blocks, and hence any change of fuses involved the expense and trouble necessitated by a complete renewal of blocks.

When all fuses are standardized as to style of terminal, however, the make of fuse showing the highest efficiency, and which most closely conforms to specifications in actual service, can and will be used. The manufacturers, therefore, will then naturally exert greater effort to keep the quality of their product up to the highest state and strive to give better satisfaction to the consumer. As, moreover, the whole fuse must conform to the underwriters' specifications, the resulting effect is that all manufacturers are placed on the same basis—i. e., the advisability of purchasing any one of a number of fuses will depend entirely on the intrinsic merits of the several makes, and not on local conditions. Furthermore, as no manufacturer will think it advisable to have the Board of Underwriters condemn a line of his fuses, they will exert an especial effort to the end that their fuses may comply in every way with the board's specifications, which are at first sight rather stringent, but which err, if error there is, properly on the side of safety. The consumer is thus seen to be the gainer by the action of the board, but on the other hand, it will be easily seen that the manufacturers in the long run will also reap an important advantage by the action. With the increased efficiency of enclosed fuses, and the more definite assurance of their reliability, will come a greater demand for their use, directly benefiting the manufacturers.

RELATIVE ADVANTAGES

With a clear understanding of the construction and action of the circuit breaker and of the enclosed fuse, the question as to which will afford the better protection to apparatus in any electric circuit presents itself, keeping in mind always that the circuit breaker in good condition will open directly a certain fixed amount of current flow through it, while the fuse cannot be immediately open even under conditions amounting to short-circuit. It is obvious, therefore, that each has its especial advantages. A circuit breaker can be set at a point which represents the maximum amount of current that can safely pass the circuit—the exceeding of this danger point even for the merest fraction of time opens the circuit. On the other hand, it will not guard against any currents below this point, no matter how long continued they may be. Thus on a line of varying voltage, or on a circuit of varying resistance, the circuit breaker can efficiently guard against all brief and excessive overloads, but not against a low overload continued for a long time. The latter case is, however, exactly what the fuse will protect satisfactorily, while the momentary high overload or short-circuit might materially damage a fuse-protected circuit before the fuse would go out. Wherever there is a steady and fairly con-

stant load upon the circuit which it is wished to protect, a fuse will answer all purposes, and, owing to its cheapness, will, of course, be given the preference. But where the load is intermittent and irregular, it would seem that only by the use of both devices can proper protection be secured, the fuse to guard against continued overloads, and the circuit breaker for short-circuits or high overloads of brief duration.

In street railway motor circuits two chief classes of trouble are found, and it is to obviate these that protective devices are placed in the motor circuits. The first is the burning out of apparatus by short-circuits, or "grounds," developing, and being continued long enough to do severe damage; the second is the baking or roasting of armatures and field by continued overloading. In the first case the matter of time, rating or composition of the fuses, or of the adjustment of the circuit breaker are not of importance, as any conductor which is weaker than the wiring of the circuit is sufficient. But in the latter case, where the most suitable way of protecting against overload is desired, the question presents a great many more functions. On the motor circuit of a railway car such peculiar conditions are met with that neither device by itself would seem to cover all the sources of danger. To bring out this idea more clearly two

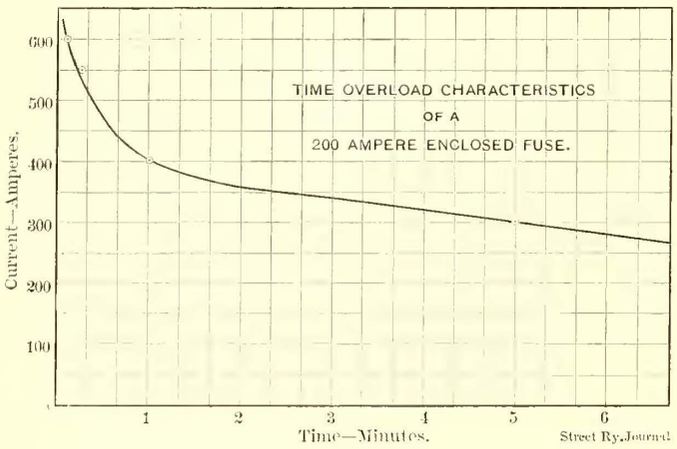


FIG. 1.

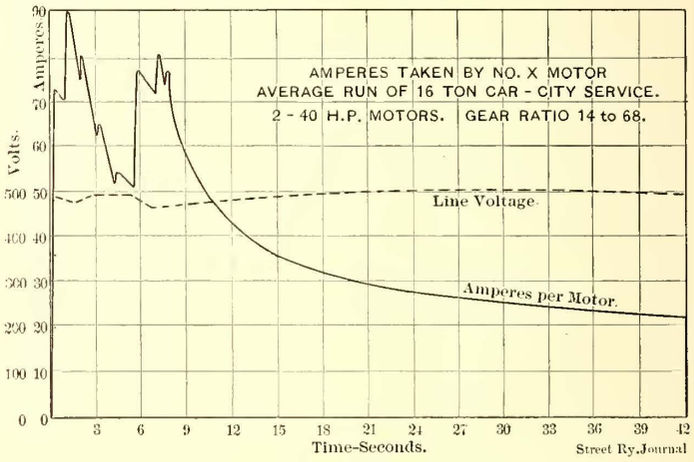


FIG. 2.

curves are here presented, one to illustrate the characteristics of the current taken by a railway motor during acceleration and running; the other showing the time that the same motor could carry various current loads without injury.

MOTOR CURRENT CONSUMPTION

Fig. 2 represents the average current input of a single motor (40 hp) on a 16-ton car in city service during the average run, the figures and data being obtained from the average of a great number of runs carried through many days and under varying conditions of grade, rail, etc. It was found that the motor received current for forty-two seconds on the average run, that the car coasted for an additional nineteen seconds and that the average stop was but six seconds. It will be noted on the curve that the current fluctuates widely, reaching at one instant 90 amps., and averaging during the first ten seconds 67 amps., while at full speed, just before dropping off power, only 22 amps. were taken. When it is remembered that this curve represents average conditions, it can be easily seen that the actual variation of current under adverse circumstances might be considerably larger. Assuming as a supposititious case, however, that the maximum current reached under normal conditions is 90 amps., as shown, the circuit breaker must be set above this point, and can offer no protection to overloads of whatever nature or duration that are beneath this point.

In order to guard against such cases which might be due to excessive journal friction, heavy up-grades, or other causes, a fuse would seem to be the only solution. A discussion of the heating effect on the motors of comparatively low currents through varying lengths of time would enable a better idea of the value of such fuse protection to be arrived at, and at the same time illustrate the difficulty of deciding upon the size of fuse most suitable in any given case. To facilitate the discussion a curve is shown in Fig. 3, of the heating effect of continuous currents, and the time that they can be carried by the particular motor in question before exceeding the danger point in temperature.

Integrating the current values shown in curve of Fig. 2, we find the root mean square current value of approximately 40 amps. Such a current as this if carried continuously on a 500-volt circuit would bring the motor temperature to the danger point, or give a 20-deg. rise above 75 degs. C. in 100 minutes after reaching 75 degs. C. But it must be remembered that the power is on only forty-two seconds, on each average individual run, while the car coasts for nineteen seconds, and makes a six-second stop. Thus, out of the sixty-seven seconds which is the average running time from the beginning of one acceleration till the beginning of the next, the power is on but forty-two seconds, or 63 per cent of the time. As this average holds true throughout an entire day's run, a secondary current value, averaged through the entire running time, must be secured. In the above case, averaging the current through the sixty-seven seconds gives 25 amps.

The 40 amps. first mentioned, however, is by no means the maximum current taken by the motor. It is the average of the currents taken on a great number of runs, under many widely differing conditions of grade, speed, voltage, etc. The curve itself, even in the portion representing acceleration, does not show the highest points reached by the currents under abnormal conditions. The maximum heating effect is thus seen to be very difficult of calculation, as the heating effect does not vary directly with the current, but with its square, in accordance with the $C^2 R$ formula.

Besides these points just mentioned, there is still another most important factor to be considered; this is the fact that in actual operation the power is on but 63 per cent of the time, and that the car is coasting or standing during the remaining 37 per cent. It is obvious that the motors are cooling during this period, and that the radiation of heat will be more rapid during the coasting than while the car is at rest, due to the increased ventilation. The effect of this intermittent heating, and of the varying rates of cooling and the many indeterminate factors entering into any calculation of the motor heating, renders it impossible to exactly determine the ultimate temperature of a motor after a predetermined length of run. But were the motor operating continuously, even with the current variations as great as in the curve, this value, 40 amps., would enable a very close approximation of the time the motor could run before overheating, to be made.

But it will be evident that under the conditions of actual

operation, with the power on but 63 per cent of the running time and the motors heating during the same period, and cooling off during 37 per cent of the time, that the lower current value or 25 amps. will more closely represent the figure that must be used in calculating the heating effect. The motor in question will carry 25 amps. continuously for an indefinite period without overheating, and it could be therefore assumed that they will never overheat except under the most abnormal circumstances while in ordinary operation.

ADVANTAGES OF THE FUSE

Now, should this motor through some adverse condition be subjected to an overload that would bring its root mean square current from 40 amps. to 50 amps., for instance, it will be evident that the temperature will then increase very rapidly, for while the 40 amps. could be carried continuously for 100 minutes the 50 amps. could be carried but thirty minutes. In other words, an average increase of but 10 amps. would with this motor reduce the safe time of running by 70 per cent, and could only be guarded against by a fuse, which is selected to meet the same conditions as the motor.

The writer is of the opinion that, in view of the above considerations, where large cars are used much advantage will be gained by using both the fuse and the circuit breaker, and that by an intelligent review of the local case practically every circumstance that can be anticipated can be guarded against where this double protection is adopted.

FUSING INDIVIDUAL MOTOR CIRCUITS

The matter of not only fusing the main circuit of a car, but of also fusing the individual motor circuits independently, has been suggested and tried, with the idea that in case of trouble with any one motor, instead of the entire car circuit being opened, only the one containing the injured motor is cut out, leaving the remaining motors in, so the car can be transported on its own power to the end of its run. Another point is that the individual motor would be fused at a much lower point than if only a main fuse were installed. In case of a four-motor equipment, the total current of any one motor would have to rise to only one-quarter as much as it would if only a main fuse were used. It is obvious that a greater margin of protection is given and the danger of blocking the road with dead cars is less serious.

The disadvantages of this method, which are generally considered to outweigh the advantages, are the greater number of parts which would be necessitated, together with a considerable amount of additional wire. For it must be understood that the fuse could not be placed in either armature circuit, because were the fuse in the positive side of the circuit when going ahead it would necessarily be on the negative side when the direction of the car was reversed. Again, it could not be placed in the field, as this is usually on the negative side of the motor, and a fuse here could not protect an armature from grounds. For this reason it is evident that on a two-motor car equipment the fuses would of necessity have to be placed in the No. 15 and No. 19 wires leading from the main controller drum to the reverser, and that on a four-motor equipment each armature lead would have to have a fuse, making it necessary to use two fuses per motor to give protection while car was moving in either direction.

Where the strictest economy in motor repair is necessitated, the foregoing method would seem to be advantageous, but as above mentioned, the added number of parts, the additional first cost, etc., render the practicability of the scheme doubtful, except in special cases.

SELECTION OF FUSES

In considering and deciding upon the particular class, kind or make of fuse that would be most suitable for protecting railway apparatus, there are two points of primary importance that should be considered in the comparison: 1. Which fuse is the least likely to short-circuit? 2. In which, after blowing, are the indications of burning the least? Or, in other words, which will allow the greatest number of refillings?

A simple but most severe test of these points, and one which the writer has found by experience to be reliable, is the placing of the fuse under test on a 50 per cent overload and allowing it to remain there until blowing. This will also develop the important and interesting fact of whether the fuse can be relied upon to open the circuit without any outward manifestations of the interior fusing action. The fuse should be tested on a circuit where the drop in potential on the short-circuiting of the fuse would be the minimum.

There is still another point that should be ascertained at the time of the test. It has been found by extensive use and exeprriment that when the filling of an enclosed fuse becomes damp by absorbing moisture from the atmosphere through the vents it is much more liable to short-circuiting, the production of

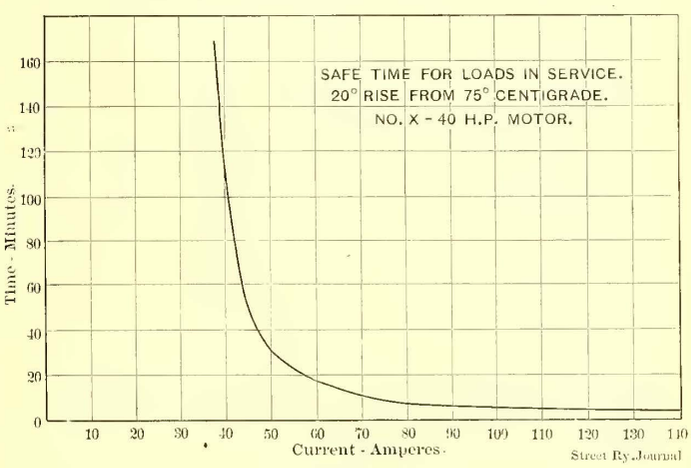


FIG. 3.

pyrotechnic effects in blowing, etc. For this reason it is important in testing, where there have been a number of fuses submitted, to make sure that the fuses are sufficiently old. Before being filled at the factory the filling is thoroughly dried out in high temperature ovens, and a certain amount of moisture will be gradually reabsorbed after the fuses are exposed to the atmosphere for any considerable length of time. And not only will the moisture held in mechanical suspension cause trouble, but should the filling compound contain sufficient water of crystallization, the short-circuiting effect on the fuse will be fully as severe.

Indeed, this water of crystallization in the filling compound may cause a very perplexing situation. Where the manufacturers have secured very favorable tests on fuses whose filling was immediately out of the high temperature ovens, the fuses on being tested ten days later gave most unsatisfactory results. This was laid to the absorption of moisture from the atmosphere, and the fuses were left for twenty-four hours in a temperature of 100 degs. C., in an attempt to drain off the moisture, but tests immediately following showed repeated short-circuiting. The theory in this case advanced and agreed upon as the true explanation was that the water of crystallization in this filling could be driven off only at a temperature of 120 degs. C., or higher, which was secured in the high temperature ovens at the factory, but was not reached in the second attempt to dry the fuse before testing.

These facts bring another important question to the front. It has heretofore been the common practice of the fuse manufacturing companies to throw out all enclosed fuses returned to them for refilling which have their outer coverings burnt, returning in their stead new fuses, and charging the full price for the same, rather than the refilling cost. In nine cases out of ten it is through no fault of the operating company that the fuse became burnt to such an extent that it was not refillable. In

view of this fact the question arises: "Why should customers pay for defects in the manufacturers' equipment, even if said defects developed after the purchaser's tests?" It is undisputed by the manufacturers that if a fuse is in first-class condition no perceptible burning should take place in the tube, so it is only reasonable that they (the manufacturers) should be made to stand the loss of their defective fuses. By insisting on this form of guarantee from the fuse companies a nice per cent of the cost of fuses per year could be saved for the railway company.

When the points just discussed have been decided upon and the make of fuse selected, the question of the size of fuse presents itself. Should the load which the fuse is installed to carry be of a constant or steady character, the question can be easily answered, but where a railway motor circuit is under consideration, there are several rather complex considerations to be taken in account: The excessively high currents taken while accelerating; the non-uniform amount of current while running, owing to the character of the track, the grade, etc.; the relative time the car is coasting and standing; the various classes of service, and a number of local conditions. The effect of these points have been touched upon in an earlier paragraph, and it is easy to perceive that each must be properly considered in order to intelligently decide which fuse would be most economical from the double standpoint of protection to equipment and the purchasing cost of the fuses.

CONCLUSIONS

In conclusion, it must be apparent that only by the use of both protective devices, the fuse and the circuit breaker, conjointly, is it possible to protect a railway motor against short-circuits and sudden or continuous overloads. Furthermore, it will be evident that the protection afforded the motor also serves the same end in regard to the power house, checking line trouble before it can react dangerously upon the station equipment. It must be borne in mind, however, that only by exercising the greatest care in the selection of the fuse can efficient results be obtained. All the local conditions which can be a function of the calculation of the proper fuse must be taken into consideration. Economy in the initial cost of the fuse should not be allowed to affect the judgment on the other far more important points. A fuse will not blow out unless there be an abnormal condition occurring upon its circuit, and when this takes place it is far preferable to have a fuse let go than to take any chances with the more valuable equipment. The small cost of refilling a fuse cannot, obviously, be weighed against even the most insignificant motor repair, and the most economical fuse is the one that is most reliable, regardless of the purchase price.

The same reasoning applies to a circuit breaker, which should be thoroughly reliable. But the best of circuit breakers will give good results only when properly adjusted and maintained. It should be set at the minimum point at which it will stay in when carrying its normal load. It will be necessary to inspect and readjust it at least every two months, and there should be as stringent rules against holding it in, when in service, as there are against tying down a safety valve on a boiler, as the purposes of the two devices are almost identical.

The practice of installing complete protective devices is a measure of the truest economy, and one wherein the cost of maintenance cannot be considered a prime function. The benefits to be derived from them far exceed this item, and while the economy of their use may not be readily apparent to one not familiar with all the details of railway maintenance, it nevertheless is true that innumerable armature and controllers are saved from damage and many accident suits averted by the installation of efficient protective apparatus. The writer, from many years experience in testing, handling and experimenting upon electric railway equipment, can recommend unreservedly the application of both fuses and circuit breakers jointly upon the motor circuits of the heavier equipments.

CREATING TRAFFIC—III. ADVERTISING OTHER THAN IN NEWSPAPERS

BY E. P. HULSE

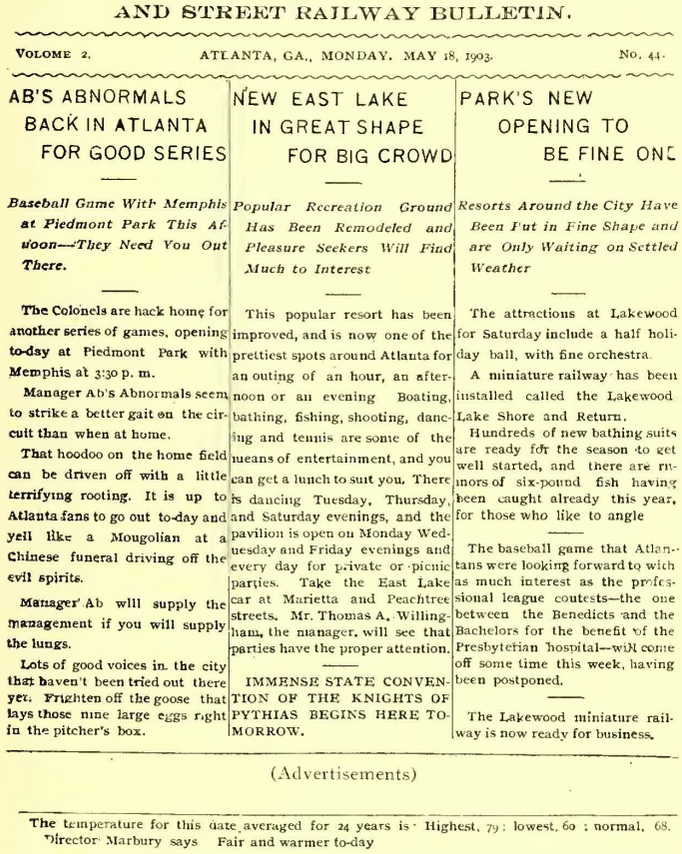
I have always found that the best form of publicity is through the use of pictures; they tell a story at a glance that would take columns of descriptive reading matter to equal. They stick in the mind better. A person going along a hot sidewalk on a summer day and catching sight of a picture of some cool grove or breeze-swept beach is quite likely to act on the suggestion. Bromide or solar enlargements of small photos of pretty scenes along the lines or at the resorts, say 16 ins. x 20 ins., mounted on cardboard, are quite inexpensive in quantities, and they may be placed in store windows all over the cities on your lines. Wall cases to contain posters the same size as the dasher signs may be cheaply constructed of little more than the glass front and the wood or sheet-iron back, both of which, with the poster between, slip into a grooved metal frame, by which the case is fastened in a conspicuous place along the sidewalk on a building front. Dozens of positions on the busiest thoroughfares may be secured for these cases, where the commercial bill-poster would not dare to tread. Their locations and the space taken in store windows by the enlarged photos previously referred to may be paid for by a season ticket to the amusement resort, admitting two people once each week—similar to the customary "lithograph" pass of the city theaters. As you will get riding, engendered by the possession of this theater pass, that you might not otherwise get, this form of advertising is really a source of income.

The dasher signboards on the cars should be large enough to allow the use of wood type, and should also be of such a size that paper can be displayed on them which will cut without waste or trim from the regulation stock size of 29 ins. x 42 ins., the dimensions of a theatrical one-sheet. A dasher signboard to carry a quarter-sheet—14½ ins. x 21 ins.—is a size frequently seen. These quarter-sheet dasher signs can also be used in the wall cases, and the type matter that goes on them can also be printed on a cardboard 14 ins. x 22 ins. (one-half of the regulation stock size of cheap board) and displayed in such store windows as you have made the season ticket arrangement with. By planning your signboards and wall cases so that the printer will not have to trim down the stock sizes of paper to get the size you demand, you will save materially on the cost of your printing. Wall time-tables, containing a condensed schedule and a map in two colors, with a row of half-tone views at top and bottom, will be given space in restaurants, hotels and other public places. This wall time [illegible] must be handsomely designed, as a plainly printed on [illegible] d be torn down after a few days. They can [illegible] brass tacks and long inch-wide strips of phot [illegible] d, making a very attractive panel.

Fliers are all right for s[illegible] d distribution, but when hung in bunches in t[illegible] ot of much value as an advertising medium. [illegible] f probabilities, they present a blank back to [illegible] igers, unless printed on both sides; on the o[illegible] whirls them around or tears them out and s[illegible] y of them where they do no good. A printe[illegible] s of the car, designed to fit a certain space, [illegible] l notice in better form and can be changed [illegible] l. Your contract with the concern that han[illegible] advertising in the cars usually permits you [illegible] hing in your cars that tends to build up tr[illegible] sually called 8's or 16's, the former measur[illegible] s. and the latter 6 ins. x 9½ ins., they being [illegible] leet about 25 ins. x 38 ins.

Banners across [illegible] inal points, where legally admissible, and signs [illegible] -tables and other information, are effective in suppl[illegible] g the starter, and a bulletin board like a blackboard serves a frequent advertising oppor-

tunity for events of interest where printed posters cannot be brought out in time. The regular billboard service in each city, usually controlled by the theatrical or circuit owners, is a good form of publicity when not overdone. The customary charge is 4 cents a sheet. The bill-poster in each city should be required to send you a list of the locations he is using, as often as the wallpaper is changed, and an occasional checking up of this list is a wise precaution. A lithographed poster, a half-sheet, 21 ins. or 22 ins. x 28 ins. or 29 ins., half the quantity ordered being printed on paper and half on cardboard, containing a fancy design in colors suggesting the various amusements and entertainments at the resort, is a good stock method of advertising. Other fancy lithograph pictures—for instance, a series on the order of the familiar Fencing Girl—might also



DAILY AMUSEMENT PROGRAM
AND STREET RAILWAY BULLETIN.

VOLUME 2. ATLANTA, GA., MONDAY. MAY 18, 1903. No. 44.

AB'S ABNORMALS BACK IN ATLANTA FOR GOOD SERIES

Baseball Game With Memphis at Piedmont Park This Afternoon—They Need You Out There.

The Colonels are back home for another series of games, opening to-day at Piedmont Park with Memphis at 3:30 p. m.

Manager Ab's Abnormals seem to strike a better gait on the circuit than when at home.

That hoodoo on the home field can be driven off with a little terrifying rooting. It is up to Atlanta fans to go out to-day and yell like a Mongolian at a Chinese funeral driving off the evil spirits.

Manager Ab will supply the management if you will supply the lungs.

Lots of good voices in the city that haven't been tried out there yet. Frighten off the goose that lays those nine large eggs right in the pitcher's box.

NEW EAST LAKE IN GREAT SHAPE FOR BIG CROWD

Popular Recreation Ground Has Been Remodeled and Pleasure Seekers Will Find Much to Interest

This popular resort has been improved, and is now one of the prettiest spots around Atlanta for an outing of an hour, an afternoon or an evening Boating, bathing, fishing, shooting, dancing and tennis are some of the means of entertainment, and you can get a lunch to suit you. There is dancing Tuesday, Thursday, and Saturday evenings, and the pavilion is open on Monday Wednesday and Friday evenings and every day for private or picnic parties. Take the East Lake car at Marietta and Peachtree streets. Mr. Thomas A. Willingham, the manager, will see that parties have the proper attention.

IMMENSE STATE CONVENTION OF THE KNIGHTS OF PYTHIAS BEGINS HERE TOMORROW.

PARK'S NEW OPENING TO BE FINE ONE

Resorts Around the City Have Been Put in Fine Shape and are Only Waiting on Settled Weather

The attractions at Lakewood for Saturday include a half holiday ball, with fine orchestra.

A miniature railway has been installed called the Lakewood Lake Shore and Return.

Hundreds of new bathing suits are ready for the season to get well started, and there are rumors of six-pound fish having been caught already this year, for those who like to angle

The baseball game that Atlantans were looking forward to with as much interest as the professional league contests—the one between the Benedicts and the Bachelors for the benefit of the Presbyterian hospital—will come off some time this week, having been postponed.

The Lakewood miniature railway is now ready for business.

(Advertisements)

The temperature for this date averaged for 24 years is: Highest, 79; lowest, 60; normal, 68. Director Marbury says Fair and warmer to-day

carry a map of one size or another. The extensive dissemination of an inexpensive map shows on the car register. There is nothing the public needs more when the traveling impulse is working. You know where your road runs and what are the through-car routes and connections, but the "man on the street" does not, and the chances are you have never brought to his attention any places where he can get this information in a way to make him remember it. This matter is often overdone, though; a lithographed map in several colors is a good thing to hang up in public places, but it is usually too expensive to give away in large quantities to nickel passengers. Vest-pocket folders, containing a condensed time-table, a map, a list of through-car routes, and a schedule of distances, fare and running time, perhaps even with time of arrival and departure of steam road trains at certain connecting points, can be placed in boxes in the cars and racks in public places.

Pamphlets and portfolios of views, too expensive to hand out indiscriminately to individual patrons, are of immense value in securing the patronage of organizations of various kinds that have outings during the summer and that can be handled

(Advertisements.)

PLACES TO VISIT ABOUT THE CITY

The Interesting Points for Visitors to See and a Reminder to Residents, Also, of What is Within Their Gates.

The Bijou. — The Giffen Musical Comedy Company returns to the Bijou this week in one of their greatest successes, "The French Maid." If it is any better than they have given in the past it is well worth seeing.

Fort McPherson. — Eight companies of the Sixteenth Regiment, with a band of 24 pieces are stationed at the post. Concert every Monday, Wednesday and Friday; from 3 to 4 p. m. Dress parade every morning except Friday, at 8:30 a. m.; Friday forty minutes before sunset weather permitting. Daily drill 9 to 10 a. m. Guard mount 9:50 a. m. Reached by East Point or Barracks lines.

Soldiers' Home.—This is one of the prettiest and most interesting places about the city. It is a favorite trip "on a Sunday afternoon." Take Blue Line cars on Decatur street and transfer.

Federal Prison. — This great penal institution, recently located here by the government, contains much to interest well worth a visit. It is open to inspection Monday and Thursday from 9 to 12 a. m. and 1 to 4 p. m. There are several hundred convicts, many of them with noted histories in the criminal annals of the government. Take South Pryor street Federal Prison cars.

Battle of Atlanta. — Battlefields of great interest, with the trenches still in a fine state of preservation, surround the city and can be reached on almost every car line. Take a trip first to the Cyclorama at the entrance to Grant Park, where a grand panoramic picture of the battling lines will prepare you for the identification of the exact locations. Intrenchments may be seen on the Peachtree line, the River line or on the East Point and College Park line.

Suburban Trolley Ride.—The long lines to Decatur, Lakewood, Brookwood (out Peachtree.) East Lake, College Park and the Chattahoochee river with large, comfortable cars, running over even, well-ballasted road-beds, give comprehensive views of the city and suburbs.

Library.—Corner Forsyth and Carnegie Place. Free reading room open to all.

Firemen's Practice. — Chief Joyner has established a system by which all the firemen of Atlanta's crack department will be given regular fire drill in the more perilous tasks that they may be called upon to attempt at any time in the saving of life. There is a frame-work in the rear of the fire department head quarters on Alabama street, six stories high, and the men climb up to the top of it by the small scaling ladders, rescue fire-bound people at the top, learn how to handle the life-nets, jump into them themselves, and do all the other hair-raising feats in the line of a fireman's duty. These drills begin every afternoon weather permitting, at 3 o'clock and Chief Joyner has stated that visitors who wish to inspect the work and preparation of the department in this line will be mad welcome.

Special cars for trolley parties at reasonable charges. Phone 1474.

(Advertisements)

FIRST AND FOURTH PAGES OF A TYPICAL BULLETIN. THE SECOND PAGE CONTAINS HUMOROUS MATTER AND THE THIRD CHANGES IN SCHEDULES AND IN RESORT ATTRACTIONS

be used. Steam railroads, particularly the Alton, and even soap and lard concerns, have used this idea very effectively. Those you adopt might be entitled the Blank Park Picnic Girl, matinee girl, canoeing girl, front seat girl, bowling girl, dancing girl, bathing girl, golf girl, etc. This style of advertising has one great point of value—permanency. They are seldom thrown away.

These window cards, posters, enlarged photos, wall time-tables, wall cases and bulletin boards can be attended to by a corps of distributors, boys from the high schools or college preparatories, who welcome the chance to do effective work at a very low figure during the summer. Such a corps, preferably uniformed in inexpensive khaki, forms the best medium of planting the "suggestion" in the public mind. The greater part of their time is taken up with tours of the offices and residential sections, leaving advertising matter, such as small circulars or cards or blotters. If an excursion is to be run from some point along the lines or a special day pulled off at some resort, their work in billing a city goes further for the money expended than any other form of publicity.

Almost all the advertising matter for an electric road should by the carload. A list should be secured early in the spring of all churches, Sunday schools, lodges, unions, posts, clubs, women's organizations and societies of all kinds, and this form of advertising, accompanied by a printed letter, will result in quite a boom to the special car business, especially if followed up by letter, telephone or personal solicitation. This pamphlet should give a description of the interesting points along the line and at the resorts, illustrated with half-tone views, or the pictures may be printed separately on cards and grouped into a portfolio. There is then more possibility of their being retained and some of them being displayed or mounted. Outwitting the waste basket, which swallows so much good printing, is the point to aim at.

Quite the most effective means of bringing about a better feeling between the public and the corporation is by getting out a daily or semi-weekly bulletin, printed in the form of a diminutive newspaper, placed in the cars and distributed in all public places. This bulletin should call attention to all the attractions and interesting features along the system, the amusements and entertainments and public events in the cities that it reaches, and keep patrons and the public informed of changes

in schedule and improvements in the service. If interspersed with humorous stories of street car life or interlarded with clipped humor, it attracts more attention. Some sample sheets of such a typical bulletin are presented on the preceding page.

Many lines have adopted this little newspaper of their own, some daily and some weekly, and I have never found one that gave it up willingly. As a "sop to Cerberus" it certainly brings about a friendlier feeling between the public and the corporation. The spirit in which it is brought out usually marks it as popular at once. The cost can be saved out of the newspaper appropriation or it can be supported independently by carrying a few small ads. at high prices. I have seen an instance where these bulletins became so popular that a printing plant was installed in one of the car houses, similar to those maintained by many insurance and traffic associations, where the small printing of the company was also done. The feasibility of this is doubtful; it all depends on the man secured to run it.

These bulletins are distributed in the cars by means of boxes or hooks. Small metal boxes placed on the post by each bench, at a sufficient height so that there can be no danger of a passenger's head striking them, are best. They cost all the way from 3 cents and 4 cents apiece for dipped and japanned tin boxes to 50 cents and 75 cents for brass receptacles, in quanti-

THEATER TICKET GIVEN IN RETURN FOR DISPLAY SPACE IN STORE FRONTS

ties. I have found plain brass hooks, at about 80 cents a gross, almost as good. They should be placed high up on the post so that millinery cannot become entangled therein. The printer punches a hole of corresponding size in the thousands of bulletins, at a sufficient distance from the edge to prevent the breeze stripping them out, and the night men in the car houses hang them on the hooks.

There are many other mediums of publicity through judicious printing. The souvenir programmes at the resorts usually more than maintain themselves, so far as the cost is concerned, by the advertising space sold; and if they are made so attractive that patrons carry them away, there is no addition to the expense of cleaning up the place. Tags such as race-track patrons loop over a button on the coat are sometimes given out to good advantage. Free theater tickets, admitting to Monday and Friday matinee, distributed from dry goods stores, pharmacies and soda water fountains, etc., in the cities, keep the travel up on the bad days of the week. A phonograph at terminal points, calling out some clever "spiel," if a road management is not too conservative to adopt such a method, will direct more travel to its cars than the best of starters.

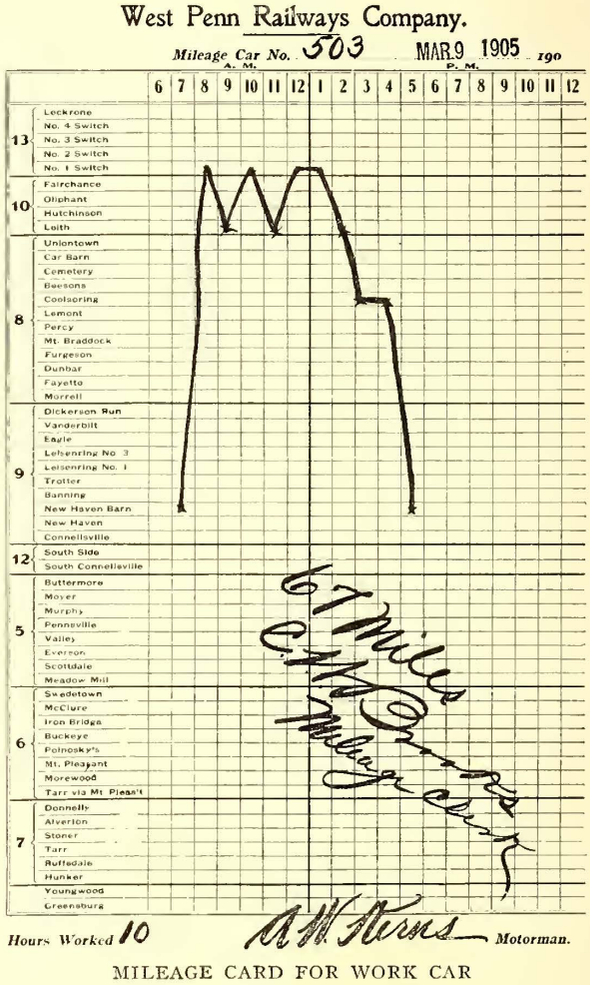
In the next issue there will be a discussion on what to advertise.

At the trial in Washington, D. C., recently, of a conductor charged with "knocking down" fares, a witness who attended without subpœna glibly and without the slightest consciousness of wrong-doing admitted that he never paid a car fare if he could avoid it. Unless he was asked for his fare he never offered it; never put himself out of the way to help the conductor whose car was crowded; never failed to cheat the street railway company if he was not asked to be honest.

KEEPING MILEAGE OF WORK CARS

In many electric railway offices doubt frequently arises as to the reliability of the figures turned in on the mileage of work, line and construction cars, owing to the fact that these cars operate back and forth between so many different switches, giving rise to lack of exactness in reporting the car-miles run, as the crews on the work cars are often not familiar with the fractions of a mile between the various sidings or points to which they have to run to do work, or to clear regular cars.

J. W. Brown, superintendent of transportation for the Pittsburg, McKeesport & Connellsville Railway Company, of Connellsville, Pa., has devised a simple method of obtaining this mileage correctly. A sheet 7½ ins. x 12 ins., like the sample reproduced here, is used, and all the work car crews have to do



MILEAGE CARD FOR WORK CAR

is to report the points to which they went, and the car mileage is worked out by the mileage clerk in the office. For instance, this particular diagram shows that work car No. 503 left New Haven car house at about 7:30 a. m.; ran to switch No. 1, then back to Leith, then to switch No. 1 again, and back to Leith, and again to switch No. 1. It lay over at this point an hour and then ran to New Haven car house, stopping at Coolspring for an hour on the way. The mileage clerk, knowing the exact distance between all points, can readily determine the car-miles run from the diagram.

The road is divided into sections for the convenience of the maintenance of way department, and these sections are indicated by heavy lines on the sheet. It is therefore readily seen in what sections non-revenue cars were at work.

W. L. Stehlau, general manager of the Springfield & Xenia Traction Company, has arranged with the Dayton & Xenia Traction Company to operate through service from Springfield to Dayton by way of Xenia, Ohio.

THE QUESTION BOX

Questions and answers relating to freight and express and the track department are continued in this issue. Next week the publication of interesting answers pertaining to other departments will be recommenced.

D.—THE EXPRESS AND FREIGHT QUESTION

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

Very unsuccessful, unless the haul is very short and a high rate can be charged. A. Eastman.

We are satisfied with our experience.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Not satisfactory. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We have had very little experience in handling rough carload freight. We have handled, all told, not over 40 carloads of ice, but this business was not particularly profitable. We have handled no coal or wood. Last year we entered into a contract for the hauling of some 5000 yards of crushed stone, which we handled successfully and profitably. E. J. Ryon, Supt.,
Schenectady Ry. Co.

We have had no experience in handling heavy commodities such as ice, coal, wood, etc. George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

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

Milk is a desirable commodity to handle on electric cars if enough of it can be obtained so as to allow the use of a regular double-deck milk car, hauling from 300 to 400 cans
A. Eastman.

Milk is one of the articles that we are especially prepared to handle. Our milk cars run on convenient schedules. Shippers are sold tickets at a fair cost, which entitle them to forward the can filled, and secure its return empty.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Revenue from milk is a large item in gross freight receipts on our lines. Charges are from 1 cent to 1½ cents per gallon. Use milk tags which are sold direct to shippers, usually 5, 8, 10-gallon tags. Use regular shipping tag perforated for two coupons, one for auditor, one for loaded can, remaining part of tag for return of empty. Stations "from and to" stamped on tag as case requires. Auditor's stub is detached before tickets leave the office. Shipper attaches tag to can. Conductor lifts going coupon. "Return free" tags remain on can. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Our experience in handling milk has proven entirely satisfactory. Up to the present time we have run no special cars for the handling of milk, the milk cans being handled on our regular runs. The milk is handled by a system of milk tickets which are attached to the cans, and provide for the return of the empties.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Our milk business has been comparatively light, and we have handled same on our regular express cars and on regular trips.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

We handle milk on both passenger and freight cars, using a milk ticket with coupon covering return of empty can. We find this a profitable branch of our business.
C. C. Collins, Gen. Supt. Exp.,
The Appleyard Lines in Ohio.

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

If it can secure enough milk business to be handled at reasonable rates to justify the service rendered.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Do not stop at every farm house or "Local Stop" to take on milk. Have regular milk stops established along line at places most suitable. A platform built the height of freight car floor is desirable. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I do not know of any particular conditions that are essential to the profitable handling of the milk business. If the milk is there and can be handled, the business will pay a higher rate per hundred pounds than ordinary freight. E. J. Ryon, Supt.,
Schenectady Ry. Co.

The milk business would be a profitable one if sufficient business could be obtained to warrant the running of a special car and the milk was delivered to platforms along the road and was accepted by consignee at express platform at the end of the route so that there would be no delivery expense at either end.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

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

We have been successful in handling light packages at rates that satisfy our customers. We would like to increase the traffic.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Light packages are a part of our business.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

This company handles light packages in exactly the same manner as they are handled by the large express companies.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Our experience in handling small packages has been highly satisfactory. We get a minimum charge of 15 cents to all points. Our drivers call at the department stores the same as is done by the old line express companies. If small packages are picked up at 3 o'clock in the afternoon, we can deliver them the same day at any point on our system. J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

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

Our passenger rates being approximately one-third and one-half of the steam railroad rates, we make a charge of 25 cents per package for baggage. The public appreciate the reason and are satisfied. In consequence, our baggage business is considerable.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Considerable. Rates 25 cents for each division, no excess. We carry baggage on all passenger cars. Our patrons require this. Freight service of four trips a day not frequent enough.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Passengers' baggage going over the lines of the Schenectady Railway Company is handled by the Electric Express Company. We make a flat charge of 40 cents for a trunk, including cartage on both ends of the line. This arrangement is carried out more to secure travelers over the lines of the road rather than as a profitable investment to the express company. We have no combination cars handling both passengers and baggage.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

We handle baggage on our regular express cars and on their regular trips. The rate is 35 cents per piece under 150 lbs. For anything over 150 lbs. we charge our regular express rate.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Baggage is carried only on the regular freight and express cars, a charge of 15 cents per piece being made with a limit of 150 lbs.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

We carry baggage as regular matter and make an arbitrary rate of 25 cents for ordinary baggage and 50 cents for commercial men's trunks. This is a profitable business. The charge of 50 cents for commercial men's trunks is less than the "excessive weight" charges made by the steam roads.
J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

We carry baggage upon same basis as do the steam lines, but not on all trains. We have baggage and express compartments on some cars for the purpose. Southern Superintendent.

We carry baggage on all passenger and freight cars, using checks similar to those used by the steam lines, and charge 25 cents per piece any distance. On account of our low rates of fare this charge does not operate against us in competition with the steam lines. C. C. Collins, Gen. Supt. Ex.,
The Appleyard Lines in Ohio.

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

Unless the city be very large I would not recommend wagon collections and delivery unless absolutely necessary to compete with other companies. A. Eastman.

Collections and deliveries had better be entrusted to some reliable company having suitable facilities and a reliable staff to conduct the business. It is not and ought not to be a part of the railway company undertaking any more than would be the business of transporting the individual from his landing place to his home.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

When conducting a regular express business.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

It is not advisable to give wagon service except where the volume of business is sufficiently large to warrant such extra expense, and where such business cannot be secured without this service.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

It is advisable to give wagon collection and delivery where there is competition, and where such service has been established by the old line express companies. George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

The success of our business is due to the wagon service. We give a wagon collection and delivery in Albany, Troy, Watervliet, Cohoes and Waterford. This wagon service puts us on even a better footing than the old line express companies. We do not, of course, attempt to do a local wagon express business in any of the cities. We maintain six wagons in Albany (population, 100,000); four in Troy (population, 80,000); two in Watervliet (population, 12,000); three in Cohoes (population, 25,000). The Cohoes wagons also serve Waterford (population, 5000).
J. W. Gibney, Supt Ex. Dep.,
United Tract. Co., Albany.

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

Good service is the best solicitor. A. Eastman.

Judicious advertising. Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Personal interviews. We also distribute blanks to be signed by merchants requesting shippers to forward all shipments via electric express. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

The soliciting of business by our company is in the hands of its general manager who personally calls upon our patrons and shows them the advantage of handling their business over our lines, both from a financial and time standpoint.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Advertising. We also call on shippers and explain our service and rates. George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

D 20.—What arrangements do you make for local agents at different points on your line? Is it better to pay local agents a commission or salary?

Commission when arrangements can be made. A. Eastman.

Where it is warranted agents are paid a salary commensurate with the service rendered. At other points, commissioners are paid on the gross outbound business. Salaried agents are preferable. Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Our agents at way stations are storekeepers. They receive an annual pass. They consider that the agency brings them business. Agents at terminals are on straight salaries.
J. R. Harrington, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

At the large offices our agents are exclusively employed by our company. At small places where the traffic is not heavy we pay our agents on a commission basis. The question of a salary or commissioned agency depends entirely upon the circumstances and the volume of business to be handled. From a financial standpoint it is cheaper to pay salaries where business is large, and commissions where it is small. E. J. Ryon, Supt.,
Schenectady Ry. Co.

We employ as local agent, where possible, a man who has lived in the town for some time and is personally acquainted with the shippers. Pay agents a salary
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Ticket agents at all local stations take care of the express business. Pay regular salary.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

We have local agents at each of our four principal terminals. We pay express agents a weekly salary, and it takes up all their time to handle the express and freight.
J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

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

Yes. Delivery is at the risk of the owner.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Way-billed to collect at station beyond. Destination is shown on way bill as the prepaid station. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We do not handle shipments destined to points at which we have no agents, unless by previous arrangement the consignee meets our cars and takes care of his property, giving us a receipt for the same. E. J. Ryon, Supt.,
Schenectady Ry. Co.

Yes. The shipper prepays all charges and signs receipt, and goods are put off at points where there are no agents, entirely at the owner's risk. George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Shipments must be prepaid, and are delivered alongside track at owner's risk as covered by shipping receipt.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

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

Depends entirely on the amount of business handled. I think agents should remit daily if the amount of receipts are over five dollars per day. A. Eastman.

Daily or weekly, as circumstances may dictate.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Settlements once each week. Remittance by passenger car conductor.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We require local agents to make remittances weekly. This should all be regulated by the volume of business, but should not extend beyond a period of 30 days.
E. J. RYON, Supt.,
Schenectady Ry. Co.

Express receipts should be forwarded to cashier by express car daily, express messenger signing receipt for having received same from agent.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Agents remit express receipts daily, and these receipts are held until the third day after receipt of goods, so that three days is given all agents for the collection of their accounts. The daily report shows the express and freight received and shipped, together with the value of the same, but the money remitted does not necessarily correspond to the amount charged against any agent as he is given additional leeway of a day or two, but all moneys must be turned in to cover the calendar month, credit of course being given the agent for goods on hand and uncalled for.
H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

Our local agents remit every morning the cash received the previous day. The money is kept over night in small safes at each of the terminal stations.
J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

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

I would advise the adoption of a plan of auditing as simple as possible. Experience has demonstrated the fact that it is advisable to simplify everything connected with the express service, as the revenue derived from an express service is so small that it will not allow the adoption of a too complicated set of accounts.
A. EASTMAN.

Express agents' report is covered on one blank which he uses for the daily and monthly reports. This blank, as will be seen

STATION. ..... 19.....

DAILY REPORT—EXPRESS RECEIVED AND SHIPPED.

	RECEIVED FROM			SHIPPED TO		
	POUNDS	COLLECT	PREPAID	POUNDS	COLLECT	PREPAID
SYRACUSE						
SPLIT ROCK						
MARCELLUS						
SKANEATELES						
AUBURN						
TOTAL						

ENCLOSED FIND $ WITH WHICH PLEASE CREDIT MY ACCOUNT.

..... AGENT.

EXPRESS AGENTS' REPORT—AUBURN & SYRACUSE

from the accompanying reproduction, is very simple. The form is but 3 ins. x 5 ins. in size, nevertheless it gives all the data desired.
H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

Unnecessary reports, complicated reports, or superfluous reports are to be avoided. So simplify matters as to render the report a concise, understandable and correct exhibit of the business.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Make accounting as simple as possible, of course, but do not form too many combinations. Each transaction should be distinct, and each entry to check another. Our freight accounting is similar to steam railroad practice. J. H. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I advise that the reports be made as simple as possible. This company is working on practically the same lines as the large express companies.
E. J. RYON, Supt.,
Schenectady Ry. Co.

The accounting reports should be made as simple as conditions will permit.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

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

I think abstracts should be made on the 7th, 14th, 21st and last day of each month. A. EASTMAN.

Daily, weekly or monthly, depending upon the volume of the business and the necessity for checking and revising rates or other circumstances peculiar to each situation.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Once each week. J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Abstracts of express matter received and forwarded are in reality all there is of the accounting to be made by a local office, and these abstract reports should be made as often as the business warrants.
E. J. RYON, Supt.,
Schenectady Ry. Co.

Abstracts of express received and forwarded should be reported every week, or not less than four times each month.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Daily. H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

D 26.—Who should audit the express accounts?

The general auditor. A. EASTMAN.

The general auditor, until the business warrants the employment of an auditor of freight receipts and disbursements.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Some one who is familiar with freight business and freight auditing.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

The answer to this question depends entirely upon the conditions. If the express business is handled as a department of the railroad company, the auditing properly comes under the railroad department.
E. J. RYON, Supt.,
Schenectady Ry. Co.

A regular express auditor. GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Our express department has a cashier who is practically the auditor for this department.
J. W. GIBNEY, Supt. Ex. Dept.,
United Tract Co., Albany.

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

Same form and conditions as used by steam roads.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

In my opinion the best form of shipper's receipt is a duplicate shipping order, inasmuch as a carbon copy may then be retained for future reference.
E. J. RYON, Supt.,
Schenectady Ry. Co.

A duplicate receipt made out by the shipper, one copy of which accompanies the shipment and enables the warehouseman to check up the shipment and ascertain whether the goods have been received in accordance with the receipt signed by the driver.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

I.—THE TRACK DEPARTMENT

I 19.—Is there any advantage in greasing curves?

The advantages are two. First, it prevents the curves from wearing so rapidly; second, it prevents the car from leaving the track. This can be readily observed if one will notice carefully a curve immediately after a train when the weather turns off cold and dry. The rails are very rusty, and the first few cars passing over them grind off small portions of steel, and in some cases the cars leave the tracks.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Grease applied to the guard of a curve reduces wear of both guard and wheel flanges and deadens noise of wheel vibration. Black oil applied with a swab, after thoroughly cleaning the rail, is as efficient, is applied more readily, and costs less than grease, and there is less liability of claims for damage to clothing of pedestrians. Grease is scraped from the guards by the wheels and dropped in large lumps on the pavements and crossings. If curves are oiled or greased at all, they should be gone over thoroughly at least once a day.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Many advantages if greased properly.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Yes. The results are, saving of flanges, of wheels and of power.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

Yes. Have ours always greased. J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

There certainly is an advantage in greasing curves, for if they are not greased there is a very noticeable difference in the operation of the rolling stock and wear of rail.

Asst. Eng. Ry. Dept.

The writer is of the opinion that there is considerable advantage in greasing curves, on account of the decreased friction and absence of "squealing" due to wheels grinding against the guard. On ungreased curves there is also the danger of derailment of cars, owing to the tendency of the cars to climb over the guard, and this danger also applies to plain curves in a more marked degree. It is generally accepted as true that the squealing due to dry curves is very objectionable to the patrons and to the general public, aside from the question of rough riding. It has been mentioned, however, as a disadvantage, that the wheels pick up the grease and carry it along the straight track, where it is sometimes responsible for "skidding." This, in our experience, has not been a serious matter, and has never been the cause of anything in the nature of an accident that would warrant our allowing our curves to be dry.

P. Ney Wilson, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

I 20.—What are the relative costs of various kinds of woods available for ties? What are their relative length of life?

We use only three kinds of ties. Creosoted pine, long leaf yellow pine, and post oak or white oak. The sap pine tie (6 ins. x 8 ins. x 8 ft.) including creosoting costs 20 cents laid down at our yards; the long leaf yellow pine, 32 cents, and the oak, 38 cents.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

White oak ties are without doubt the best, but it is now almost impossible to get ties of that material. The life of a white oak tie is about 25 per cent longer than that of Southern pine, and the cost is at least 25 per cent greater. First quality hewed Southern pine ties, costing 60 cents delivered, and 35 cents to 40 cents for creosoting, are without doubt the best obtainable for use in the Northern States. The additional life, resistance to rail wear, and spike-holding qualities obtained by creosoting, make such treatment an economical practice. Treated ties are especially to be recommended in concrete paving foundations.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Sawed pine ties 6 ins. x 8 ins. x 8 ft., 45 cents f. o. b. Birmingham. Will last 2 to 5 years. Hewn pine ties 7 ins. x 9 ins. x 8 ft., 55 cents. Will last 2 to 5 years. Hewn oak ties, 6 ins. x 8 ins. x 8 ft., 53 cents. Will last 3 to 5 years. Creosoted pine ties, 8 ins. x 8 ins. x 8 ft., 85 cents. Will last indefinitely.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

The price of ties vary so much in the different sections of the country that satisfactory comparisons cannot be made.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 21.—Has any satisfactory substitute been found for wooden ties? What has been the experience with iron, steel, glass, concrete or other materials for ties?

I have never been able to find a substitute for wooden ties. In fact, I have never attempted to do so, but have been satisfied with the experience of others.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

None that we know of.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

Steel ties, channel section on concrete foundation, have been used on this system in the paved streets for about three years, and thus far have given great satisfaction. The cost of laying the road on steel ties, which are put 5 ft. apart, is practically the same as a road laid on wooden ties 2 ft. apart.

Asst. Eng. Ry. Dept.

The steel tie has been used experimentally by several steam roads. Additional answers to this question are especially requested.

Editors.

I 23.—What methods are available for welding joints? Please give your experience with any of the methods of welding track, including detailed cost of doing the work, and the results secured.

We have been cast welding our joints for the past seven or eight years and have had remarkable success with them. We have not lost one joint in a hundred. Our device is rather primitive, but most effective. We secured a boiler shell 4 ft. in diameter and 8 ft. long, lined it with fire brick and mounted it on a track, using this for the cupola. On this same truck was a blower operated by a discarded street car motor. Also on the truck we built up platforms for carrying the coke and iron. This outfit was hauled on its own wheels to the location of the welding, where we would pour from one hundred to two hundred joints at a run; the number depending on the size of the rail welded. The cost of these joints depended of course on the iron market. Sometimes we were paying $8.50 a ton for iron, and again $18.00. A mixture of 50 per cent new iron and 50 per cent old scrap cast iron was used, and with the market at $12.00, the joints on 9-in. rail cost about $2.90 each. We have some sections of 9-in. track which have been cast welded since 1897, and it is almost impossible to find the joints.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

I 24.—In sanding track, is it better to sand one rail or both? Why?

A sufficient amount of sand can be placed on one rail to do the work, and it is superfluous to sand both rails if one is sanded properly. Sand on both rails is an additional precaution, however, as it presents more friction, and it might be advisable to sand both rails on very steep grades. In sanding only one rail it wears the wheels and brake shoes on that side of the car, and it is well to alternate from one rail to the other in sanding.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

With one rail clean a better return is insured. Sanding should alternate from one rail to the other on succeeding hills, to maintain wheel wear as even as possible.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Depends on grade and approaches to crossings. On city streets we prefer to sand both rails, as we believe we get a better contact between rails and wheels when bringing car to a stop.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Sand inside rail only. If too much sand is put on rails the electrical contact will be lost altogether. Too much sand is as bad as none. TRACKMAN.

We believe in sanding both rails.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

It has been our experience that it is more economical to sand one rail instead of both rails. We find from practical experience that sanding one rail answers the purpose, as it is not so difficult to do and requires less sand. I might mention in connection with this that we have no grades on our system over 2 per cent. On any grade over 2 per cent both rails should be sanded.

P. NEY WILSON, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

Both, because more effective. J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

I 25.—When sanding track, is it better to sand from a special sand-car or to have sand on each car? Why?

It is best to have the track sanded from a special car, and also to have sand on each car. It often happens that the track becomes very slippery in places before the special sand cars can get to them, and in such cases sand on each car comes in very handy.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

It is safer to carry sand on each car, but on steep hills a man should be stationed to sand by hand.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

We consider that there are a great many advantages in sanding from a sand car. We find that it is expensive both in the first cost and maintenance to keep sand box in good condition on the cars, and the sand box is liable to fail at a dangerous moment, as the sand becomes lumpy, or in cold weather it may become damp and freeze hard. Sand buckets on front end of car present an unsightly appearance and they are undesirable. We have known cases where cars have been derailed by too much sand.

P. NEY WILSON, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

On a hilly road sand should be on each car. Barring the possibility of accident, greater economy of operation should be secured on comparatively level roads by sanding with a special sand car. J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

Owing to the many and heavy grades on our system, the groove girder rail is sanded by hand by trackmen, as well as from sand boxes on the cars, and at times a sand car is used.

Asst. Eng. Ry. Dept.

Believe it is better to sand from each car, as conditions of weather change so suddenly, and the motorman should have means for applying sand quickly at dangerous places.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Light & Power Co.

We not only keep the rails sanded on grades in cities, but also provide all cars with sand.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 26.—Is it a good idea to mix salt with the sand? Why?

It is not necessary to mix salt with sand in warm weather. When the conditions are such that there is a considerable amount of moisture or snow near, or on the rails that is likely to freeze, then it is well to mix in some salt.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Salt acts like grease on the rail.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

It is not, because during damp weather the salt will melt. Prefer to have straight sand dried in a kiln.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Light & Power Co.

No. Each is often used where the other is not required.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

During freezing weather the mixing of sand and salt is desirable, but otherwise no mixing is required.

Asst. Eng. Ry. Dept.

We would not mix salt with sand under any condition. The moisture drawn by the salt makes the sand lumpy and it will not run. P. NEY WILSON, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

No, not here. We only use salt in switches and special work, and on steep grades occasionally. J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

I 27.—What can be done to overcome slippery rails, due to dead leaves on the track?

The only way in which we have ever treated this is to sweep the rails with a steel broom, and then sand them.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

If rails cannot be cleared of leaves wet the rail and use sand freely.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

There are two ways of overcoming this difficulty. One is to send out a sprinkler and thoroughly sprinkle the roadbed and tracks. It will be found that water running down the track will wash a great deal of the gummy substance produced by crushed leaves from the rail. This trouble can also be overcome by placing a man on the front end of the car with a wire broom to clean the rails. P. NEY WILSON, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

Sand liberally. J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

When our rails get very gummy and slippery from this and other causes, we have found that the use of the sprinkling car with spray nozzle removed, and pipe arranged to wash the head of the rail, gives good results.

Asst. Eng. Ry. Dept.

ADDITIONAL QUESTIONS ON TRACK DEPARTMENT

The following questions relating to track work have been received from correspondents. Suggestions and opinions in answer to any or all of these from any of the readers of the STREET RAILWAY JOURNAL will be appreciated:

I 28.—What is a good method of testing rail-bonds?

I 29.—What is the best method of keeping records of individual rail-bond tests?

I 30.—What has been the experience with soldered bonds?

I 31.—In using bond tester on special work in which each joint is bonded in addition to long bonding, what is the method of procedure in case the tie-rods span two or more joints?

I 32.—What is the best form of portable rheostat to use in connection with bond-testing instrument?

I 33.—Has the conductivity of the zinc joint held up?

I 34.—What is the best method of preventing switches from "kicking"?

I 35.—How many renewals of hard centers can be made on modern special work before the abutting rails are worn out?

THE CENSUS REPORT ON STREET RAILWAYS—I.

The complete report on the subject of street and electric railways issued by the United States Census Bureau has just been published. As readers of this paper will remember, an advance bulletin on this subject, known as Bulletin No. 3, was dated June 5, 1903, and was published in abstract in the Street Railway Journal for July 11, 1903. The present report is a volume of 439 pages with 104 tables, as well as maps and half-tone illustrations. It is divided into two parts. The first, prepared by Prof. Edward Dana Durand, discusses the following subjects: Chapter I., scope and method of investigation; Chapter II., comparison with census of 1890; Chapter III., traffic; Chapter IV., capitalization; Chapter V., financial operations; Chapter VI., employees, salaries and wages; Chapter VII., interurban railways, economic, financial and social features; Chapter VIII., consolidation of street railways; Chapter IX., franchises, public regulation and public ownership; Chapter X., street railways in European countries. Part II. has been prepared by Thomas Commerford Martin, and is divided into five chapters, as follows: Chapter I., history and development of electric traction; Chapter II., roadbed, track and electric construction; Chapter III., cars and miscellaneous equipment; Chapter IV., interurban railway construction and equipment; Chapter V., power houses, equipment and output. The entire report has been prepared under the supervision and immediate direction of W. M. Steuart, chief statistician for manufactures.

CLASSIFICATION OF RAILWAYS

An interesting feature of the traffic figures is the fact that a classification has been adopted according to the population served—that is, the roads are divided into six divisions, as follows:

1. Railways in urban centers of 500,000 population and over.
2. Railways in urban centers of 100,000, but under 500,000 population.
3. Railways in urban centers of 25,000, but under 100,000 population.
4. Railways in urban centers of less than 25,000 population.
5. Fast, long interurban railways.
6. Miscellaneous interurban railways.

This classification of companies according to population, the authors acknowledge, involves no little difficulty. In the first place the more important street railways are not confined, as they were formerly, to a single municipality. They extend into the suburbs and adjacent rural districts, and often to cities and towns at a considerable distance. In determining the area to be credited to a given urban center, the rule followed has been to include all the municipalities reached by the lines of the company, or companies, which serve the city that constitutes the leading component in that center. The statistics of minor railways serving any part of the area thus defined have been added to those of the more central systems, and the population of any additional localities reached by these minor companies. The population of strictly rural areas, through which primarily urban street railway systems pass, has necessarily been disregarded in discussing urban centers, since there is no way of ascertaining what proportion of the inhabitants of such areas are actually within reach of street railway facilities.

Pittsburg and the neighboring cities and towns are cited as a striking illustration of the difficulty of ascertaining the population served by a railway company. Of the 469.47 miles of track reported by the eight Pittsburg companies, 188.19 miles lie entirely outside of the limits of any municipality. Nevertheless, the traffic is so largely carried on within city limits that these companies have been classed as urban rather than interurban. A somewhat similar condition exists in Buffalo, N. Y., and its vicinity, while the railways serving Detroit, Mich.; Fall River, Mass.; Canton and Akron, Ohio; New Haven, Conn., and several other important cities are so largely interurban that their statistics have been excluded from the urban groups.

HIGH SPEED AND INTERURBAN RAILWAYS

For the purpose of showing the operating results of the more typical modern interurban railways, fifty-five companies have been selected, which may be fairly described by the term fast, long interurban lines. No company was included in this group which reported less than 15 miles of single track, or which had more than one-third of its trackage within municipal limits, or which operated cars at a maximum speed of less than 20 m.p.h. The distinction between such interurban railways and those in the miscellaneous group was necessarily more or less arbitrary. Several of the companies in the miscellaneous group operated at least part of their trackage in such a way as to conform to the criteria indicated for fast, long interurban lines. This is notably the case with the Detroit United Railway Company, which yet carries the greater proportion of its passengers wholly within the limits of the city of Detroit, thus rendering the statistics of its total business quite incomparable with those of more strictly interurban lines. Group 6, the miscellaneous interurban class, includes on the one hand such cases as the Detroit United Railway Company and the Boston & Northern Street Railway Company, and, on the other hand, many small railways connecting mere villages, or operated in connection with summer resorts.

COMPARATIVE FIGURES WITH 1890

In Chapter II. are presented some statistics on geographical distribution of the railways and aggregate figures, as compared with 1890, which are largely the same as those presented in Bulletin No. 3.

TRAFFIC

Chapter III. on traffic will prove to the student of street railway values one of the most interesting in the book. The total number of fare passengers was 4,774,211,904; of transfer passengers, 1,062,403,392; the average fare passengers per mile of track, 212,217; the total car-miles, 1,144,430,466.

PASSENGERS PER MILE OF TRACK AND PER CAR-MILE

The number of passengers per mile of track for the country as a whole is 212,217. If only companies operating the entire year be considered, the number of passengers carried per mile of track is 218,616. The average density for all full-time electric surface railways combined is 205,478 passengers per mile of track. Elevated roads perhaps have a somewhat greater possible carrying capacity than surface roads, because of their large cars, long trains and high speed. It may be noted, however, that the number of passengers per mile of track on the Manhattan Elevated Railway in New York City, 1,837,625, only slightly exceeds that on the Third Avenue and New York City surface systems in that city, which are 1,612,630 and 1,434,088, respectively.

The average passengers per car-mile throughout the country were 4.26. The average on the Manhattan Elevated was 4.78, as compared with 6.51 on the New York City and 6.59 on the Third Avenue, on account of the shorter rides on the latter roads. Unfortunately, less than half the street railways of the country keep records of car-hours. The total number of car-hours reported in 1902 by the 390 companies which gave this information was 65,869,342. These companies carried 2,176,886,559 fare passengers; therefore, each car carried an average of 33.28 passengers per hour of operation. Most of the companies reporting car-hours are operated by electricity. The four elevated railways in Chicago have from 43.21 to 56.93 passengers per car-hour; these figures, as might be expected from the high speed of elevated trains, being considerably larger than for most surface railways in great cities.

Owing to the difficulties of separating interurban from city

service in a number of cases, the report gives the following table of totals, and then two tables of selected cities in which the interurban traffic does not interfere with the city traffic:

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN GROUPS OF URBAN CENTERS, 1902

	All centers over 500,000 population.	All centers of 100,000 but under 500,000 population.	Twenty-nine selected centers of 25,000 but under 100,000 population.	Forty-six selected centers of less than 25,000 population.
Total population served	10,274,470	5,380,647	1,258,615	718 254
Number miles of track.	4,998.89	3,559.82	951.93	485.95
Miles of track per 1000 of population	.49	.66	.76	.68
Number of passengers.	2,456,542,270	994,327,853	135,842,312	49,179,495
Number of rides per inhabitant	239.1	184.7	107.9	68.5

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN SELECTED URBAN CENTERS WITH POPULATION OF LESS THAN 25,000: 1902

Name of Center.	Population of Center.	Number of Passengers. Total.	Number of Passengers. Per Unit of Population.	Number of Miles of Track. Total.	Number of Miles of Track. Per 1,000 of Population.
Fort Smith, Ark.	11,587	731,553	63.1	8.93	0.77
Riverside, Cal.	7,973	547,051	68.6	9.52	1.19
San Diego, Cal.	17,700	2,220,000	125.4	16.60	0.94
Santa Barbara, Cal.	6,587	814,405	123.6	8.50	1.29
New London, Conn.	17,548	1,320,791	75.3	8.51	0.48
Stamford, Greenwich, Conn.	18,417	1,327,617	72.1	12.69	0.69
Pensacola, Fla.	17,747	998,290	56.2	9.00	0.51
Athens, Ga.	10,245	356,969	34.8	6.53	0.64
Alton, North Alton, Upper Alton, Ill.	17,487	1,497,130	85.6	12.25	0.70
Cairo, Ill.	12,566	870,838	69.3	9.67	0.77
Kankakee, Bradley, Bourbonnais, Ill.	15,708	714,769	45.5	12.78	0.81
Vincennes, Ind.	10,249	450,000	43.9	8.00	0.78
Burlington, Ia.	23,201	1,600,000	69.0	14.50	0.62
Muscatine, Ia.	14,073	865,120	61.5	8.69	0.61
Ottumwa, Ia.	18,197	1,211,028	66.6	10.00	0.55
Atchison, Kan.	15,722	533,867	34.0	9.00	0.57
Wichita, Kan.	24,671	1,460,000	59.2	18.50	0.75
Shreveport, La.	16,013	1,450,000	90.6	8.80	0.55
Biddeford, Saco, Maine.	22,267	728,909	32.7	8.15	0.37
Benton Harbor, St. Joseph, Mich.	11,717	1,198,826	102.3	10.50	0.90
Marquette, Mich.	10,058	373,672	37.2	7.00	0.70
Menominee, Mich.	12,818	529,764	41.3	6.71	0.52
Vicksburg, Miss.	14,834	1,188,289	80.1	8.75	0.59
Springfield, Mo.	23,267	1,700,715	73.1	19.10	0.82
Great Falls, Mont.	14,930	939,436	62.9	11.90	0.80
Concord, N. H.	19,632	1,510,856	77.0	12.71	0.65
Laconia, N. H.	8,042	436,171	54.2	8.87	1.10
Long Branch, Deal, Allenhurst, Asbury Park, Bradley Beach, Neptune City, Belmar, N. J.	16,148	3,737,541	231.4	23.68	1.47
Perth Amboy, Metuchen, N.J.	19,485	880,128	45.2	9.06	0.46
Dunkirk, Fredonia, N. Y.	15,743	681,770	43.3	7.00	0.44
Kingston, N. Y.	24,535	2,217,334	90.4	9.16	0.37
Ogdensburg, N. Y.	12,633	478,283	37.9	10.00	0.79
Ashtabula, Ohio.	12,949	999,857	77.2	5.75	0.44
Lima, Ohio	21,723	1,375,979	63.3	18.55	0.85
Tiffin, Ohio	10,989	482,000	43.9	7.33	0.67
Zanesville, Ohio.	23,538	1,800,000	76.5	10.00	0.42
Sayre, Athens, Pa.; Waverly, N. Y.	9,481	1,059,507	111.8	9.11	0.96
Tarentum, New Kensington, Pa.	10,137	622,447	61.4	6.61	0.65
Greenville, S. C.	11,860	537,603	45.3	7.00	0.59
Austin, Tex.	22,258	1,213,703	54.5	13.38	0.60
Waco, Tex.	20,686	1,605,525	77.6	16.29	0.79
Ogden, Utah	16,313	861,910	52.8	11.00	0.67
Burlington, Winooski, Vt.	22,423	1,270,136	56.6	11.22	0.50
Everett, Wash.	7,838	971,650	124.0	9.65	1.23
Ashland, Wis.	13,074	503,658	38.5	7.68	0.59
Janesville, Wis.	13,185	304,398	23.1	7.41	0.56
Totals	718,254	49,179,495	68.5	485.95	0.68

Averages for density of traffic might be vitiated by the undue influence of a few companies having extremely high or extremely low density of traffic. To guard against such errors the accompanying table was prepared, which shows the number of full-time street railways which did not supply commercial lighting and which was within each population group reporting traffic of different degrees of density.

This table shows that the arithmetrical average of the groups is not greatly affected by high maxima and minima.

TRAFFIC IN URBAN DISTRICTS

A table (see page 562) is then given showing the trackage and traffic in urban centers of over 100,000.

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN SELECTED URBAN CENTERS WITH POPULATION OF FROM 25,000 to 100,000: 1902

Name of Center.	Population of Center.	Number of Passengers. Total.	Number of Passengers. Per Unit of Population.	Number of Miles of Track. Total.	Number of Miles of Track. Per 1,000 of Population.
Montgomery, Ala.	30,346	1,849,395	60.9	20.00	0.66
Little Rock, Ark.	38,307	3,841,415	100.3	20.70	0.54
Sacramento, Cal.	29,282	3,948,791	134.9	23.50	0.80
Pueblo, Col.	28,157	4,065,162	144.4	36.25	1.29
Meriden, Wallingford, Conn.	31,033	2,589,737	83.5	19.50	0.63
Augusta, Summerville, Ga.	42,686	2,360,674	55.3	31.02	0.73
Peoria, Averyville, North Peoria, Peoria Heights, Ill.	60,340	6,750,000	111.9	41.25	0.68
Quincy, Ill.	36,252	2,127,623	58.7	17.38	0.48
Rockford, Ill.	31,051	1,989,080	64.1	23.00	0.74
Springfield, Ridgely, Ill.	35,328	3,532,013	100.0	23.83	0.67
Evansville, Howell, Ind.	60,428	3,629,534	60.1	30.50	0.50
Dubuque, Ia.	36,297	2,391,355	65.9	20.85	0.57
Sioux City, Ia.; South Sioux City, Neb.	34,000	4,138,944	121.7	43.00	1.26
Topeka, Kan.	33,608	2,730,287	81.2	28.63	0.85
Lexington, Ky.	26,369	2,350,682	89.1	15.13	0.57
Bay City, West Bay City, Essexville, Mich.	42,386	1,986,982	46.9	23.30	0.55
Duluth, Minn.; Superior, Wis.	84,060	9,418,517	112.0	73.84	0.88
Dayton, Ohio	85,333	14,667,094	171.9	52.88	0.62
Springfield, Ohio	38,253	3,784,338	98.9	28.13	0.74
Altoona, Gaysport, Juniata, Bellwood, Pa.	46,034	4,759,279	103.4	27.50	0.60
Williamsport, South Williamsport, Pa.	32,085	2,582,297	80.5	16.41	0.51
Dallas, Tex.	42,638	6,574,773	154.2	46.30	1.09
Galveston, Tex.	37,789	2,851,603	75.5	35.86	0.95
San Antonio, Tex.	53,321	5,268,627	98.8	45.51	0.85
Salt Lake City, Murray, Utah.	56,833	10,631,591	187.1	78.04	1.37
Richmond, Va.	85,050	16,313,560	191.8	43.96	0.52
Spokane, Wash.	36,848	5,028,388	136.5	36.55	0.99
La Crosse, Onalaska, Wis.	30,263	1,706,728	56.4	17.11	0.57
Oshkosh, Neenah, Wis.	34,238	1,973,843	57.7	32.00	0.93
Totals	1,258,615	135,842,312	107.9	951.93	0.76

TABLE SHOWING DISTRIBUTION OF COMPANIES, IN THE VARIOUS POPULATION GROUPS, ACCORDING TO NUMBER OF FARE PASSENGERS CARRIED PER MILE OF TRACK OPERATED: 1902

Passengers per Mile of Track.	Total.	Number of Companies. Urban Centers, Population. 500,000 and over.	100,000 to 500,000.	25,000 to 100,000.	Under 25,000.	Interurban Railways. Fast Long.	Other.
Under 25,000.	72	4	..	2	8	17	41
25,000, but under 50,000.	86	1	1	3	23	14	44
50,000, but under 10,000.	191	10	3	13	75	10	80
100,000, but under 200,000	150	13	1	40	54	1	35
200,000, but under 300,000	36	3	15	8	6	..	4
300,000, but under 400,000	16	4	8	2	2	..	..
400,000 and over.	17	13	4	..	..	..	..
Totals.	568	48	38	68	168	42	204

In comparing the different urban centers at the present time it may be observed that length of track is a less accurate measure of street railway development than the number of passengers carried or the car-mileage operated. The amount of track required to serve adequately the needs of the people depends largely on the density of population and the topographical conditions of the city. Thus, largely because of the dense population in New York City, the proportion of trackage to population there is lower than in any other urban area except Albany and Troy, N. Y., and St. Joseph, Mo. Philadelphia and Boston also show considerably less track per 1000 inhabitants than most of the smaller cities. The population of Chicago is more scattered than that of the large cities just named, and it has, therefore, a larger proportion of trackage to population. The greatest length of street railway track per 1000 of population is found in the Western cities, Denver, Col., and Oakland and Los Angeles, Cal. This is explained by their scattered population and also by the fact that the companies operating there have a considerable suburban and interurban trackage.

Other conditions being equal, the extent to which the people of a city will patronize its street railways will depend largely

on the size of the city. This is borne out by the figures in the table on page 562. The rank of the cities in 1902, as regards the ratio of passengers to inhabitants, bears a rough parallelism to their rank in population. Other factors, however, also influence the relative amount of street railway traffic, among which are the shape and general topographical features of the city, especially the presence or absence of hills; the density of population per unit of area, and the situation of the business sections with reference to the residence sections. The average wealth of the masses of the people and their habits and customs of life also affect their patronage of the street railways.

San Francisco, though falling into the second group of urban centers, has by far the largest ratio of rides to inhabitants, owing to its steep hills and the fact that its manufacturing and commercial interests are mostly centralized within a small area, while the residence section is extensive and comparatively thinly populated.

Among the centers of less than 500,000 population, Los Angeles, Cal.; Kansas City, Mo., and Washington, D. C., follow San Francisco in the ratio of passengers to inhabitants. The patronage of street railways is least per inhabitant in the Scranton, Pa., center. The low ratio is probably due to the fact that the patronage comes largely from a mining population with a low average of per capita wealth and with residences near the place of work. St. Joseph, Mo.; Rochester and Albany-Troy, N. Y., are also conspicuous for the small degree of street railway patronage.

A comparison of these statistics for individual cities in 1902 bears out in a general way the opinion that the larger the city the greater tends to be the number of passengers who will be carried per unit of track, but many other influences also enter in and often counteract that of population.

TABLE SHOWING TRACKAGE AND TRAFFIC IN URBAN CENTERS OF 100,000 POPULATION AND OVER IN 1902:

Urban Center.	Population*	Miles of Track.	Miles of Track Per 1,000 Population.	Fare Passengers Carried.	Passengers Per Inhabitant.	Passengers Per Mile of Track.	Passenger-Car Miles.	Passengers Per Car Mile.
Albany, Troy, Rensselaer, N. Y.	216,530	75.83	0.35	26,417,076	122	348,372	7,449,410	3.5
Baltimore, Ellicott City, Md.	510,288	365.12	.72	96,763,878	190	265,019	23,330,292	4.1
Boston, Cambridge, Chelsea, Everett, Malden, Newton, Somerville, Brookline, Waltham, Mass.	927,994	451.68	.49	228,179,308	246	505,179	47,524,724	4.8
Buffalo, Niagara Falls, Lockport, North Tonawanda, N. Y.	421,694	320.48	.76	74,136,881	176	231,331	17,290,756	4.3
Chicago, Ill.; Hammond, Ind.	1,769,961	1,036.24	.58	410,284,094	232	395,935	102,366,407	4.0
Cincinnati, Ohio; Newport, Covington, Ky.	429,137	263.57	.61	86,208,384	201	327,080	23,940,175	3.6
Cleveland, Ohio, and vicinity	405,359	237.04	.58	81,370,202	201	343,276	18,768,515	4.3
Columbus, Ohio, and vicinity	127,022	106.43	.84	26,489,927	208	248,895	5,619,476	4.7
Denver, Col.	133,859	149.77	1.12	31,085,443	232	207,554	6,458,908	4.8
Indianapolis, Ind.	169,164	109.86	.65	30,005,026	177	273,120	6,921,490	4.3
Jersey City, Elizabeth, Hoboken, Paterson, Passaic, Newark, Bayonne, Orange, N. J.	969,736	463.54	.48	148,094,623	153	314,639	24,589,773	6.0
Kansas City, Independence, Mo.; Kansas City, Argentine, Rosedale, Kan.	237,042	181.24	.76	57,148,083	241	315,317	15,979,864	3.6
Los Angeles, Pasadena, Santa Ana, Orange, Cal.	118,746	164.16	1.38	30,803,086	259	187,641	9,533,269	3.2
Louisville, Ky.	204,731	147.13	.72	34,503,388	168	234,510	9,566,844	3.6
Memphis, Tenn.	102,981	71.88	.70	16,598,823	161	230,924	3,653,631	4.5
Milwaukee, Whitefish Bay, Wauwatosa, Wis.	301,701	145.50	.48	46,974,373	156	322,848	9,143,023	5.1
Minneapolis, St. Paul, Stillwater, Minn.	378,923	251.02	.66	63,009,957	166	251,016	12,895,343	4.9
New Orleans, La.	287,104	180.31	.63	53,184,273	185	294,960	17,810,169	3.0
New York, Yonkers, White Plains, Mt. Vernon, New Rochelle, Pelham, N. Y.	3,548,096	1,299.10	.37	943,687,316	266	726,416	180,499,539	5.2
Oakland, Alameda, Berkeley, Hayward, Emeryville, Cal.	101,872	122.80	1.20	17,247,022	169	140,448	5,449,713	3.2
Omaha, South Omaha, Dundee, Neb.; Council Bluffs, Ia.	155,268	105.95	.68	21,418,791	138	202,159	6,373,697	3.4
Philadelphia, Pa.	1,293,697	517.53	.40	331,304,685	256	640,165	61,175,495	5.4
Pittsburg, Allegheny, McKeesport, Bellevue, Sharpsburg, McKees Rocks, Carnegie, Wilkinsburg, Braddock, Homestead, Connellsville, Uniontown, Pa.	640,380	469.47	.73	168,632,339	263	359,197	34,311,111	4.9
Providence, Pawtucket, R. I.	268,946	137.05	.51	45,163,704	168	329,542	8,016,662	5.6
Rochester, Irondequoit, N. Y.	178,333	95.86	.54	20,171,260	113	210,424	5,196,819	3.9
St. Joseph, Mo.	102,979	35.15	.34	8,534,278	83	242,796	2,198,630	3.9
St. Louis, Mo.; East St. Louis, Granite, Ill.	614,328	396.21	.64	129,596,027	211	327,089	31,014,097	4.2
San Francisco, San Mateo, Cal.	344,614	276.50	.80	117,357,877	340	424,441	20,553,252	5.7
Scranton, Dunmore, Olyphant, Jermyn, Carbondale, Pa.	155,655	76.68	.49	8,331,663	54	108,655	2,322,162	3.6
Syracuse, Onondaga, Geddes, DeWitt, N. Y.	123,776	68.16	.55	14,234,508	115	208,840	3,704,195	3.8
Toledo, Ohio	135,271	97.78	.72	20,104,076	149	205,605	5,517,484	3.6
Washington, D. C.	279,940	139.67	.50	63,829,752	228	457,004	15,577,212	4.1

* Population shown for 1902 is that reported at the census of 1900.

PASSENGERS PER CAR-MILE

Because of differences in the size of cars and in the average length of rides a bare comparison of the number of car-miles operated in the different individual cities and of the number of passengers per car-mile is much less instructive than the other comparisons thus far presented. It is impossible, from the statistics, to trace any connection between the size of the city and the number of passengers carried per car-mile. The highest ratio of passengers to car-mileage is reported from the great urban center in Northern New Jersey, of which Jersey City, Newark and Paterson are the most important constituents; yet this center was the only one of the eight centers having a population severally of 500,000 and over that showed a ratio of passengers per inhabitant below 190. Other cities showing more than five passengers per car-mile are, in the order named, San Francisco, Providence, Philadelphia, New York and Milwaukee. The lowest ratio of passengers per car-mile, that of New Orleans, was 3, while that of both Los Angeles and Oakland was 3.2.

FARES

As regards fares, the report states that while 5 cents as a cash fare is practically universal, more than 200 companies offer tickets at a price of approximately 4 cents each. The most common practice among such railways is to sell six tickets for 25 cents. Sometimes a further reduction is made if a larger number of tickets is bought, twenty-five tickets being frequently sold for $1, and sometimes twenty-six or even more. On some railways the reduced fare is granted only to those who buy tickets to the value of $1. It is quite common for such companies to sell twenty-four or twenty-five tickets for $1. This is the custom, for instance, on the lines of the Connecticut Railway & Lighting Company, and on the systems at Springfield, Ill.; Des Moines, Iowa; Muskegon, Mich.; Syracuse, N. Y.; Chattanooga, Tenn.; Seattle, Wash., and a considerable number of smaller places. Occasionally, the purchase of a still larger number of tickets is required in order that the reduced fare may be obtained. Thus the Torrington & Winchester Railway in Connecticut sells seventy-five tickets for $3, and the companies at Atchison, Kan., and Cumberland, Md., with one or two others, sell 100 for $4. Two railways, in Olean, N. Y., and Bradford, Pa., require the passenger to buy 200 tickets in order to get a 4-cent fare, while the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., offers 500 tickets for $20. It is evident that a great majority of passengers will not take advantage of reduced fares if they are required to buy more than a dollar's worth of tickets at a time.

The approximately 4-cent fare in the various forms mentioned is found for the most part in cities and towns of medium or small size. In no urban center of more than 500,000 inhabitants are tickets sold to all classes of passengers at reduced rates. The largest cities in which, at the time of the census, six tickets were sold for 25 cents were Washington, D. C.; Detroit, Mich.; Milwaukee, Wis.; Dayton, Ohio; Indianapolis, Ind.; Reading, Pa.; Worcester, Mass.; Utica, N. Y.; Wilmington, Del., and Richmond, Va. In Detroit, however, these tickets are good only during the "rush hours" of morning and evening and the same may be true in some of the other cities named. Subsequent to the date of the census, the two railway companies in Cleveland, Ohio, reduced fares to the same basis, but they later restored the straight 5-cent fare.

The sale of tickets to patrons generally at reduced rates is quite rare among the street railways of New England, although a few of them grant lower rates to passengers who buy a dollar's worth of tickets. In the smaller cities and towns of New York a considerable number of railways sell six tickets for 25 cents. This is the practice, for example, in Binghamton, Oswego, Rome and Schenectady. On several railways in this State twenty-four or twenty-five tickets are offered for $1. Pennsylvania has even more railways which sell six tickets for 25 cents than New York. Among the more important Pennsylvania railways offering this rate are the Chester Traction Company, of Chester and vicinity; the Conestoga Traction Company, of Lancaster and vicinity; the Lebanon Valley Traction Company, of Lebanon and vicinity; the Schuylkill Valley Traction Company, of Norristown and vicinity; the Wilkesbarre & Wyoming Valley Traction Company; the Warren Street Railway Company, and the United Traction Company, of Reading. Altogether there are more than forty street railways in this State which have approximately a 4-cent fare.

In the Middle Western States of Ohio, Michigan, Indiana, Illinois and Wisconsin, the reduced fare, usually in the form of six tickets for 25 cents, is more common than elsewhere, and may almost be said to be the prevailing rate, except in two or three of the largest cities and on interurban railways. Practically all urban street railways in Indiana and Wisconsin sell six tickets for 25 cents, and the same is true of more than twenty-five of the street railways of Ohio. A fare at least as low as 4 1-6 cents is available for all passengers in every city of more than 25,000 inhabitants in Ohio, except Youngstown, Toledo and Cincinnati. A fare of approximately 4 cents appears also in about a dozen places.

Fares even lower than 4 cents exist in a few cities and towns. The most familiar instance is Detroit, Mich., where, on part of the system now operated by the Detroit United Railway Company, eight tickets for 25 cents are sold, in accordance with the terms of the franchise under which these lines were constructed. The new Central Market Street Railway in Columbus, Ohio, sells eight tickets for 25 cents, while the older street railways in this city offer seven tickets for 25 cents. The rate of seven tickets for 25 cents also prevails in Salem and Delaware, Ohio, while in two or three other towns of the State where six tickets are sold for 25 cents, twenty-seven may be bought for $1. A rate of seven tickets for 25 cents is also made on the Pittsburg, McKeesport & Greensburg Railway of Pennsylvania, while in Kansas one of the minor companies offers twenty-eight tickets for $1, and another thirty.

In addition to railways which thus practically fix their fares at 4 cents or less, there are a number which grant slight reductions from the 5-cent fare. The rate of eleven tickets for 50 cents exists in Pueblo, Col., on two interurban railways of Maine and in several other places. In Mobile, Ala.; Santa Barbara, Cal.; Colorado Springs, Col.; Auburn, N. Y.; Lincoln, Neb.; Toledo, Ohio; Spokane and Tacoma, Wash., and a number of other places the railways sell twenty-two tickets for $1. The leading companies of Northern New Jersey offer twenty-one tickets for $1, while on a number of railways of minor importance in various parts of the country, from 105 to 110 tickets are sold for $5.

REDUCED FARES FOR PARTICULAR CLASSES OF PASSENGERS

Sometimes street railway companies carry young children in company with their parents for half fare. In Baltimore, Md., for example, the fare for children is 3 cents. It is probably more common, however, to charge full fare for children above a certain age and carry others free. A more important practice is that of granting reduced fares to school children. In such cases the most common rate is 2½ cents, though sometimes 3 cents or 4 cents is charged. In New England it is almost universal for street railways to carry school children at reduced rates. Outside of New England the practice is frequently found in smaller cities and towns, and in a few instances in large cities also. Among the important cities which offer a fare of 2½ cents to school children are Boston, St. Louis, San Francisco and Denver. Street railway companies presumably act on the theory that, by thus reducing the fares of school children, they will secure a considerable amount of traffic from those who would otherwise walk.

The practice of granting special rates to working people is comparatively rare in the United States. The returns to the Bureau of the Census do not indicate, in some cases, whether such special rates reported are limited in any way, and in other cases they do not show precisely the restrictions imposed; but usually there is no restriction except as to the time of day at which the journey is taken. In general, it may be said that the reduced fare for workingmen is confined to the hours from about 6 to 8 in the morning and from about 5 to 7 in the evening. Naturally any person who rides at that time may usually avail himself of the reduced fare. The special rate is sometimes confined to particular routes or distances. The practice is more common in New England than elsewhere. About sixteen of the street railway companies of Massachusetts reported reduced fares for workingmen, the most common rate being 2½ cents, although several railways reported 3 cents or 4 cents. The most important company which makes special rates for workingmen is the Boston & Northern Railway Company, which serves many cities and towns in Eastern Massachusetts.

Among other instances of reduced fares for working people may be mentioned the practice of certain railways in the mining districts of Pennsylvania. For example, two companies centering at Shamokin, and several others elsewhere, sell thirty workingmen's tickets for $1. The Detroit & Port Huron Shore Line and the Saginaw Valley Traction Company sell eight tickets for 25 cents to workingmen, while the railways of Zanesville, Ohio, and Clinton and Dubuque, Iowa, make a 2½-cent rate. When the elevated railways were first opened in New York they charged a 10-cent fare, but were required by law to carry passengers for 5 cents during the rush hours morning and evening.

It is rarely if ever true that workingmen taking advantage of such special rates are confined to particular cars.

At the solicitation of the local postmaster at Des Moines, acting for Postmaster-General Wynne, the Des Moines City Railway Company has equipped one of its cars with a new mail box, known as the "McAllister," which promises to afford the advantage of mailing letters while the car is in motion. A car in Washington, D. C., is similarly equipped so as to thoroughly test the device. Unlike the boxes now in use in Des Moines, the new device is placed on the side of the car instead of on the rear dasher. It is open at the top, and is so designed as to receive letters while the car is in motion without obliging the depositer to manipulate a lid of any kind in mailing the letter. Neither rain nor snow can injure the mail after deposit.

ANOTHER ELECTRIC TRACTION NIGHT AT THE NEW YORK RAILROAD CLUB

Recognizing the general interest developed at the January meeting of the New York Railroad Club by the paper of W. B. Potter, of the General Electric Company, on "Developments in Electric Traction," and lack of time having prevented a general expression of opinion from members at that meeting, the executive committee of the club decided to continue this important topic for the meeting held at Carnegie Hall on March 17. This meeting was well attended and many prominent electrical engineers as well as steam railroad motive power men were present.

In the absence of President Vreeland, George W. West, superintendent of motive power for the New York, Ontario & Western Railroad, presided. No regular paper was presented and the entire evening was devoted to a further discussion of Mr. Potter's paper, which was printed in full, together with the discussion at the January meeting, in the Street Railway Journal for Jan. 28, 1905. Mr. Potter was called upon to open the discussion, but confined himself to a few general remarks, stating that he preferred to listen to the opinions of some of the steam railroad motive power men relative to the possibilities of the electrification of steam lines.

The chairman then called upon N. W. Storer, of the Westinghouse Company. Mr. Storer said that two points seemed to have been brought out conspicuously by the paper and the previous discussion; one of these was that electricity was to have a prominent place in railroad work in the future, and the other was that the third rail for conveying the current to the car or train, however successful it may have been in the past, does not fill all of the requirements for heavy and high-speed work. The speaker thought the third rail has many very desirable features, but lacks certain requisites for meeting steam railroad conditions. It is an obstruction, and no matter how well it may be protected it will always introduce a dangerous element, particularly to the section gangs engaged in track maintenance work. The various questions involved in the subject of electric traction on steam roads should be approached by everyone interested with an open mind and in a spirit of conservatism. The speaker agreed with the opinion expressed by Mr. Sprague at the previous meeting, that conservatism must be the rule. Whatever the limitations of the present steam locomotive, it is doing its work and doing it well, and any proposed change looking to the retirement of the steam locomotive must receive most careful consideration from every point of view. If electricity is to be given the attention it deserves from steam railroad men, the electrical engineer must be able to show economies in operation, particularly in the handling of suburban traffic. The choice of electrical systems is of the greatest importance. It seems to be well established that for suburban and terminal situations, where the traffic is very dense, as found on the New York Central lines out of New York, the direct-current motor is the thing. But continuous current will not do on trunk lines where traffic is not dense, owing to the cost of transforming and converting, thus making necessary economies impossible. For this long-distance high-speed work high-tension current must be used and alternating-current motors must be provided on the cars or trains. In the present stage of the art it is impossible to deliver direct current at sufficiently high voltage to give the advantages desired; it is also impossible to use the third rail for high voltages. It is therefore necessary to use high-tension currents, either single-phase or three-phase. Polyphase current is not suitable for railway work, because it requires complicated overhead conductors, and because the characteristics of the three-phase motor are not such as to meet best the conditions, particularly in the matter of variations in speeds. If the polyphase motor is out of it, single-phase distribution must be adopted.

There are several ways of utilizing single-phase currents. One method is to have motor-generator sets on the cars. This system is not desirable because of the great additional weight on the individual car units. The future railroad system will consist of a main line with many branches. These branches will be operated with single cars which will be delivered to the main line and made up into trains, so that every unit must be complete, and they must be capable of multiple control. This cannot be accomplished with motor-generator sets on each car, principally on account of the great excessive weight. This method might do for slow-moving freight traffic, but not for high speeds; and it will scarcely be the final system. About the only system available therefore for trunk and branch line work is single-phase distribution with series-wound motors on the cars. Something better may be developed some time, but at present this seems to be the only suitable method that will fill all the conditions of long and high-speed service.

A. H. Armstrong, of the General Electric Company, frankly admitted that the goal of the electrical engineer is to equip existing steam lines with electricity. It was the speaker's opinion that this whole question was one of finance more than of engineering. The large manufacturing companies have been able for some time to furnish electric locomotives that will do the work required, but heretofore they have not been able to offer economies over the steam locomotive. The art has now developed to a stage that will justify the electrical engineer in going before the steam railroad directorate and asking them to consider a complete proposition for equipping their lines electrically, in part or in whole. In making the decision as to the choice of generating and distributing methods, each section of a large system should be considered by itself as well as in relation to the whole problem, for a section comprising a long heavy grade may introduce entirely new factors. In this regard the electrical engineer, in attempting to make comparisons with steam operation, has been at a disadvantage, because it has been very difficult to segregate the accounts of the steam roads so as to obtain the results with reference to each particular section. Any road having a variable profile should have a motor that will give flexibility in varying speeds. Another road having a regular profile, whether it be comparatively level or a continuous grade, so long as the profile is reasonably regular, will find a three-phase system feasible. Continuous-current distribution in and around cities is so firmly fixed that for these conditions it will undoubtedly stay. All three single-phase roads now in operation in this country are using catenary construction.

I. C. Hubbell drew attention to the fact that although rapid strides are being made in the development of the electric motor, it must not be forgotten that improvements will also be made in the present steam locomotive, and in any comparisons between the two systems this must be taken into consideration. The speaker ventured to predict that within five years steam locomotives would be in use capable of producing a horse-power on 18 lbs. of water per hp-hour, as against 22 lbs. of water, the present measure of efficiency. Mr. Hubbell asked Mr. Potter if he would state the indicated horse-power developed by the stationary engine which supplied the power for the electric locomotive in the recent New York Central tests. He understood the electric locomotive developed 3000 hp, and wanted to know what was the output of the stationary engine in the power house at the time of the test. Later in the evening, Mr. Potter answered this by stating that the efficiency as shown by the indicated horse-power of the stationary engine in relation to the horse-power developed at the rim of the driver was about 65 per cent—that is, in order to obtain 3000 hp at the locomotive the engine would have to deliver about 4500 hp. These figures were obtained by taking the efficiency of the generator as 94, of the transmission lines as 95, of the sub-station apparatus as 90, of the third rail 90, and of the locomotive 90.

A. M. Waitt was of the opinion that electricity would make itself manifest in the steam railroad problem of the near future, not only on the score of economy, but also because of many other advantages. The incandescent light has supplanted gas in many instances, not because it is a cheaper form of illumination, but because it possesses many conveniences. Electricity on trunk and suburban roads will come because it offers many advantages that can be obtained in no other way. He was also convinced that the third rail will be the approved medium for conveying current because there is no room, especially in freight yards, for overhead wires with the complicated crossings, switches, etc.

Frank J. Sprague spoke at some length touching upon the arguments brought out at the previous discussion. He believes that we have not yet reached the limit of continuous-current distribution, and it is possible to use continuous current at higher voltages than are now customary.

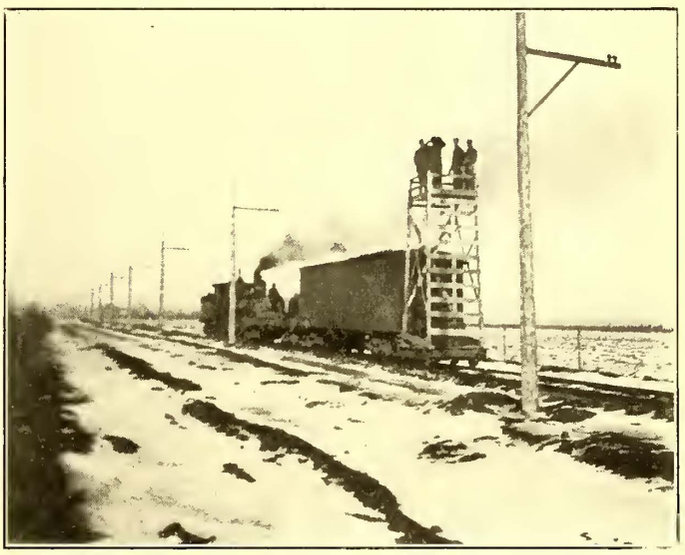
Additional remarks were made by Messrs. Rice, vice-president of the General Electric Company; Mitchell, Hibbard, Sprague and others, and Mr. Potter then closed the discussion, referring briefly to some of the points already brought out in the paper and the discussions.

THE OPENING OF THE BLOOMINGTON, PONTIAC & JOLIET SINGLE-PHASE RAILWAY

The Bloomington, Pontiac & Joliet Railway Company last week opened for traffic that part of its line between Pontiac and Odell, a distance of 10.4 miles. This road is equipped with single-phase, alternating-current motors of General Electric Company manufacture. That portion of the road now under construction is to extend from Pontiac to Dwight, a distance of 20 miles. It was considered by the Arnold Company, of Chicago, which has done the engineering of this road, that the situation was one calling for a low investment, and that a single-phase alternating-current trolley line was the best thing to install. The generator is located in the power station of the Pontiac Light & Water Company, which is owned by the same interests that control the railway company.

By using single-phase alternating current on the trolley at 3300 volts, it is intended to operate the whole line as far as Dwight without any feeders by simply connecting the power station at one end of the two No. 00 trolley wires with which the road is equipped. The overhead construction is very simple on the interurban portion. The trolley wires are hung from ⅜-in. steel stranded catenary cables. The trolley wires are grooved No. 00, and are to be supported from the catenary every 10 ft., though at present the supports are placed only every 100 ft. midway between the poles. The poles are placed 7 ft. from the center of the track. Instead of iron brackets a wooden cross-arm 3 ins. x 5 ins. in cross section and 7 ft. 9 ins. long extends out from the pole over the track, and is supported by a 3-in. x 3-in. wood brace. The cross-arm and brace are fastened to the pole as well as to each other by malleable iron fittings. The poles are 35 ft. long, set 7 ft. in the ground. The trolley wires are supported 19 ft. 6 ins. from the track. The catenaries are insulated by Thomas brown porcelain center bearing insulators placed 10 ins. apart. These insulators are mounted on malleable iron pins, on to which they are cemented with Portland cement. The trolley wire is supported by mechanical clips on which are bronze hooks, which slip over the catenary cable, and are hammered down so as to prevent them from coming loose.

Inside the city of Pontiac side pole instead of bracket construction was adopted. Both the trolley wires and the catenary cables are supported from span wires, the catenary spans being just above the trolley spans. The catenaries are used for safety. The insulation of trolley and catenary conductors is obtained entirely by strain insulators of impregnated wood 24 ins. long, similar to those used on the Schenectady-Ballston line, upon which the first General Electric experiments were tried. Additional insulation is secured by porcelain insulators located at the pole to which the span wire is attached. The ordinary form of trolley pole and wheel are to be used, exceptional precautions, however, being taken to insulate the trolley base. Drawings of the line construction are given in the paper which George A. Damon, managing engineer of the Arnold Company, presented to the American Institute of Electrical Engineers, March 24, and will be published in the next issue of this paper. The description of the cars purchased from the American Car Company for this road appeared in the Street Railway Journal of Feb. 18, 1905. They are equipped with four 75-hp G. E. A-605 25-cycle series compensated motors. Unlike the cars on the Schenectady-Ballston line, which had to operate on both direct and alternating current, these cars are equipped with a



METHOD OF STRINGING OVERHEAD WIRES ON THE PONTIAC SINGLE-PHASE LINE, USING A CONSTRUCTION LOCOMOTIVE

method of control which varies the speed of varying potential through the medium of a transformer, being designed for use on an alternating-current supply only. The cars have 25-cycle are headlights, the operation of which will be watched with considerable interest. No sub-stations are used on this portion of the line.

The Bloomington, Pontiac & Joliet Electric Railway is to form one of the important links in the chain of interurban roads which will probably be soon completed between Chicago and St. Louis.

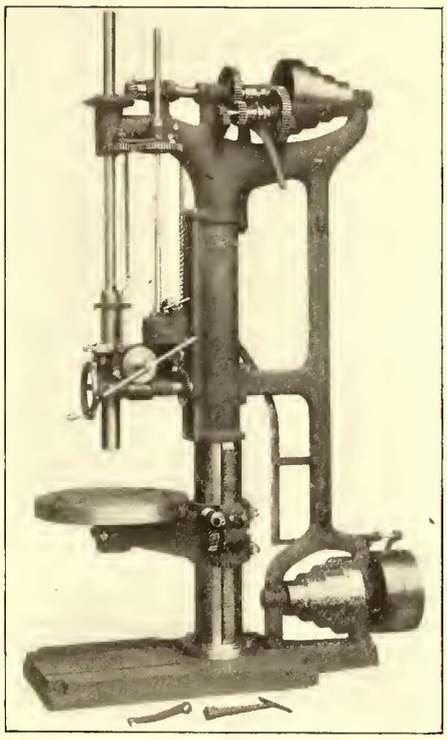
The officers are J. A. Carothers, president; W. F. Van Buskirk, treasurer, and F. L. Lucas, general manager.

Springfield, Ohio, has obtained membership in the Central League of Baseball Clubs, and the quarters of the home club will be at Hill Top Park, which is owned by the Springfield, Troy & Piqua Traction Company. The company will give a 5-cent fare and local service to the park, and will probably arrange to haul cars in trains to baseball games. The company will enlarge the grand stand and make other improvements to the park.

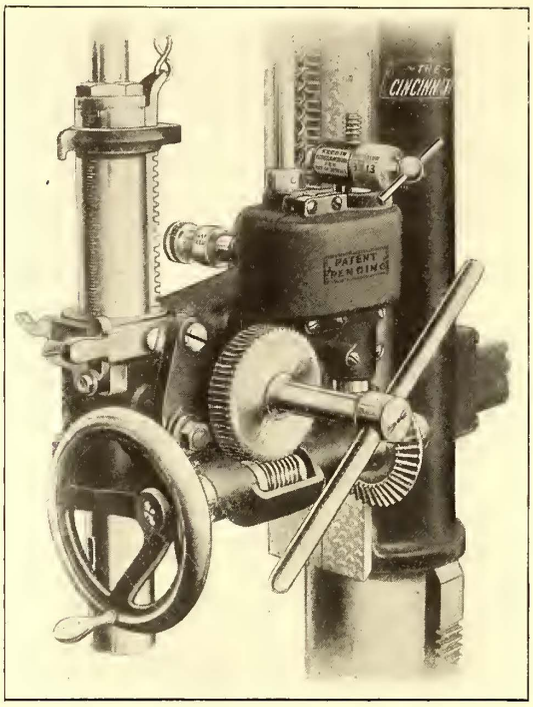
The annual report of the Union Depot Company, which operates the union passenger station (steam) in Columbus, Ohio, indicates that the local business on all the lines using the station had decreased considerably, owing to the competition of electric roads. Only the World's Fair business saved the station from a large decrease in gross earnings as compared with the year previous.

NEW HEAVY DESIGN OF UPRIGHT DRILL

One of the most important of the machine tools required in electric railway repair shops is the drilling machine. From the very nature of the work usually encountered, which tends naturally toward truck and underrigging detail repairs, the use of a drill is a prime necessity. Furthermore, the day is past when the ordinary simple design of drill, or makeshift second-hand device, will meet the requirements of repair shop work; the modern railway shop operating under the stress of present-day service must be equipped with the most rapid and efficient tools that can be had, in order to turn out the maximum quantity of work.



THE NEW DESIGN OF UPRIGHT DRILL, WITH GEARED FEEDS



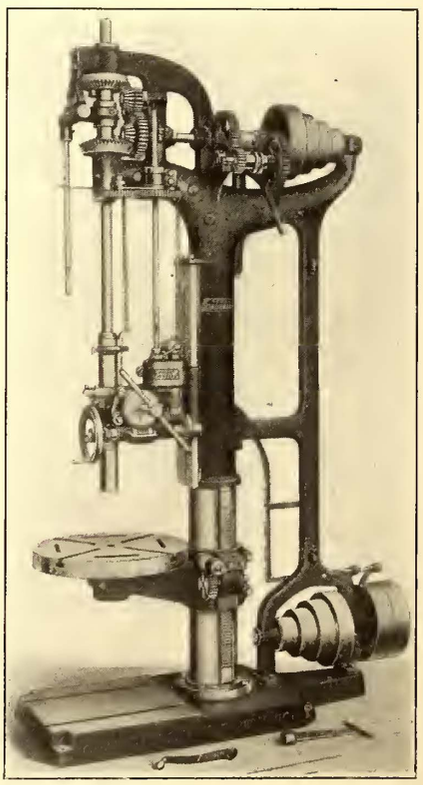
DETAIL VIEW OF THE POSITIVE GEARED FEED MECHANISM USED

In anticipation of the increasing requirements in this direction, the Cincinnati Machine Tool Company, Cincinnati, Ohio, specialists in the manufacture of drilling machinery, have recently added still further improvements to their extensive line of upright drills, which make them of particular interest to repair shop men. Their latest designs of heavy pattern upright drills are illustrated herewith, both the standard drill and the same with their new geared tapping attachment being presented. An additional view illustrates the improved positive geared feed mechanism which forms one of the most interesting features of the new drill.

It will be noticed that the feed cones formerly placed on the top of the drill have now been entirely eliminated and that the feed is now obtained entirely through gears. In this respect the drill differs from many others on the market which have a series of gears attached to the feed rod at the top of the machine, and is the only machine which has the feed changes placed directly on the head. It is now equipped with an entirely gear-driven feed, which has a quick-change feed box attached to the sliding head of the machine, so as to be most convenient for the operator. Through this mechanism six feeds in thousandths per revolution of the spindle are instantly obtained through the movement of a conveniently placed handle, as follows: 6-, 9-, 13-, 18-, 27- and 39-thousandths. An excellent idea of its mode of operation may be obtained from the detail view of the mechanism; as it is shown, the feed is set for 13- or 39-thousandths per revolution of the spindle, according as the slow or fast feed is used. This change from fast to slow is very conveniently made from a little button at the left of the gear box, and not at the point where the spindle drives the feed rod at the top of the machine, as is usual in other styles of drills.

The detail view shows also incidentally the arrangement of feed drive to the spindle and the automatic depth gage for throwing out the feed when the spindle has descended a predetermined distance. For this latter purpose the spindle is graduated in inches and provided with an adjustable throw-out pointer which, after descending close to the arm, presses downward the feed-release lever shown above the hand wheel. This results in dropping the worm out of mesh with the large work gear. The feed drive from the mechanism to the spindle takes place through the horizontal shaft carrying the worm and hand wheel; the worm meshes with the large worm wheel on the shaft above, which passes at a right angle through the arm to drive the spindle rack. This latter shaft when released from the worm is used for quick adjustment of the drill to or from the work.

It will be further noticed from the standard drill that the main drive from the upper belt cone to the spindle is through a conveniently arranged back gear, which may be shifted by the mere throwing of a lever conveniently placed at the right of the frame. This lever operates by throwing a jaw clutch so as to clutch in either the fast or the slow drive. The belt shifter is operated by a handle at the left of the frame, which comes close to the table and is convenient to the operator. While this machine is shown as arranged for belt driving, the design is such as to easily permit the application of the motor for direct driving. The company has designed a special type of bracket which is easily bolted over the back-stay of the drill frame so as to bring the motor directly above the outside belt-driving pulley. This makes a very convenient and easily applied support for the motor; one of its most convenient features lies in the fact that it can be applied to the Cincinnati drill at any time,



THE NEW CINCINNATI DRILL, WITH GEARED TAPPING ATTACHMENT

whether the drill is a new or old one. The gear-tapping attachment which this company has designed for application to its upright drill has many features of advantage. It is, in fact, the only attachment of its kind which may be placed directly upon the standard design drill so as to form a part of it, and which has a ratio of return to advancing speed of 2:1. By its use the operator is enabled to start, stop or reverse the machine at will through the lever shown at the front of the spindle. It will be seen at a glance that this arrangement will greatly facilitate the operation of tapping of holes. By merely pulling the handle outward, the tapping drive is started at the slowest speed, while pulling the handle to its neutral position, the drive is instantly stopped; by pushing the handle inward, the return or backing-out drive at the double speed is thrown in.

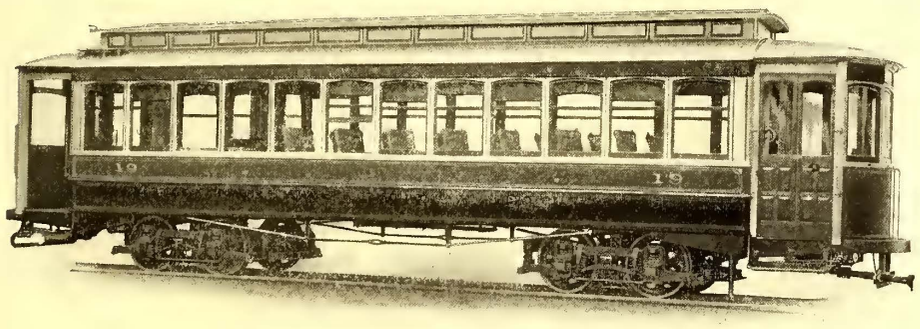
The Cincinnati Machine Tool Company manufactures these drills as a specialty, devoting its entire time to this class of work. Drills are built either plain or with the tapping attachment, as desired, and in sizes from 21 ins. to 42 ins.

SPECIFICATIONS OF THE 24-IN. CINCINNATI DRILL

Height of drill	8	ft.
Drills to the center of	25	ins.
Distance between base and spindle	48	"
Distance between table and spindle	36½	"
Traverse of table on column	19¾	"
Traverse of head on column	21¼	"
Diameter of table	22	"
Diameter of spindle in sleeve	1 11-16	"
Diameter of spindle above sleeve	1 9-16	"
Traverse of spindle	9	"
Revolutions of countershaft per minute		250
Floor space required	21½ ins. x 58	ins.
Weight of drill, pounds		2,000

ROLLING STOCK FOR NEWPORT NEWS

Nine semi-convertible cars built by the J. G. Brill Company have recently been placed in operation on the lines of the Newport News & Old Point Railway & Electric Company, Virginia. The cars are intended for use in the city of Newport News and for suburban service between Newport News and Old Point. The railway company has seventy-five cars in commission and about 30 miles of track.



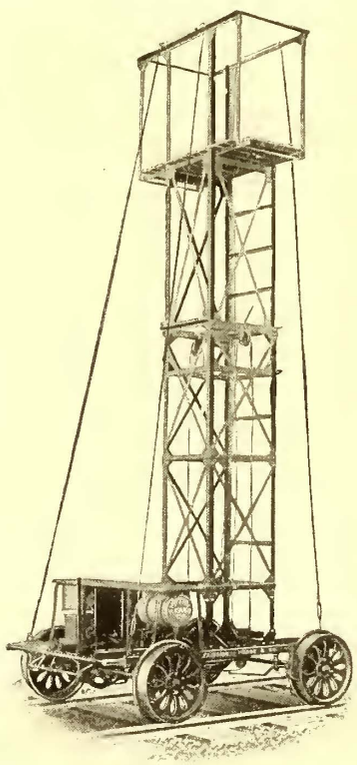
DOUBLE-VESTIBULE SEMI-CONVERTIBLE CAR FOR NEWPORT NEWS, VA.

The cars measure 33 ft. 4 ins. over the end panels and are 8 ft. ½ in. wide over the sills. They are seated for forty-four passengers and have a smoking compartment 8 ft. 9 ins. long at one end. The cane-covered seats, 24 ins. high, are of the double-roll back type and have grab handles attached. The interiors are handsomely finished in cherry, with ceilings of decorated birch. The semi-convertible window system particularly adapts the cars to the mild climate of Hampton Roads, as the sashes may be changed at will and held at any height, or raised entirely into pockets in the side roofs, thus admitting any amount of air desired. The advantages claimed for the roof pockets are that there is a gain of several inches in the interior width of the car, and that there is no danger of fingers being pinched, nor glass broken, as is so often the case where wall pockets are used.

The builder's specialties used include angle-iron bumpers, radial draw-bars, "Dedenda" gongs, "Retriever' bells, vestibule door controlling devices and sand boxes. The general dimensions of the cars are: Length over the crown pieces and vestibules, 43 ft. 4 ins., and panel over the crown pieces and vestibules, 5 ft.; width over the posts at the belt, 8 ft. 4 ins.; sweep of the posts, 1¾ ins.; centers of posts, 2 ft. 8 ins.; side sill size, 4 ins. x 7¾ ins., plated with ⅜-in. x 12-in. steel; end sill size, 5¼ ins. x 6⅞ ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 3¼ ins. The No. 27-G trucks on which the cars are mounted have a wheel base of 4 ft., and 33-in. wheels.

A GASOLINE EMERGENCY AND INSPECTION CAR

On an interurban road where it is difficult to reach the scene of an overhead line break-down with a trouble wagon within any reasonable time, and where the breaking down of an overhead line may result in cutting off the current supply so as to prevent an electric motor car from reaching the scene of the accident, a gasoline emergency car may be a very desirable addition to the rolling stock of a company. Such a car is now being offered by Fairbanks, Morse & Company, of Chicago. This car is equipped with either a wood or steel tower for overhead line work. The gasoline engine, which is of the automobile type, is capable of running the car up to a speed of about 30 m.p.h., or it can be operated at very slow speed if necessary for repair work. It can be reversed at a speed of about 10 m.p.h. The gasoline engine, being always ready without a constant expense in keeping up fires, is certainly preferable to a steam locomotive as an emergency wrecking car. The car embodies principles well tried in gasoline automobiles and railroad speeders, so that there is really nothing experimental about the outfit. On the whole, it is rather remarkable that more emergency cars of this kind are not in use.



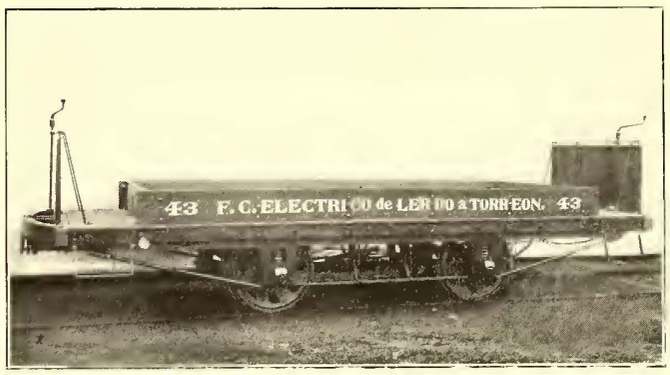
GASOLINE EMERGENCY AND INSPECTION CAR

INSTRUCTION CAR FOR SCHENECTADY

The Schenectady Railway Company has secured from the General Electric Company the skeleton car which it exhibited at the Louisiana Purchase Exposition to show the details of the equipment all exposed. The car will be used by the Schenectady Company as an instruction car for employees.

PLATFORM CARS FOR CENTRAL MEXICO

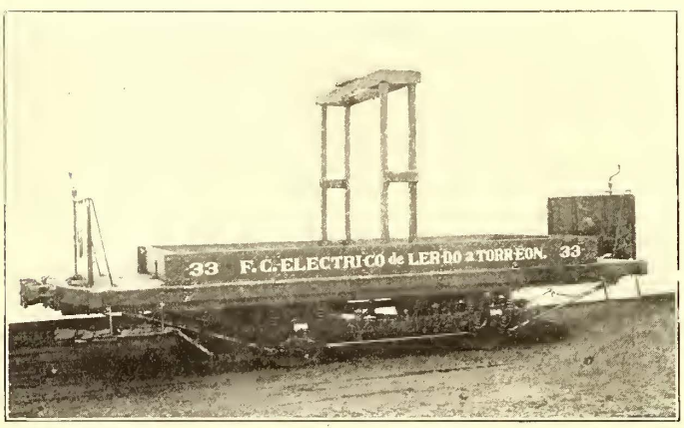
The platform cars shown in the accompanying cuts were recently shipped by the American Car Company to the Ferrocarril Electrico de Lerdo a Torreon, Mexico, where they will be placed on the 8-mile line between Lerdo and Torreon. The motor car with the trolley bridge is intended for use as a locomotive as well as for carrying loads, while the other cars are simply for use as trailers. This type is used for construction work and for carrying freight, and has proved quite profitable to the railway company. The cars are strongly built and will



TRAILER PLATFORM CAR FOR FERROCARRIL ELECTRICO DE LERDO A TOREON

stand plenty of hard work and can be put to a great variety of uses. The railway company operates a number of this type which have been built by the American Car Company.

The motor car is 21 ft. long over the end sills and 2 ft. 6 ins.



PLATFORM MOTOR CAR WITH TROLLEY BRIDGE

from the end of the body to the outside of the dasher. The width over the sills is 7 ft. It is mounted on Brill No. 7 trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. The trailers have the same dimensions as the motor car, and are mounted on Brill equalizing running gear trucks. Brill brake rigging, "Dedenda" gongs and angle-iron bumpers are included in the equipment.

The Schoen Steel Wheel Company, of Pittsburg, has recently closed an order for 2700 of its solid rolled-steel wheels with the Brooklyn Rapid Transit Company. These wheels are for use on 200 passenger surface cars, 50 freight surface cars and 100 elevated cars. Particulars of the order for the cars on which these wheels are to be used was published in the Street Railway Journal for March 11. This order is probably the largest single order for steel wheels ever placed for surface electric railway use.

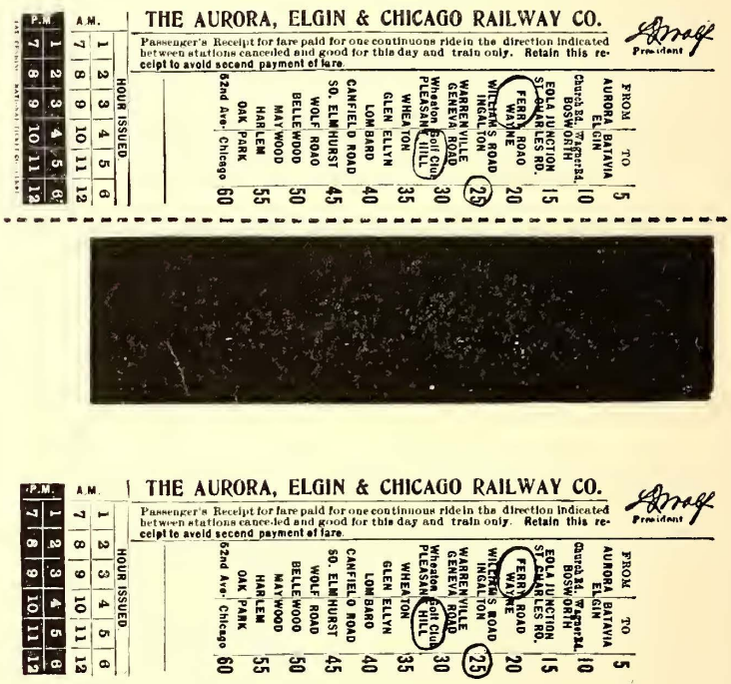
NEW INTERURBAN TICKET

The National Ticket Company, of Cleveland, is putting out a novel form of interurban ticket, which consists of a cash fare receipt in combination with a concealed duplicate.

The ticket comprises three sections, which are designed to be folded one upon the other. The first or upper section bears a list of the stations "from and to," a column of fares between stations and a time indication. The third or bottom section is a duplication of the first. Between these two is a blank section having a carbon coating, so that any marks made on the first will be reproduced upon the third. The second and third sections are sealed along the edges, and it is impossible to get at the third section without cutting along the edge.

To issue a receipt the conductor marks with an indelible pencil around or through the stations "from and to," and amount of fares paid, and any other data the road may require. The conductor then tears off the first section and gives it to the passenger as a cash fare receipt. After the receipt is issued the conductor cannot alter the marks on the concealed section without mutilating the ticket.

The auditor opens the concealed duplicate with a letter opener, or in cases where large numbers of tickets are used, several hundred may be stacked up and cut with a small paper



TELL-TALE INTERURBAN TICKET

cutter. The receipts are numbered in duplicate and bound in books of fifty. A metal case with hinged cover is furnished, which affords a smooth hard surface to support the paper while it is being marked.

COST OF SNOW REMOVAL IN BROOKLYN

Some figures as to the cost of snow removal on the lines of the Brooklyn Rapid Transit Company during the last four years have become available since the publication of the article last week on "The Effect of the Past Two Winters." They are as follows:

	Per mile of single track.
Average of two years ending June 30, 1903.....	$113.61
Average of season of 1904.....	199.94
Average of season of 1905, up to March 1.....	203.87

These figures, like those published last week, show a very large increase for this item during the last two years.

FINANCIAL INTELLIGENCE

WALL STREET, March 22, 1905.

The Money Market

There was a decided improvement in the money market this week. The demand for funds was more active than in the preceding week, and rates responded to the heavy losses in cash sustained by the local institutions on the interior movement, and by the payment of $13,500,000 government funds by the depository banks. At the beginning of the week the rate for call money advanced to 4 per cent on the shifting and calling of loans preparatory to the payment of the Standard Oil dividend and other large disbursements, and although the rate later yielded to 2½ per cent on liberal offerings, the ruling rate for the week was about 3¼ per cent, as against 2½ per cent, the rate at which the bulk of the transactions were made in the previous week. The advance in call loans was followed by a general marking up in the rates for time contracts to 3½ per cent for all maturities. Local banks declined to offer with the customary liberality, and for the first time in many weeks borrowers were compelled to pay the full asking rates. A feature of the week was the heavy offerings, both on call and on time, by the international houses against exchanged transactions, and had it not been for this source of supply, it is probable that rates for all classes of accommodations would have attained a higher level. As a result of these operations by foreign houses, sterling exchange broke sharply to 4.8595 for prime demand bills, a loss of about 85 points for the week, and the lowest point attained thus far this year. The bank statement published last Saturday, although an extremely bad document, was, in some respects, better than was generally anticipated. The decrease in cash was $7,430,000, nearly $4,000,000 less than the preliminary estimates. The decrease in loans of $5,241,900 was probably due to the shifting of loans to other institutions. Deposits decreased $13,227,700. The reserve required decreased $3,306,925, which, subtracted from the loss in cash, left a decrease in the surplus of $4,123,928. The surplus is now $5,154,175, as against $27,310,575 in the corresponding week of 1904, $3,180,400 in 1903, $3,471,350 in 1902, $16,272,425 in 1901, and $5,817,300 in 1900. Mercantile paper was more active, owing to the preparation for the spring trade. Rates are firmly held at 4 per cent as the minimum for the best names. The market at the close, although a trifle easier in tone, was unchanged as to rates. It is expected that rates will rule at about the present level, at least for the present. The banks are already taking out new circulation against the bonds released by the payment of government money, which will increase the supply of lendable funds. It is also pointed out that so long as the present easy conditions prevail in the European money markets, international institutions will continue to offer funds liberally in the local market, which will operate against any appreciable advance in interest charges. Discount rates at the principal European centers remain practically unchanged from a week ago.

The Stock Market

Extreme irregularity in values characterized the dealings in the stock market this week. At the beginning the trading was upon a rising scale of activity, but the increase in activity was in most instances accompanied by a lower range of prices. The improvement in prices for American stocks in London, and the subsequent heavy purchases for foreign account, had absolutely no influence upon local sentiment. The expectation of dearer money, and reports of trouble at Paris, were used effectively by the advocates of lower values, and in many of the recently active issues prices were forced down from 1 to 2 per cent. New York Central and Union Pacific, and in the industrial, Colorado Fuel & Iron and American Smelter were especially weak, the weakness in the latter stock being attributed entirely to the death of one of the promoters of the company. Later, there were sharp recoveries from the low prices. The improvement, however, was only temporary. On Saturday, the Western element was decidedly bearish and sold stocks freely, which together with short sales by the local traders resulted in another sharp downward movement in values. Pressure against New York Central and St. Paul was pronounced, but just before the publication of the bank statement there was extensive covering by shorts which brought about a sharp rally on comparatively light purchases, but after the receipt of the statement there was renewed selling, and the market again displayed a reactionary tendency. At the opening of the present week, renewed pressure was brought to bear in certain quarters of the market, but this attempt to lower prices was not entirely successful. The failure of money rates to harden appreciably, and the reports of heavy traffic from Western traffic managers of all the leading roads, together with the continued improvement in all of the leading industries, imparted a decidedly firm tone to the market, and prices recovered sharply. Conspicuously strong features of the week were New York, Ontario & Western, American Locomotive, and some of the Southern Iron & Steel stocks, the strength in the latter group being due to the renewed talk of progress in the merger negotiations. Republic Iron & Steel issues were strong on prediction of an early resumption of dividends on the preferred stock. Tennessee Coal & Iron was also strong, but later declined about a point on the declaration of a 1 per cent dividend on the common stock, being the first since 1900. Toward the close the market became considerably less active, and on renewed attacks by the bears prices ran off sharply. The closing was weak. The bond market was fairly active and in the main prices held firm. That a good demand still exists for high-grade issues is evidenced by the fact that the $25,000,000 American Telephone & Telegraph 4 per cent gold bonds were largely over-subscribed before the opening of the books. Of the total amount, nearly $10,000,000 were taken abroad. Another feature of the bond market this week was the successful flotation of the £1,000,000 sterling St. Paul, Minneapolis & Manitoba Railway Company, Pacific Extension, 4 per cent bonds.

The local traction issues were irregular, but prices generally ruled comparatively firm.

Philadelphia

The local market for traction issues was fairly active this week, and although prices displayed more or less irregularity, the undertone was generally strong. In the early dealings all of the active issues sustained fractional losses, as a result of sales to realize profits, but toward the close the market grew firmer, and many of the leading issues more than recovered the early declines. One of the principal features of the trading was the activity and strength in Philadelphia Rapid Transit. From 30¼, at the opening, the price ran off to 29½, but later a fairly heavy buying movement developed which advanced the stock to 31¼, the close being at 31⅛, a net gain for the week of ⅛. About 20,000 shares of the stock changed hands. Philadelphia Company common was conspicuously strong. The initial transactions were made at an advance of 2⅜ over the previous close on the report of a deal by which the United Gas & Improvement would absorb the company. Later the price ran off about a point, but toward the close there was a recovery to within a small fraction of the highest. Upward of 35,000 shares were traded in. No confirmation of the rumor of a deal was obtainable. United Gas & Improvement, on the other hand, displayed pronounced weakness, the price declining from 116¼ to 114¾, but in the late dealings there was a recovery to 116⅜, which price represents a loss of ⅞, as compared with last week's closing figure. About 9000 shares changed hands. Philadelphia Traction ruled strong, several hundred shares selling at 100⅛ and 100. Other transactions included 10,000 shares Philadelphia Electric at prices ranging from 10½ to 10⅞, Railways General at 3⅞ to 3¾, Union Traction at 59 to 58¾, United Traction, of Pittsburg, preferred at 49⅞, United Companies of New Jersey at 273½, and Consolidated Traction of New Jersey at 82½ to 83.

Chicago

Trading in the street railway stocks was upon an extremely small scale this week, there being little disposition on the part of traders to deal actively, in view of the uncertainty regarding the franchise situation. Early in the week, officials of several of the local lines announced their intention of going ahead with the contemplated improvements, such as ordering new cars, and otherwise improving the service regardless of the municipal election. These plans, however, may be altered in view of the action of the Mayor and City Council in rescinding the ordinance granting an extension of the franchise rights to the City Railway Company. The Council also ordered the Corporation Counsel to file suit at once against the company to test the validity of the ninety-nine-year act, which the company contends extends its rights. The ordinance, however, contains a provision that the company shall be allowed to operate its lines preceding the result of the suit.

The Elevated Railway stocks were extremely quiet, but strong. Metropolitan common advanced from 23⅜ to 24, while the preferred rose from 65½ to 65⅞. South Side "L" jumped from 96 to 97¼ and closed at 97. Chicago & Oak Park common sold at 6⅝ to 6⅞, while the preferred brought from 20⅞ to 21½. Chicago Union Traction sold to the extent of 400 shares at 12¼ to 12⅛, and North Chicago brought 88½. West Chicago sold at 60.

Other Traction Securities

Interest in the Baltimore market centered largely in the United Railway issues, all of which were active and reactionary. The stock opened at 16½, and under moderate pressure the price ran off to 14½. Subsequently, there was a partial recovery, the closing being at 15¼, or 1¼ points below last week's closing. Announcement was made that the pool in charge of Alexander Brown and George C. Jenkins, as trustees for the common stock, was closed on March 15, and it is understood that considerably over a majority of the stock was deposited. The agreement runs for three years, and provides that the trustees may sell the stock on terms approved by 75 per cent of the stock deposited. The income bonds were extremely active at declining prices. From 66, at the opening, the price declined to 64½, with a subsequent rally to 65½. Nearly $400,000 of the bonds were traded in. The 4 per cent bonds were relatively firm, about $40,000 of them selling at from 94½ to 93⅝, and back to 94. Other strong features were the Indiana Northern Traction 5s, $30,000 of which sold at 97⅛, and Lexington Street Railway 5s at 103¾ to 104¼. Other transactions included Augusta Railway 5s at 104½, North Baltimore 5s at 121, City & Suburban 5s at 114⅜ to 114¾, and Macon Railway & Light 5s at 98¾. In the Boston market trading in the street railway issues was practically at a standstill. About the only issue to display activity was Boston & Worcester common, about 3000 of which sold at prices ranging from 29½ to 32, while the preferred brought 76 and 76½. The strength in these shares was attributed to the preparations making for the installation of a freight and express service upon its lines, which it is expected will increase the gross earnings of the company by $125,000 a year. Massachusetts Electric common and preferred were also strong, the first named advancing to 19⅜, and the preferred to 65, with a subsequent reaction to 64. Boston Elevated sold at 156 and 155½. Other transactions included West End common at 98½ to 98, and the preferred at 116. On the New York "curb" the dealings in Interborough Rapid Transit were somewhat smaller than in the preceding week, but the price fluctuations continued erratic. From 219⅜ the price dropped to 212 ex the dividend of 1¾ per cent, but at the close there was a rally to 215. Upward of 12,000 shares were dealt in. New Orleans Railway new stock displayed decided strength, about 2000 shares changing hands at from 25⅜ to 26⅜, an advance of about 1½ points. Bid prices for the old common and preferred stock advanced 1 and 1¾, respectively. United Railways of St. Louis preferred was strong, 400 shares selling at 79½ to 80. Washington Railway 4s were fractionally higher, at 89¾.

Security Quotations

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

	March 15	March 22
American Railways	52½	52
Boston Elevated	155	155
Brooklyn Rapid Transit	66¾	66¼
Chicago City	a199	199
Chicago Union Traction (common)	12¼	11
Chicago Union Traction (preferred)	47¾	45
Cleveland Electric	82½	82½
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	110¼	110¼
Detroit United	81½	80¾
Interborough Rapid Transit	214	*214
International Traction of Buffalo	29	27
International Traction of Buffalo (preferred)	64½	62
International Traction of Buffalo 4s	81	82½
Manhattan Railway	171	169
Massachusetts Electric Cos. (common)	a18½	18¼
Massachusetts Electric Cos. (preferred)	a64½	63
Metropolitan Elevated, Chicago (common)	23	23¼
Metropolitan Elevated, Chicago (preferred)	65	65
Metropolitan Street	122½	123⅝
Metropolitan Securities	84¾	87
New Orleans Railways (common)	3½	4½
New Orleans Railways (preferred)	14	16
New Orleans Railways, 4½s	81	81½
North American	103	100⅝
North Jersey Street Railway	23	23
Philadelphia Company (common)	46¾	47
Philadelphia Rapid Transit	29¾	30¾
Philadelphia Traction	100	100
Public Service Corporation 5 per cent notes	97¾	97¾
Public Service Corporation certificates	72	72
South Side Elevated (Chicago)	a95	—
Third Avenue	130	129
Twin City, Minneapolis (common)	109	109¼
Union Traction (Philadelphia)	58¾	58⅞
West End (common)	98	98
West End (preferred)	115¼	116

a Asked. * Ex-div.

Iron and Steel

The "Iron Age" says the most interesting event of the week has been the sale of 200,000 tons of steel billets, the largest transaction of its kind for a long period. The purchaser was the Pittsburg Steel Company, owning a large wire mill at Monessen, and a barhoop mill at Glassport, Pa. The company does not make steel, and using, as it does, about 200,000 tons of billets per annum, is the largest single consumer in the country. It is understood that the sale is on a flat price, somewhat above the market, on 1½ inch billets for the hoop mill, but that no difference has been made in the price of Bessemer and of open-hearth steel. The sale of this large quantity of semi-material for delivery during the year, beginning July, 1905, is significant as showing confidence of buyers and sellers in the market. The United States Steel Corporation has prepared to bring down 19,000,000 tons of lake ores, while outside interests are arranging to ship 14,000,000 tons, a total of 33,000,000 tons, against the record of 27,570,000 tons in the banner year of 1902.

A PROJECT IN THE BLUE GRASS REGION

An important project for building interurban lines in the Blue Grass region is backed by Louis des Cognets, president of the Lexington Railway Company, of Lexington, Ky.; D. F. Frazee and J. W. Rodes, of the Phœnix National Bank, of Lexington, and others. The enterprise will be officially known as the Central Kentucky Traction Company, a company of that name having been incorporated with a capital stock of $200,000. This company will succeed to all the rights of the Fayette Interurban and the Blue Grass Consolidated Traction Companies, and will carry out in their entirety, so it is said, the plans of these companies. Unofficially it is said that the first line to be built will be the one between Lexington and Versailles.

ST. PAUL FRANCHISE CONTROVERSY SETTLED

A compromise has been agreed to between the city of St. Paul and the Twin City Rapid Transit Company regarding the rights of the latter in the city of St. Paul. The contention of the city was that the company's franchise was void, and it was proposed to bring suit against the company on this ground to oust it from the streets. What the result would have been of this litigation if carried to the courts is a matter for speculation. At any rate, it has been decided peaceably to settle the question. As a result, the company has agreed, among other things, to a 6 per cent tax upon its earnings, less what is paid in city, county and State taxes, and to make certain improvements to its system which are mostly of purely local interest.

AN INTERURBAN LINE BETWEEN HOUSTON AND GALVESTON

Johnston & Read, of Houston, Texas, have secured a charter from the State of Texas for the Houston-Galveston Electric Railway Company, with a capital stock of $1,350,000. The company is formed for the purpose of building and operating an electric railway, to run between Houston and Galveston, a distance of approximately 52 miles.

Johnston & Read are now located in Houston, and it is their purpose to build the proposed line at a very early date. An engineer corps is now in the field locating the line. This firm constructed, and now owns and operates, the Trinidad Electric Railway and the Trinidad Light & Power Company at Trinidad, Col. Mr. Read, of the firm, organized and constructed the Coal Belt Electric Railway at Marion, Ill. The first board of directors of the Galveston & Houston Company is as follows: Frank P. Read, W. M. Johnston, R. M. Johnston, George L. Horton and A. D. Trotter.

THE BOSTON-PROVIDENCE HEARINGS

Several important hearings on the proposed interurban line to be built between Boston and Providence were held in Boston last week before the legislative committee on street railways. The first proposition to be presented was that of the Shaw and Gaston group of capitalists, represented by Congressman Samuel L. Powers. Attorney William H. Coolidge, of the Boston & Maine Railroad appeared in opposition.

Congressman Powers stated that it was hardly necessary to argue the need of a high-speed electric railway between Boston and Providence. The two cities have a joint population, including suburbs, of nearly 2,000,000, are only about 40 miles apart, and the territory between is capable of great development. Massachusetts has been slow in building interurban roads, but its one notable example, the Boston & Worcester Electric Railway, has been a success. This road last year carried 8,000,000 5-cent fare passengers, of which 5,000,000 were through passengers. In 1890 the proportion of trolley to steam railway mileage was as 1 to 27, while in 1904 it was as 1 to 8. The speaker then described the interurban railway development of the Middle West, and discussed at length the advantages of a private right of way.

The Shaw-Gaston project is to build a double-track road from Forest Hill to the Rhode Island line, making arrangements with the Boston Elevated Railway Company and the Rhode Island Company to run cars through from Park Square, Boston, to Haymarket Square, Providence. It is hoped to make a schedule time of 1 hour and 55 minutes; line to be as much as possible on private right of way. It is not intended to sell power, except to other connecting street railway companies. The right of eminent domain is an absolute necessity if the line is to be built.

M. A. Cavanaugh, a street railway surveyor and contractor, then testified that the proposed route was 41.5 miles in length, and that it would pass through Boston, Hyde Park, Dedham, Norwood, Westwood, Canton, Sharon, Foxboro, Mansfield, North Attleboro, Attleboro and South Attleboro to the Pawtucket line. In Hyde Park and in Rhode Island it would be necessary to operate in the streets. The right of way would be about 50 feet wide. The heaviest grade after leaving Readville would be 3 per cent, and some heavy cuts and fills would be necessary. Between Readville and the Rhode Island line 24 highways would be crossed, but none of these would be grade crossings. Five trolley lines would also be crossed, serving as feeders. In round numbers the cost of the road would be $3,000,000, or $72,000 per mile of route, using the most modern equipment. Possibly the cars would be equipped for third rail operation on the Boston Elevated.

James L. Shaw testified that the Boston & Worcester Street Railway, of which he is president, carried 500,000 people last year between Boston and Worcester, and that 25 or 30 per cent of this was pleasure traffic. Summing up the history of his efforts to build a line between Boston and Providence, Mr. Shaw stated that the original intention was to run into Boston over the Boston & Worcester tracks, but this project, assumed a year and a half ago, was given up, as other interests were found to be planning a shorter line with faster running time, and a connection with the Boston Elevated.

Charles H. Blood, an attorney representing W. O. Chapman and others, then spoke in favor of a charter being granted to the Boston & Rhode Island Electric Company, capital stock, $1,000,000. His route would be from Forest Hills through Hyde Park, Milton, Canton, Sharon, Foxboro, Mansfield, North Attleboro, Attleboro and Seekonk to Providence. His company does not propose to carry freight, and could make the run in 1 hour and 42 minutes, with a fare of 55 cents. He estimates the total cost of construction as $2,000,000. This project is backed largely by residents of the territory to be covered.

Continued hearings on the Boston and Providence interurban electric railway bills have been held during the past few days. Additional information was brought out by Charles H. Blood, attorney for the Boston & Rhode Island interests. The proposed fare by the backers of this road would be 55 cents, of which 5 cents would be paid to the Boston Elevated Railway Company, and 10 cents to the Rhode Island Company, operating in Providence. W. O. Chapman, of Canton, one of the petitioners, testified that the proposed electric line fills a place which the steam railroads cannot, and that his route is the shortest, easiest in grades, cheapest to build, least expensive to operate and would accommodate the largest number of people. In Mr. Chapman's opinion, this line could be built for $1,000,000 less than any other proposed line. The cars each would be equipped with four 125-hp motors, and would be capable of a maximum speed of 60 m.p.h. A 66 ft. right of way, large enough for 4 tracks, had been figured. The total estimated cost is $2,000,000. The through business constitutes the main reason for building such a line.

The next bill heard was that of W. F. Garcelon and others for the incorporation of the Massachusetts & Rhode Island Electric Railway, an enterprise backed by Stone & Webster, of Boston. The capital stock is $1,500,000, and the proposed route connects with the Boston Elevated at Mattapan, running through the towns of Milton, Canton, Stoughton, Sharon, Easton, Foxboro, Mansfield, Norton, Attleboro, Rehobath and Seekonk, where it connects with the Providence system. Attorney H. H. Newton stated that in view of the present connection of the Blue Hill Street Railway with the Boston Elevated it would be necessary for the company to build for only 22 miles, and that solely a passenger business was wanted. Nor was the right of eminent domain desired. The road would accommodate a very large number of people not now served by steam roads or electric lines. The estimated running time is about 2 hours, and the fare, 50 or 60 cents. Geo. M. Thompson, consulting engineer, was then called and stated that in his opinion a double-tracked road of this character could be built for $66,000 per mile, including equipment.

Frederick S. Pratt of the executive committee of Stone & Webster then discussed the subject of interurban roads at length. He stated that Stone & Webster's experience had been that high-speed roads, with their expensive roadbed and equipment, could not be operated at a profit without correspondingly high rates of fare. Thus, the Puget Sound line, between Seattle and Tacoma, was operated at a loss until it began to carry freight. This road is 37 miles long; the fare charged is 60 cents, and the cars attain a speed of 60 m.p.h. This in Mr. Pratt's estimation constitutes a very high-speed road, while a moderately high-speed line, like the proposed route between Boston and Providence, calls for rolling stock capable of making 35 to 45 m.p.h. maximum speed, and a location at the side of the highway in part, and also on private right of way in certain portions. Mr. Pratt closed by stating that his company had no intention or desire to operate through cars from Providence to Boston over the elevated structure in the latter city.

RECENT WESTINGHOUSE RAILWAY ORDERS

A few of the important contracts recently entered into by the Westinghouse Electric & Manufacturing Company are given below. The orders include all sizes of apparatus from the smallest to the largest, and indicate the scope of this company's output. Additions to the equipment of electric railways and the installation of new roads, however, make up a greater total output in horsepower than any other branch of electrical engineering.

As an extension to its system the Louisville Railway Company will install two 750-kw, three-phase rotary converters, six 300-kw, air-blast transformers, with blower outfits and two switchboards.

The United Railways and Electric Company, of Baltimore, has contracted for three 1000-kw rotaries, and nine 350-kw air-blast transformers. These will operate on a 13,000-volt line, transforming to 330 volts. Eighteen rotary converters with a total capacity of 27,000 kw, in 1000 and 1500-kw units, will be placed in substations of the New York Central & Hudson River Railroad Company. Two 1500-kw direct current generators will be built for the Carnegie Steel Company to furnish power for two 1500-hp 250-volt motors. For the protection of this apparatus 10,000 amp circuit-breakers will be mounted on the switchboard. These motors will be the largest ever built for this voltage.

UTICA & MOHAWK VALLEY MAKES POWER CONTRACT

The Utica & Mohawk Valley Company has closed a contract with the Hudson River Electric Power Company for power for use on its lines and extensions thereof, and also for power for the operation of cars between Syracuse and Utica. The contract takes effect July 1, upon which date power is to be ready for delivery in Utica. The power company will build a large steam plant in Utica which will be added to from time to time as demands necessitate. Presumably, this plant will be built on a plot of ground of some 31 acres, recently purchased by the Utica & Mohawk Company. C. Loomis Allen, of the Utica & Mohawk Company, says, however, that the plans of his company as regards this land are not matured. The contract for power is for 3000 kw at present, with the right to take 15,000 kw. The term of the contract is twenty-five years. The steam plant in Utica will be used to fill the contract only until transmission lines can be run from a new plant to be built by the power company to utilize the waters of the Scoharie River.

HUNTINGTON'S SAN GABRIEL LOOP LINE

A direct electric railway from Los Angeles to Riverside and Redlands, completing a belt road which will touch nearly every point of interest in the great San Gabriel Valley, is the latest move of the Huntington interests, according to an authentic report. For a long time it has been known that the Pacific Electric Railway Company has had in mind the reconstruction of the old San Gabriel Rapid Transit Company's line, running from Los Angeles to Monrovia, cutting through Shorb and what is now known as Dolgeville. When reconstructed the old rapid transit will be the main line of a network now in operation, consisting of the two roads to Pasadena and San Gabriel. This, it is understood, will greatly facilitate traffic and insure a more rapid and satisfactory service. Mr. Huntington owns large tracts of land in and around Dolgeville, and a new road into that territory, making a complete circle around his possessions, will undoubtedly advance property in that neighborhood very materially. The town of Dolgeville is steadily growing, and within a few years it will be a large manufacturing center. The present scheme of increasing railway facilities there will, therefore, be of great advantage financially and commercially.

CANADIAN ASSOCIATION MEETS

The regularly quarterly meeting of the Canadian Street Railway Association was held in the Russell House, Ottawa, on March 7. The morning session was occupied in the reading of papers and discussion thereon. W. H. Moore, assistant to the president of the Toronto Street Railway, read a paper on "Problems of the Radial Road." "The Transportation of Mail" was treated by C. A. Carr, of London. At the afternoon session there were papers by W. G. Ross, of the Montreal Street Railway, on "Street Railway Benefit Associations," and by Dr. Ickes, of Brantford, on the "Sunday Observance Law in Ontario." Those present were: Allan Royce, Toronto Suburban Railway; Patrick Dube, Montreal Street Railway; T. Ahearn, W. Y. Soper, J. D. Fraser, J. E. Hutcheson and J. Murphy, Ottawa Electric Railway; E. A. Evans, Quebec Railway; Col. H. H. McLean, St. John Railway; Dr. Icks, A. J. Patterson, J. Turnbull, Grand Valley Railway; J. McArthur, Toronto & York Railway, and Acton Burrows, of the "Railway World."

INTERURBAN FREIGHT CARS ALONG CITY THOROUGHFARES—THE INDIANAPOLIS CASE

The suit brought in the Indiana Appellate Court by Lottie A. Kinsey, a property owner in College Avenue, Indianapolis, against the Union Traction Company and the Indianapolis Street Railway Company to determine the right of interurban railway companies to operate large passenger and freight cars upon the streets of the city, is likely to be terminated by the sale by her of the College Avenue property. The claim is made by attorneys that no action for injunction or damages will lie now that Mrs. Kinsey has sold. On the other hand, Gavin & Davis, attorneys for Mrs. Kinsey, say they do not believe that the sale of the property will terminate her right of action in the litigation now pending. They contend the statute provides that the transfer of an interest shall not abate a cause of action, so long as the cause continues.

In this case suit was brought for damages resulting from continued operation of the interurban cars, and that these injuries might not continue an injunction was asked. The trial court ruled adversely to Mrs. Kinsey's claim for damages, and she appealed. The Supreme Court in the Ft. Wayne case held that the construction and operation of an interurban electric road to carry passengers and light express matter and mail in trains made up of one or two cars of the best and most improved pattern, is not an additional servitude upon the street for which the abutting property owners are entitled to compensative damages.

On the basis of this decision the trial court ruled against Mrs. Kinsey's claim. Gavin & Davis say there is a difference between the two suits; that the pending suits shows more explicitly the difference between a local street car service and that of an interurban company, which is engaged in carrying freight and uses heavy cars. The latter case contains facts and abundant evidence of damages, such as was not brought out in the Ft. Wayne case, which they believe will prove sufficient to influence the court in rendering a decision favorable to their client. Although not in the record, it is pointed out that the property sold for at least $6,000 less than it would have brought had it not been for the incessant use of the street by interurban cars. In such case the attorneys say the new owner can be substituted if necessary, and they will insist that the case be not thrown out of court.

Many Indiana property owners have been anticipating a decision in this case for a year or more, and the Indianapolis Traction & Terminal Company has been waiting for a decision before entering upon the construction of interurban freight stations. If it is held that traction companies have no right to haul freight through the resident districts, freight houses will not be built. If the Kinsey suit is thrown out, a similar suit brought by John R. Allen, a property owner on the same street, and held to await the action of the Appellate Court in the Kinsey case will, it is said, be pushed to a conclusion. It is hoped, however, that this unfortunate delay in securing a decision may be avoided. The question is one of great importance to interurban companies, since their right to operate freight cars is challenged in many cities of the State.

SCIOTO VALLEY IMPROVEMENTS

The Scioto Valley Traction Company has completed grading on its extension from Circleville to Chillicothe and is now laying rails. The extension will be completed about July 1, giving the company 85 miles of road. Orders have been placed with the American Car & Foundry Company, of Wilmington, Delaware, for seven cars; two baggage and five 60 ft. passenger coaches, the same as those illustrated in the description of the road, which appeared in the Street Railway Journal recently. The company is preparing for heavy traffic to Buckeye Park on the Lancaster division. This resort has been leased by Frank Mattox and J. W. Young, of Lancaster, who have arranged with the traction company for light and power. A number of attractions will be installed, the aim being to make the property one of the finest in Ohio.

A SURPRISE IN CHICAGO TRACTION MATTERS

The Chicago City Council took action at its meeting March 20, authorizing the corporation counsel to institute judicial proceedings to secure the adjudication of the rights of the city and the Chicago City Railway under the ninety-nine year act in the State courts. The action came as a complete surprise. Mayor Harrison read a message to the City Council urging that this action be taken at once so that a bill may be filed in the city courts. The street railway companies have always maintained that this is a matter for the Federal courts, and have carefully avoided letting it get into the State courts. It is a matter of common knowledge, as was plainly stated by the corporation counsel before the Chicago City Council, previous to the passage of the ordinance, that the United States courts have been much more favorable to the rights of capital where questions of the powers of legislative bodies are concerned than are the State courts. The ordinance authorizing the corporation counsel to take action was rushed through the Council and a bill was immediately filed by Corporation Council Tolman before Judge Mack, who was awaiting it in the county building, which adjoins the Chicago City Court. This gave the attorneys for the Chicago City Railway Company no time to take action of any kind.

IMPROVEMENTS FOR SPRINGFIELD—NEW POWER PLANT

H. J. Crowley, general manager of the American Railways Company, of Philadelphia, has announced that the company will spend $200,000 on improvements to the railway, lighting and park property of the Springfield Railway Company, of Springfield, Ohio. A number of attractions will be installed in Spring Grove Park. The West Pleasant Street city line will be extended. A lighting plant will be erected adjoining the present railway power station, and it is probable that two 500-hp units will be installed.

IMPORTANT WORK IN SPOKANE

Henry M. Richards, president of the Washington Water Power Company, has returned from a trip East and announces that his backers have provided $3,500,000 for the work of the company in Spokane the next three years.

The estimates of the work this year call for the expenditure of $1,100,000, and include three miles of extension to its street car system; an interurban line to Medical Lake, 16 miles; an office building in Spokane to cost $100,000; an $18,000 electric plant at Post Falls, Idaho, and a $100,000 interest in the Spokane Southern Traction Company. Mr. Richards announces that Charles Francis Adams, of Boston, has subscribed to $50,000 of the stock, and $50,000 of the bonds of the Spokane Southern, and that the General Electric Securities Company is a heavy subscriber to its bonds.

RAPID TRANSIT FOR CAMBRIDGE, MASS.

After many months of consideration it appears as though the Boston Elevated Railway Company and the citizens of Cambridge, Mass., have reached a possible basis of agreement in regard to a rapid transit scheme between the Hub and the University City. The situation has all along been a peculiar one in view of the legislative obligation laid upon the railway company to build an elevated road to Brattle Square, Cambridge, upon the completion of the new West Boston Bridge, and the subsequent opposition of the citizens of that particular suburb to that form of rapid transit.

The latest proposition is a combination of elevated and subway routes, the overhead system to be built from the West Boston Bridge to Dana Hill, Cambridge, and the subway from the latter point to Harvard Square, instead of Brattle Square. Harvard Square is the principal transfer point in Cambridge, and as such offers exceptional facilities for a rapid transit terminal. In case physical connection should be carried out between the present surface lines operating through or terminating in Harvard Square and the subway terminal, the conditions would be the exact reverse of those now obtaining at Dudley Street and Sullivan Square on the Boston Elevated system, as the surface cars would descend to the rapid transit platforms instead of ascending to the loops by open air inclines. The square would also be free from overcrowding with an underground terminal. Although the proposition in any event is to be passed upon by the legislature, it bears the mark of many excellent features. Conspicuous among these is a running time of seven or eight minutes to Scollay Square. A trip now requiring some 25 minutes by the Massachusetts Avenue and Roylston Street routes.

THE ARNOLD COMPANY—A CHANGE OF NAME

A Chicago company well known in the electric railway and construction field announces a change of name. The Arnold Electric Power Station Company is hereafter to be known as simply the Arnold Company, a name less descriptive but fully as significant to all in the electrical railway business, most of whom have called the company by its abbreviated name for some time past in familiar conversation. The Arnold Electric Power Station Company, which was formed by its president, Bion J. Arnold, in 1896, to carry on the class of construction work indicated by its title, a long time ago outgrew that title because of the constantly increasing scope of its business. The Arnold Company as it stands to-day not only carries on a consulting engineering business as regards electric power stations, interurban railways, electrical equipment of steam roads, shops and shop equipment, hydro-electric and transmission plants and modern industrial plants, but is prepared to undertake the construction on whatever work it does the designing and consulting. In order to handle this business, it is of course necessary for the company to maintain a full construction organization, and also a corps of electrical, civil and mechanical engineers capable of handling all branches of such an undertaking as electric railway construction or hydro-electric development with power transmission. One of the most important pieces of work in which the company is now engaged is a large water power plant at Lowell, Kansas, where a power station of 3000 kw capacity is to be put in operation with a 33,000-volt transmission line, carrying power to the lead and zinc mines in the vicinity of Joplin, Mo.

As to the position of Bion J. Arnold, the president of this company, in the electric railway field, nothing need be said here. His eminence makes it unnecessary. The Arnold Company, with its large organization, makes it possible to carry out on an extended scale many of the lines of work to which Mr. Arnold formerly gave his immediate personal attention and supervision. Mr. Arnold's services personally have been retained recently on some of the most important work in the country, notably the electrical equipment of the New York Central terminals at New York and a study of the Chicago local transportation problem. Most of the work coming to the Arnold office, however, is handled by the Arnold Company, of which he is president. Next to the president should certainly be mentioned George A. Damon, managing engineer, under whose supervision of the many engineering details the business of the Arnold Company has grown up, and who, although a young man, is undoubtedly one of the most popular, able and progressive engineers and business men in the Middle West.

Among the electric railway enterprises with which the Arnold Company has been prominently connected, are the building of the Chicago & Milwaukee Electric Railroad through the northern suburbs of Chicago in 1897, with rotary converter sub-stations and high tension transmission from a central plant; the power house and sub-stations of the Grand Rapids, Holland & Lake Michigan Rapid Railway; the Chicago Electric Traction Company's lines; the Lansing, St. Johns & St. Louis Electric Railway, on which the president, Bion J. Arnold, made the first single-phase railway motor experiments in the United States; the Kenosha Street Railway, and the Bloomington, Pontiac & Joliet Electric Railway, a road now under construction, using G. E. single-phase alternating current motors.

The company has a long list of clients among steam railroad companies for which the mechanical and electrical equipments for shops have been designed. The Arnold Company has had active charge of the electric power and light, compressed air and steam equipment of shops for the following railroads: Chicago & Eastern Illinois, Chicago & Great Western, Denver & Rio Grande, New York Central & Hudson River, Oregon Short Line, Pere Marquette, St. Louis, Iron Mountain & Southern, Union Pacific, and Wisconsin Central. Electric power stations have been constructed for the Chicago Board of Trade, Chicago & Alton Railway at Springfield, Ill.; Imperial Lighting Company at St. Louis; W. B. Conkey Company at Chicago; Land, Title & Trust Building, Philadelphia; Otis Elevator Company, Chicago, and Albert Dickinson Company, Chicago and Minneapolis.

The engineers of this company are very progressive, but not inclined to experiment with new apparatus at the expense of clients. The company publishes bulletins similar in make-up to those published by the large electrical manufacturing companies. These bulletins contain technical descriptions of work which the company has carried out, and are much in demand. Another advertising feature maintained by the company, which is of especial interest to electric railways, is the maintenance of a set of interurban maps of the Central States, which gives the roads in operation, under construction and projected, and the relative size of towns. Blue prints of such maps are furnished to electric railway officers upon request. The officers of the Arnold Company, in addition to the president and managing engineer already mentioned, are W. L. Arnold, vice-president, and Ralph G. Arnold, secretary and treasurer, who look after the business affairs of the company.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MARCH 14, 1905

784,639. Electrical Trolley; Seneca R. Stoddard, Glens Falls, N. Y. App. filed March 21, 1903. A contact shoe for third rails having a member mounted therein capable of lateral movement relatively thereto and acting by gravity to make and break connection with the conductor.

784,657. Means for Operating Railway Switches; Robert Crossley Bullough, Manchester, England. App. filed July 20, 1904. Details.

784,668. Car Brake; Lewis J. Evans, East Pittsburg, Pa. App. filed May 5, 1904. An emergency track brake consisting of a brake wheel adapted to be spring-pressed downwardly when released.

784,678. Trolley Catcher and Retriever; William W. Hoffman and Francis W. Powers, West Lafayette, Ind. App. filed Sept. 23, 1904. Details of a spring drum and ratchet arrangement.

781,681. Trolley Guide; John F. Jameson, Plimton, Ohio. App filed Dec. 21, 1904. The guide consists of a suitable framework for holding the trolley to the wire on curves, etc.

784,689. Holding Device for Switch Points or Tongues; Clarence C. Korns, Johnstown, Pa. App. filed Oct. 5, 1903. An arm connected to the switch tongue and pivoted to a pivoted weight eccentrically of the pivot of the latter, and means for always holding the weight in a position in which the pivotal connection of the arm therewith is above its own pivot, whereby the throw of the switch tongue will act to throw the weight.

784,696. Hand Strap; Uriah McClinchie, Brooklyn, N. Y. App. filed Sept. 10, 1904. A holder or frame for advertising matter is connected with the hand strap.

784,698. Brake Beam; John F. O'Connor, Chicago, Ill. App. filed Jan. 18, 1905. The brake beam is I-shaped in cross section, its web at the center being stretched so as to increase the depth of the beam at this point.

784,735. Railway Track Structure; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1904. Relates to the construction of wear plates at switches, crossings, etc.

784,814. Railway Motor Control; Charles P. Steinmetz, Schenectady, N. Y. App. filed Aug. 20, 1904. Provides a control system by means of which electric motors may be operated on either alternating or direct current.

784,839. Brake Beam; Seth A. Crone, New York, N. Y. App. filed Oct. 1, 1904. A novel construction of fulcrum.

784,843. Trolley; Michael O. Day, Newcastle, Pa. App. filed Dec. 20, 1904. The harp is rotatably mounted in a hollow cylindri-

cal casing, and springs are employed to return the harp to its normal position when the harp is out of alinement with the wire.

784,879. Sand Box for Street Railway Cars; Sidney W. Phelps, Globe Village, Mass. App. filed Aug. 29, 1904. A sand box mounted on the body of a car, a discharge pipe flexibly mounted on a truck-frame, and a flexible hose connecting the sand box and discharge pipe.

784,906. Car Brake; Ralph Vogel, Germantown, Pa. App. filed Nov. 24, 1903. An emergency brake consisting of track sections carried in advance of the truck adapted to be lowered upon the main rails and pass under the truck wheels between the latter and the track rails.

785,030. Switch; Abram E. Willey, Atlanta, Ga. App. filed Dec. 13, 1904. A switch-point, an oscillating disk eccentrically pivoted to the free end of the switch-point, operating bars pivoted to the disk on opposite sides of its pivot, switch-operating bars on the car, and means for independently projecting the switch-throwing bars to operate the switch-operating bars.

785,034. Car Wheel; John T. Duff, Pittsburg, Pa. App. filed Sept. 28, 1904. Provides a tread portion separate from the body of the wheel and so secured thereto that it can be easily removed or replaced in order that the tread portion can be renewed whenever damaged or worn.

12,324. Trolley Wheel Guard for Electric Wires; John L. Sullivan, Warren, R. I. App. filed Jan. 26, 1905. A pair of transversely disposed wheels mounted in the harp for engagement with the upper surface of the wire.

PERSONAL MENTION

MR. JOHN M. DIVEN has resigned as secretary-treasurer of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., and as superintendent of the waterworks system of that company, to become general manager of the Charleston Light & Water Company, of Charleston, S. C.

MR. H. N. LATEY, electrical engineer of the subway division of the Interborough Rapid Transit Company, of New York, has also been appointed electrical engineer of the Manhattan division of the company, vice Mr. Hugh Hazelton, who has resigned. Mr. Latey's new title is electrical engineer of the Interborough Rapid Transit Company.

MR. THOMAS B. ARNOLD, who has become well known as Eastern representative of the Latrobe Steel Company, left New York, March 18, to take charge of the St. Louis office of the Railway Steel Spring Company. Mr. Arnold is a very popular man in a social as well as a business way and will undoubtedly find little difficulty in making numerous good friends in his new field.

MR. J. F. SLOCUM, recently elected secretary and treasurer of the International Traction Company, and the International Railway Company, of Buffalo, N. Y., was born at Geneva, N. Y., March 25, 1876. About nine years ago he began his business career with the Power City Bank at Niagara Falls, N. Y. Four years later he accepted a position with the International Company as cashier, and a short time later was elected assistant secretary and treasurer under former secretary and treasurer, Mr. R. F. Rankine, who resigned March 2, 1905, to engage in other business.

J. F. SLOCUM

MR. CHARLES G. LOHMAN, who, as previously stated in the Street Railway Journal, has been appointed superintendent of the Indiana Railway Company, of South Bend, Ind., began his street railway career in Indianapolis six years ago as an inspector. He advanced rapidly until finally he was made a division superintendent of the Indianapolis Traction & Terminal Company. Here he had charge not only of the division entrusted to him, but also of the traction terminal building, illustrated and described in the Street Railway Journal. It was from the Indianapolis company that he resigned to become connected with the Indiana Railway. In his new position Mr. Lohman will have entire charge of the operation of a system of more than 50 miles, connecting South Bend, Mishawaka, Elkhart and Goshen and the city lines in these places. Mr. Lohman is a member of the ticket committee of the Indiana Electric Railway Association by special appointment last meeting.

MR. LEWIS B. STILLWELL has been appointed consulting electrical engineer of the Hudson Companies, whose incorporation on Jan. 9 was announced in the Street Railway Journal for Jan. 14. This company will take up the work of the completion and equipment of the four tunnels under the Hudson River, frequently referred to as "the McAdoo tunnels." The company has opened offices at 21 Park Row, New York. The appointment of Mr. H. M. Sperry as consulting signal engineer of the company was announced in the issue of this paper for March 4.

MR. H. A. NICHOLL, general manager of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio., has, as previously noted in the Street Railway Journal, been appointed general manager of the Indiana Union Traction Company. Under his direct supervision there will therefore come the largest interurban electric railway system in the world, comprising more than 250 miles of track, extending from Indianapolis as a center to such distant cities as Kokomo, Logansport, Marion, Muncie, Anderson, etc. It is a company controlled largely by Philadelphia interests, and is capitalized at $5,000,000, with $1,000,000 bonds outstanding. Mr. Nicholl is thoroughly fitted by previous training for the position, his experience having covered steam railroad, city railway and interurban work. Besides this, he had the experience in Ithaca of managing the public service utilities of the city, these being controlled by the Ithaca Railway Company, of which he was assistant manager and treasurer, the street railway and electric lighting interests of the city. As general manager of the Cleveland & Southwestern Company, Mr. Nicoll was responsible for the operation of 134 miles of standard gage interurban line.

H. A. NICHOLL

MR. WALTER H. WHITESIDE has been elected vice-president and general manager of the Allis-Chalmers Company, a position created for him. In no way will his work conflict with Vice-President Chalmers or President Warren. Mr. Whiteside formerly was manager of the sales department of the Allis-Chalmers Company. Previous to his connection with this company he was with the Westinghouse Electric Manufacturing Company.

MR. JAMES A. PIERCE, who, as previously noted in the Street Railway Journal, has become superintendent of the Mexico City Electric Tramway Company, of Mexico City, Mex., under General Manager Wheatly, formerly was with the Brooklyn Rapid Transit Company, and later was Western representative at St. Louis, of Rossiter, McGovern & Company, from which company he resigned to accept the position in Mexico. It was in 1896 that Mr. Pierce entered the service of the Brooklyn Heights Railroad. His first work was in the office of the general superintendent of surface lines. After a few months he was transferred to the engineering department. Here his service in an official capacity was very successful. In April, 1900, he was appointed division superintendent of the Southern division (surface lines) with headquarters at Fifty-Eighth Street. In November, 1901, he resigned from the company to become the Western representative of Rossiter, McGovern & Company. Mr. Pierce is about 31 years of age.

MR. C. A. ALDERMAN, who for the past eight years has been identified with Mr. A. E. Appleyard as chief engineer of the Great Northern Construction Company, which built all of the Appleyard properties as well as a large number of other roads, has resigned to go with the Elkins-Widener syndicate, of Philadelphia. His resignation took effect March 20. Mr. Alderman has been in direct charge of the construction of perhaps more miles of high-speed interurban roads than any other engineer in the country. His first work for Mr. Appleyard was at Eau Clair, Wis., where he built the Chippewa Valley Electric Railway. Six years ago he located at Springfield, Ohio, and since then has planned and supervised the construction of the Dayton, Springfield & Urbana; Columbus, London & Springfield; Central Market Street Railway; Urbana, Bellefontaine & Northern Railway; Springfield & Western Railway; the Columbus, Buckeye Lake & Newark, and the Columbus, Newark & Zanesville. In his position he will act as constructing engineer for the Cincinnati Northern Traction Company for the reconstruction, including straightening of track, the erection of a new power house and otherwise improving the Cincinnati, Dayton & Toledo Traction Company's line between Cincinnati and Dayton. As already outlined in these columns, the Cincinnati Northern Traction Company is to lease the line mentioned. For the present Mr. Alderman's headquarters will be in the Traction Building, Cincinnati. Mr. Alderman was given a farewell reception last week by officials and employees of the system, who presented him with a magnificent diamond pin as a mark of their good will.