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*Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.*

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## The End-Seat Problem Again

The battleground of public discussion is ever being revisited by the ghosts of old themes which refuse to lie decently in their graves. Just now the end-seat problem is receiving more than its deserved share of attention in some of our Eastern cities, and the columns of the daily papers wax heavy with the strife of the pens of "Constant Reader" and "Pro Bono Publico." Fortunately, the street railway manager is not seriously mixed up in this peppery fray, but now and then a verbal club, thrown by some over-excited participant, misses its aim and flies too near the official head for comfort, instead of killing the ghost of this ancient subject, as it is rightfully bound to do.

We believe that this end-seat question is no more to be settled by street railway managers than is the holder of an end seat in a theater to be obliged to move inward by the playhouse authorities when a late comer rolls majestically down the aisle. No one ever was called an "end-seat hog" for retaining his place at a concert or a play, as far as we are aware, and, to point out still another instance where lateness pays its own penalty, we have yet to learn of a case where the first arrivals in a barber shop were objurgated with opprobrious epithets by their less fortunate followers. Nor are we aware of any code of bargain counter ethics which is violated by the solidity with which the fair patrons of the department store maintain their vantage points against the onward rush of their less punctual sisters.

On the other hand, there is no denying that the more general practice of courtesy in street railway travel would result in some amelioration of rush-hour conditions, or that the exhibition of additional politeness on the part of passengers in their relations with each other and with employees would lubricate the machinery of transportation to a noteworthy degree. Rapid transit in cities, however, can never be made an Alphonse and Gaston affair as long as people persist in all going home at once, unless somebody is willing to remain down-town over night. As for the end-seat question, there are often cases where a passenger is going to leave the car so soon that it would be a serious inconvenience for him to move away from the end, only to climb over the laps and feet of subsequent comers when his near-at-hand destination arrives. It is certainly a mark of much courtesy to give up the end seat to all comers, but the passenger who retains his place can scarcely be classed among the villains of modern society, and in no event is it fair to blame the street railway company, which is as powerless to leave out the end seat, and thus solve the problem of courtesy, as is the steam railroad to omit the last car in its train as a safeguard against rear-end collisions.

## Light in Repair Shops

We have frequently called attention to various points, not to be lost sight of, in the design of repair shops for electric railways. Not the least of these is the question of good light. Nothing can take the place of plenty of daylight. A realization of this fact has caused the majority of electric railway companies to do away with night work as far as possible in the inspection and repair of motor equipments. Night inspection is necessary, of course, but any great amount of repair work carried on at night is sure to result in financial loss, because it could be done so much more cheaply in the day time. No matter how perfectly a shop may be equipped it cannot be called a commercial success unless there is plenty of daylight in all places where work must be done. This, however, does not apply to pits, which are necessarily dark and which must have artificial illumination. It is seldom that pits properly equipped with electric lights are seen. For general lighting of the pit, lights placed under each rail in recesses, where they will not be liable to injury, are best. For use around the motors and trucks portable hand lamps are a necessity. The use of some kind of a shade on these portable hand lamps is also most useful. A cheap tin shade, which will shield the workman's eyes from the direct glare of the lamp while he is working in a close place, will enable him to see very much better than he otherwise could. It is almost never that one sees pit lights equipped with something of this kind, however. A shade could be made to take the place of the regular protecting cage now used around such lights, and would considerably increase their efficiency by preventing the workman from blinding himself with the glare of the unshielded lamp. Anyone who has worked in a close place with an uncovered incandescent light, and who has tried the results with and without shading, knows that this is true.

## Cast-Welded Rail Joints

One of the things which it is to be hoped the track men will take up at the next convention is an exchange of experiences regarding rail-joints. It goes without saying that this is one of the most important subjects connected with track work, and yet, at the present time, practice is in a decidedly uncertain state regarding it. The cast-welded joint apparently does not have the popularity which it once enjoyed, yet we are inclined to think that if it has really lost any of its popularity it is on account of mistakes that have been made in the application of cast-welded joints. There are certain objections which must hold against any track-welded joint, namely, the difficulties of removing or renewing short pieces of rail or of repairingbroken joints. While these are real objections, they become of small importance if we start in the first place with good welded joints and track constructed in such a way that repairs and alterations are not likely to be necessary during the life of the rail. Cast-welding appears to have suffered considerably from the over zeal of its friends in the years that it was first introduced. Frequently track that had been operated over for a year or two with angle-bar joints had the angle-bars removed and the joints cast-welded in what would now be considered a rather slipshod manner. The joints were frequently poured with iron so cold that there was no melting of the rail base, and, consequently, there was no real union between the cast-welded joint and the rail. Further than this, a rail with angle-bar joints, if operated over for a year or two, is almost sure to become a little low at the ends, even if not low enough to cause rough riding, and if the joints are then cast-welded the low joints cause the hammering of the rail ends, even if there is no mechanical motion in the joint itself. This continues until the car wheels hammer a large depression at the joint. Another cause of dissatisfaction with cast-welding has been the annealing of the steel of the rail head by the heat of the iron in the joint. This, it is claimed, has softened the rail at the joint sufficiently so that it becomes rolled out by the car wheels more than the balance of the rail, with the result that the joint in time becomes low. It is a question whether many low cast-welded joints, thought to be due to annealing, were not really caused by the fact that the joints were low to begin with. However that may be, it is evident that all the objections that have been mentioned to the cast-welded joint as a joint, are objections which could be overcome by proper construction. The cast-welded joint does not necessarily have to be brought up to such a height that it will anneal the head of the rail. One manager we know of simply welds the base of the rail and two-thirds the web. To ensure a true weld between a cast-iron and steel rail it is only necessary to have the iron hot enough at the time of pouring, and to make the mould of a shape which will give a great body of metal around the base of the rail. Any kind of rail construction must be attended to carefully, and cast-welding is no exception to the rule. There is no place where lack of care in construction gives more disastrous results than in joint construction, no matter what the form of the joint.

We have not intended, in what we have just said, to pose as the champions of cast-welded rail-joints to the exclusion of all other types, but merely to call attention to the fact that many of the common objections to this class of joint are not valid. Electrically-welded joints, the joints welded with thermit, and many other modern rail-joints, including angle-bar joints, have also been used with equal success, but, as said before, all require attention to details during construction, and it is not likely that a joint will ever be invented which will not require such care. A good, thorough exchange of experiences on these subjects by track men would be worth millions of dollars to the electric railways of this and other countries during the next five years.

## Concerning Speed

In the past few years a great deal of money has been spent by electric railways to secure higher speeds than were customary in the earlier days of trolley transportation. Cars for both interurban and city service have been supplied with heavy four-motor equipments; gear ratios for cross-country running have decreased in numerical value, while 600-volt sub-stations and reinforced feeder copper have done their part in permitting faster schedules, no less than improvements in roadbed and track.

One of the fundamentals of rapid transit between any two points is high speed. This is everywhere recognized, but when we have said it we have only told half the story. The question is opened in its broadest aspect when we realize that two different kinds of speed—maximum and average—enter the problem.

High maximum speed has an irresistible fascination to the rebuilders of old roads as well as to the promoter of new lines. One of the first questions asked about a new suburban or interurban route is, "How fast will the cars run?" The advertisements of projected lines seldom fail to lay great stress upon the high maximum speed which it is proposed to make between the objective points, calling attention to the expensive equipment and the private right of way, as evidence of the company's efforts to provide real rapid transit for its patrons.

There are other considerations, however, which affect the running time quite as much when operation begins, as does the attainment of 35, 40 or 50 m. p. h. on favored sections of the private right of way. These are the limitations of speed in suburban and city portions of the route; the delays due to an imperfectly maintained time-table, undue restrictions as to speed in village streets, etc. The importance of high maximum speed shrinks considerably when 50 per cent have to be added to the running time between the outskirts of two cities on account of slow-downs within the city limits themselves met in completing the schedule. While it is essential that time lost in cities be made up outside, the best operating practice strikes at the root of the difficulty and attempts to avoid delays in town by running through the wider and less congested streets, keeping clear of the tracks carrying heavy local traffic, and, if necessary, establishing an interurban terminal at some point a little off the main arteries of travel. People are generally willing to go some distance out of their way to take a steam train at the railroad station, because of the great gain in time which they secure when fairly under way. The same thing should hold good with the electric interurban line. At all events, it should be borne in mind by managers of existing properties and the designers of new systems that high maximum speed costs money; that a high average speed, well sustained, is less expensive and just about as effective in maintaining a fast schedule, and that before extremely high running is capitalized by heavy investments in plant and rolling stock, it is a good plan to determine the limitations of the terminal portions of the route and do one's best to overcome them to an extent that will hold up the average speed to a point which will ensure a running time that will not destroy the effect of the speed made outside the cities.

## The Master Car Builders and the Electrified Steam Road

Mr. Vreeland's address before the Master Car Builders' Association, on June 22, reprinted elsewhere in this issue, presents a new view of the results which will follow any extensive substitution of electricity for steam power by steam railroad companies. The electrification of steam roads has frequently been discussed in its relation to traffic, but Mr. Vreeland approaches the subject from a novel and entirely different standpoint, and, in view of his long experience and success in both classes of railroading, his remarks are of more than the usual interest. In brief, he points out that a change of this kind would mean almost a complete revolution in the repair shop methods of the steam road. Every other change which has occurred in the history of steam railroading has been more in the nature of a transition from pre-existing methods. The rolling stock and the motive power apparatus have been changed and improved, but in every case the two portions of the equipment have remained independent of each other, and have been housed and maintained apart. This condition has existed not only since the origin of steam railroading, but through the ages of its predecessors, as far back as prehistoric times, when the first primitive savage constructed the original two-wheeled cart.

The electric motor car, in which the motive apparatus is practically inseparable from the vehicle, constitutes a radical departure, and one which must vitally affect the repair shop force and maintenance methods of the steam railroad company. While certain divisions of labor are possible, and indeed necessary in every large shop, the motors and the vehicle can no longer be considered or treated as separate entities. New problems of wiring, lighting, heating and fire protection, as well as those of motor suspension and motor repair, must now be considered in the vehicle with which the steam railroad car builder is familiar, and for whose design and care he is responsible. Much of his old experience is applicable to the new conditions, but there are added to it many other things which have had no part in steam railroad work and with which he must become acquainted properly to render that service to his company which the altered conditions require.

As Mr. Vreeland pointed out, this is a case which is up to the employee himself. There is not the same opportunity of making up failures in corporation service as in collegiate life. The student who fails to pass an examination has an opportunity of working off his condition, but a corporation expects its employees to be experts in the work which it requires of them, and if deficient they must give way to men who understand the duties of their position.

Three years ago we took occasion to comment upon the general lack of interest which steam railroad men, as individuals and as associations, were taking in electric railway subjects. Three or four years previously, or about the time that the electrical equipment of the suburban division of the Illinois Central Railroad was being discussed by the officials of that company, and after the introduction of electric locomotives in the Baltimore & Ohio belt line service, the conditions were different. A number of papers were presented on electric railway topics before different steam railroad associations, and there was considerable discussion of electrical methods of construction and operation. The electrical equipment of a number of the New Jersey suburban lines was also seriously considered at this time, as was possibly the equipment of lines extending out of other cities. Following the decision against electrification by the Illinois Central and the other roads mentioned, the subject was practically dropped from steam railroad consideration, as far as outward evidence went, until it came up in an acute form in connection with the developments in the neighborhood of New York. That these same officials realize the importance of the subject is shown by the paper on the standardization of third-rail location, discussed by the Master Car Builders at their annual meeting, and also reproduced in this issue, as well as by the invitation extended to Mr. Vreeland, as a practical electric railway and steam railroad operator, to address the association.

The transition from the light 16-ft. electric car of twelve years ago to the heavy 60-ft. interurban electric coach of to-day, has come so gradually that electric railway men proper have almost insensibly passed from one stage of the development to the next, and it is almost impossible to state any definite date when the street railway passed into the electric railway. Nevertheless, the interurban rolling stock of to-day differs only slightly in general construction from the steam railroad coach, and interurban practice, as a whole, bears a much closer resemblance to that which would obtain on an electrified steam railroad than to that of the 16-ft. single-truck car era. For this reason the interurban electric railway engineer of to-day is, by education, eminently fitted for the larger, if not more responsible, duties of supervising the electrical equipment of trunk lines; and it is a noteworthy fact that all of the large electric railway work up to the present day has been undertaken by engineers who have served their apprenticeship on the street railway. We do not mean to decry the steam railroad engineer, but he must realize that if he wishes to take his part in the development which is sure to come on his own road he must be preparing himself for the emergency. In many respects he may possess advantages over the street railway engineer, but if he is lacking in the essential knowledge of the machinery which he is to install, or which will be put in his charge, he may be worse than useless. The technical schools are turning out annually electrical engineers by the hundred, most of whom understand electrical matters thoroughly, but who know little or nothing of railway operation. They could not immediately be put in a responsible position on a converted steam line, but in many respects the appointment would be no more anomolous than the maintenance in his position of a steam railroad man who knew nothing of the electrical side of the subject. The time has passed when the possibilities of this new motive power in trunk line work can be ignored. The progressive steam railroad man owes it to himself, if not to his company, to become conversant with the electric railway situation, and if those who do not should fall by the wayside when electrical equipment is decided upon, they have only themselves to blame.

## CONTROL SYSTEM, MOTORS AND SHOES OF THE BALTIMORE & OHIO LOCOMOTIVES

In view of the attention directed toward the heavy electric locomotive work proposed in the neighborhood of New York, some further particulars about the equipment of the latest type of Baltimore & Ohio locomotives will be of interest. These locomotives were described in the Street Railway Journal for Aug. 22, 1903, but no details were given of the method of control other than that it was of the Sprague-General Electric type. The control is technically known as type-M, Form C, with C-15 controllers, and is designed for use with four motors. Each unit contains forty-four contactors, which are placed in cabinets in the cab. Below the contactors in somewhat larger cabinets are placed the resistances which are utilized on the various speed notches. While the contactors are of the same type as those that will be used on the Interborough cars in New York City, and described in the Street Railway Journal for March 14, 1903, the trade name being "D. B. 41 A-1," their number and arrangement differs materially.

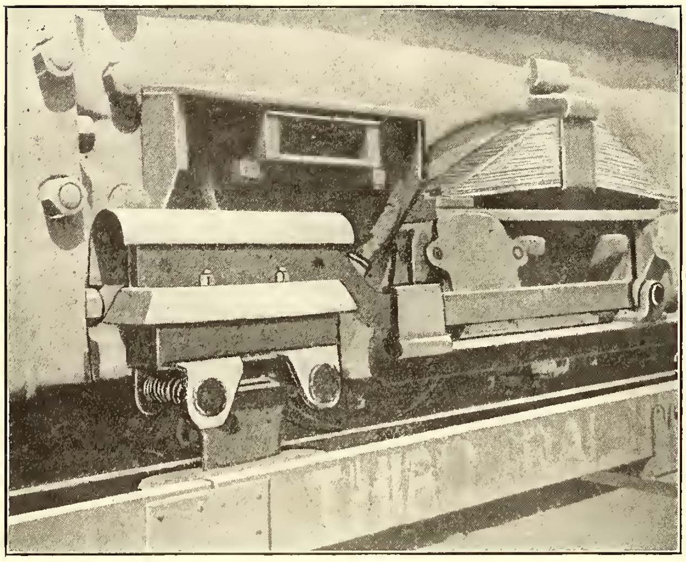


FIG. 2.—COLLECTING SHOE AND SUPPORTING BAR

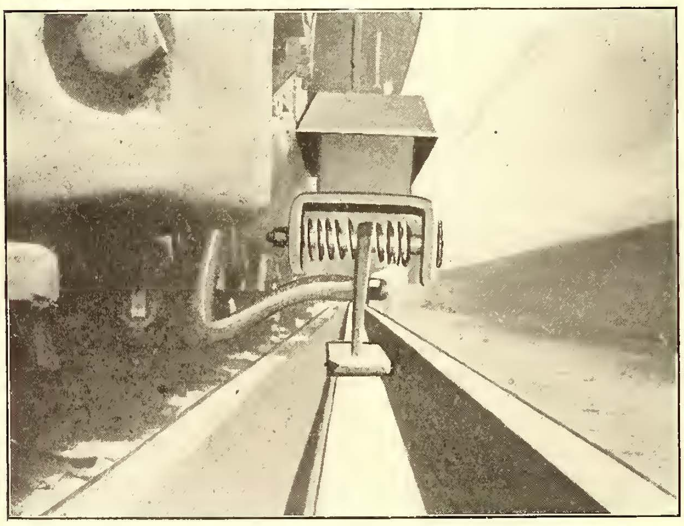


FIG. 3.—END VIEW OF COLLECTING SHOE

Consulting the diagram shown in Fig. 1, it will be noted that thirty-eight of the contactors tap to a common bus-bar. The first four contactors are in multiple, and connect this bus-bar with the shoe. The succeeding contactors in sets of two or more in multiple according to the currents required, connect this bus-bar to another bar from which power is distributed by contactors Nos. 39, 40, 41, 42, 43 and 44. These latter contactors control the series multiple connections of the motors. The direction of the motors is controlled by two reversers, one for each pair of motors. The motors themselves are arranged to be cut out in pairs with a suitable cut-out. The locomotives are operated in pairs, as illustrated in the issue of Aug. 22, and eighteen train wires are used in connecting the units in each pair together.

Each unit is equipped with four motors, having a rated horsepower of 200 each. The maximum current capacity of each motor is 275 amps., and the operating voltage is 625. This gives a maximum capacity of the unit of 1100 amps., or for the pair of units, in which form they are commonly used, of 2200 amps. With this current at 625 volts, the two units will exert a drawbar pull of about 65,000 lbs.

The motors are known as the G. E. 65-B, one turn, and weigh without pinions or gear case 4900 lbs. They were built especially for the Baltimore & Ohio locomotives, and are geared to the axles at a ratio of about 4.26 to 1, the exact teeth ratio being 81 to 19. The motors are designed for a maximum speed of about 24 m. p. h. The performance curves of these motors, shown in Fig. 4, are quite interesting. The efficiency touches 89 per cent at about one-half load, and at full load exceeds 87 per cent, and at 415 amps., which is nearly 60 per cent overload, the efficiency is 83 per cent. The speed of the motor at full load is somewhat less than 9 m. p. h.

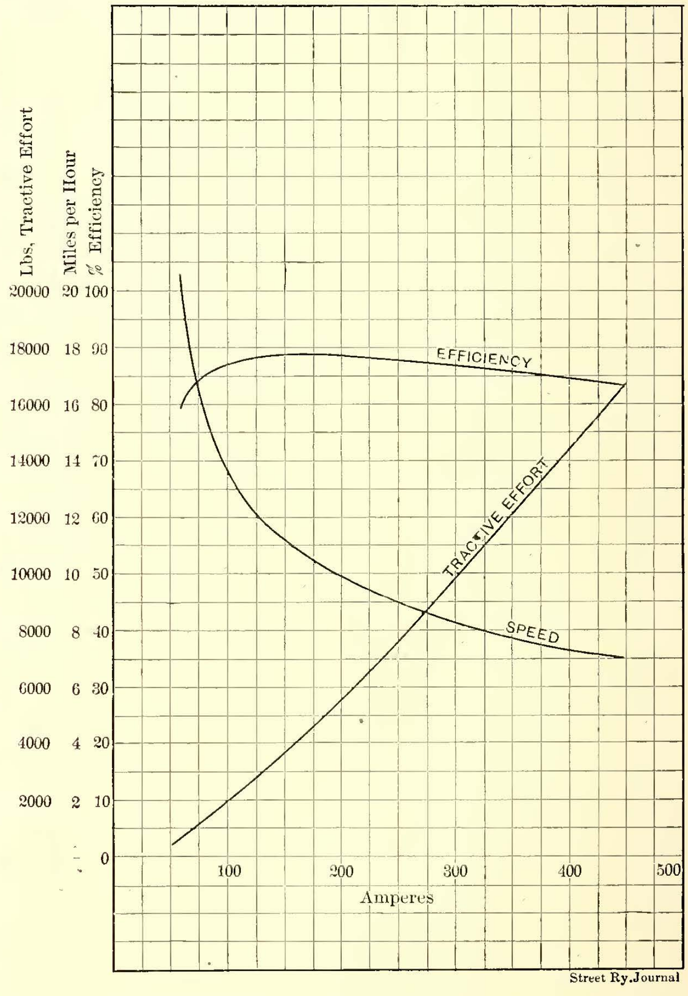



FIG. 4.—CHARACTERISTIC CURVES OF G. E. 65-B MOTOR, ONE-TURN ARMATURE, 42-IN WHEELS, GEAR RATIO 81:19

The current is supplied to the locomotive by means of four shoes, two of which are usually in contact with the rail at a time. These shoes are of an unusual type, having been constructed upon the same heavy lines as have been the previous shoes of this road described in the Street Railway Journal for March 14, 1903. The shoe itself bears on the rail with a pressure exceeding 125 lbs. As the shoe itself has to work in a slot in some places, it is provided with a long neck for that purpose, and is free to move laterally within certain limits,

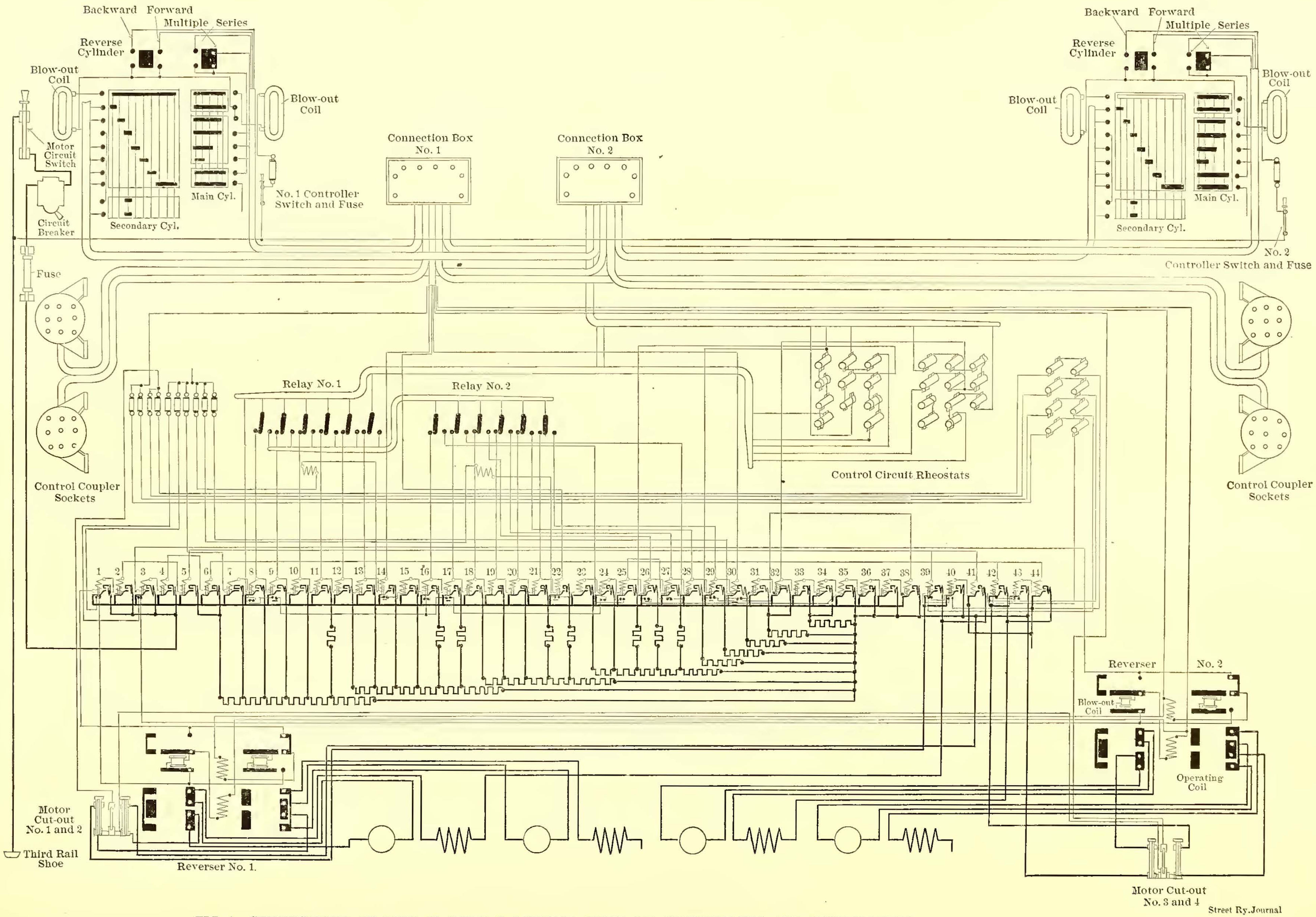



FIG. 1.—CONNECTIONS OF TYPE M, FORM C CONTROL WITH C-15 CONTROLLERS AND FOUR MOTORS

being restored to a central position by springs. The shoe is fastened to a carrying plate, and insulated therefrom by fibre pieces and bushings. This carrying plate slides on rods parallel to the axle of the locomotive. These rods are mounted in a frame which is belted to a hardwood block, affording further insulation. On the top of this block an angle-iron is bolted, which is secured to the shoe-bar and insulated therefrom by fibre sheets and washers. This triple insulation has been found necessary because of the severe exposure to weather, and the very serious character of short circuits which would result from its failure. The whole shoe is suspended from the end of a rectangular bar pivoted at the distant end and free to slide up and down in a slotted piece. This construction will be better understood by consulting Fig. 2, which shows the shoe and its supporting bar. Fig. 3 shows an end view of the shoe, the cable connections and the springs controlling its lateral position. It will be noted that hoods are fastened over the insulating portions of the shoe to shed water.

The shoe circuit is protected by a fuse, of the Case type, immediately above it. This is a fuse copper strip with its carrying capacity in the center weakened by means of a reduction of its section by a large hole in the center. The locomotive frame is constructed of four very heavy castings bolted together and forming a rigid rectangle. The frame is suspended from the axle by very heavy leaf springs. The motors are suspended by bearings on the axle and by nose suspension at the free extremity. In the cab above, which is of very liberal dimensions, are arranged eight cabinets, the upper four containing the contactors, the lower four containing the resistances. In a central position on the cab and about 4 ft. from each end are located the reversing switches in cabinets. In either corner of the cab is located an air reservoir, and in the exact middle is the motor-driven air compressor. On the side walls near the door are the circuit breakers, cutting out the motors, and either end is equipped with a controller station. The controller station comprises a C-15 controller, which gives a set of series notches on one revolution of the handle, and on returning the handle to zero, and depressing a button in the top, it will give an equal number of parallel notches. The controller station also comprises a hand switch for the contactor circuit, lighting switches for the cab, a switch for controlling an electro-pneumatic sander, a switch controlling the electric circuit of the motor compressor, the electro-pneumatic control of the air for the motor compressor, hand manipulation for the sander, Westinghouse air brake lever, bell and whistle cord. In front of the controller is mounted an ammeter, which indicates the full current taken by the locomotive, and which, for the present, is limited by the Baltimore & Ohio management to 2000 amps. Fig. 5, the interior view of the locomotive, shows, to some extent, the arrangements described in the foregoing, while a general view of its appearance can be obtained by consulting Fig. 6, which shows a view of the exterior of one of the units. These units are now used in pairs to handle the freight traffic through the Belt Line tunnel. They are, of course, of slower speed than those that will probably be employed for the passenger traffic in and about New York City, and are of somewhat less power. There is no doubt, however, that they have the greatest draw-bar pull of any electric locomotive now in existence.

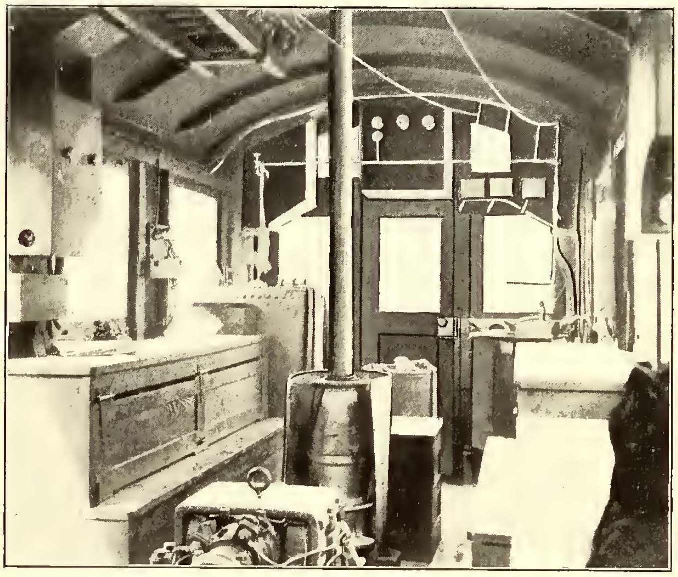


FIG. 5.—INTERIOR ARRANGEMENTS OF BALTIMORE & OHIO ELECTRIC LOCOMOTIVE

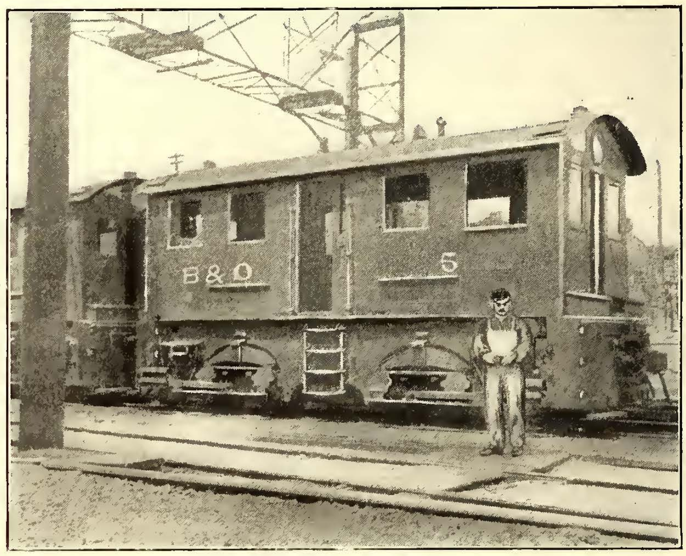



FIG. 6.—EXTERIOR OF BALTIMORE & OHIO ELECTRIC LOCOMOTIVE

## IMPROVEMENTS IN DUBUQUE, IA.

The Union Electric Company, which operates the Dubuque electric railway and lighting systems, is planning a number of important extensions this year, which, when completed, will involve an outlay of in the neighborhood of $500,000. The plan for rebuilding and improving this system has been under consideration for the last three years, but has been delayed pending the consolidation of the electrical properties in the city. Certain portions of the railway have, however, been rebuilt during this time, including the overhead system, and the rolling stock has been practically replaced. The changes at present proposed involve the construction of a new power station and car house and the reconstruction of track.

The power station will be 36 ft. x 114 ft. deep, and will be entirely of brick, stone, steel and cement. The steam equipment will consist of six boilers of 400 hp each, normal rating, and five steam turbo-units of 500 kw each, with the necessary equivalent of rotary converters for the use of direct current on the railway system. The turbo-units will be of the Curtis type, will occupy a floor space of 8 ft. sq., and will have a height of 2 ft. 2 ins. The boilers will be of the Babcock & Wilcox make, and will supply steam at 200 lbs. pressure. The steam will be superheated at 150 degs. The stack, which is of steel, will be 200 ft. high, with a diameter of 11 ft. The car house will be 108 ft. x 240 ft., and will contain the offices of the company, repair shops, etc.

The track is being relaid with 72-lb. 60-ft. rails. The L. E. Myers Construction Company has the contract for both the track work and the car house, while Witherspoon & Engler have the contract for the power station building. The work is being carried on under the direction of L. D. Mathes, general manager of the company.

## AN IMPORTANT APPLICATION OF THE STORAGE AIR-BRAKE SYSTEM AT NEWARK, N. J.

Increasing favor for the storage system of air braking for street railway cars is attested in its adoption by the railway department of the Public Service Corporation, of New Jersey, for the cars of its Montclair, Orange and West Orange lines running out of Newark. The necessity for power braking upon these lines had for some time been felt on account of the exacting requirements of the service, as well as the size of the company's heavy double-truck cars, and in considering the problem, D. F. Carver, chief engineer of the street railway department, made a careful and thorough study of modern systems of power braking for street cars.

The uniformly good results of the storage air system which is used upon the street railway systems at both Detroit, Mich., and St. Louis, Mo., induced a careful examination of its many desirable features for street railway service. The favorable experiences with the storage system in these cities led to a decision that for the peculiar conditions met in city car service, it offers many advantages over the independent system of using a motor-driven compressor upon each car—the usual method of air braking for street cars. This view was taken particularly on account of the smaller investment required for the equipment of the system, although the greater economy in the maintenance and operation of a few large stationary compressor plants, as compared with that of the motor-driven compressors upon the various cars, was also considered an important factor. The fact that the experience of the roads in the two above-mentioned cities was to find the storage-system car more reliable and less likely to fail on the road than an individual compressor-system car, was of great weight in influencing the adoption of the storage system at Newark.

The above-mentioned car lines operating out of Newark, which are being equipped, operate on high-speed schedules through territories having heavy grades to contend with, so that the system of power braking requires to be both powerful and reliable for cars of the weight used, which conditions will thus afford an excellent test of the system. The cars being equipped are of the twelve-bench open type, weighing 33,000 lbs. without passengers, and are 40 ft. 8 ins. in length over bumpers.

The system to be provided involves the application to each car of storage air tanks to hold the compressed air supply at high pressure (300 lbs. a square inch), from which the service air supply will be delivered to the brake reservoir through a reducing valve for obtaining the desired working pressure. The rest of the brake equipment will be of a standard form, as used in connection with the usual systems of air braking, the engineer's valve being of the "straight-air" type. A compressor plant, consisting of two belt-driven two-stage air compressors, operated by electric motors through belting and line shafting, will be located at the car depots of each of the three above-mentioned lines, the intention being to charge the high-pressure tanks of each car with compressed air at least once during each round trip as the car passes the depot. The usual hand brakes are, of course, retained so that in case of failure of the air brake system no delay will occur to a car.

### THE CAR EQUIPMENT

The details of a standard application of this braking equipment to a car are shown in the plan in Fig. 1. The storage tanks are located at either side of the middle of the car, with the service reservoir and brake cylinder between them, the piping connections for the operation of the system being clearly shown in the drawing. A charging line extends across the car, connecting with each storage tank, and also through the reducing valve to the service reservoir; this line is provided at both ends with one solid-head coupling of the air-brake hose type, for charging connections. The hose couplings are conveniently located at the sides of the car beneath the sills for ease of connection with the charging hose located in the street boxes opposite the car depots.

In charging these storage tanks at the car depots, compressed air enters at high pressure through a check valve in the charging line, and thence through a ground stop-cock to the storage reservoirs. The storage tanks are to be 18 ins. x 78 ins., and the service reservoirs each 12 ins. x 42 ins. in size.

By means of the reducing valve, between the high-pressure line and the service reservoir, an air pressure of 50 lbs. is maintained in the service reservoir at all times as long as sufficient pressure remains in the storage tanks to deliver through the reducing valve. From the service reservoirs connection is made to a ¾-in. air supply pipe at one side of the car, which leads to the motorman's control valves at either end of the car. The "train," or service, pipe leads from the motorman's valves at either platform back along the other side of the car to the cross connection leading over to the brake cylinder an 8-in. double-end jam cylinder, as shown in drawing. The piping is quite simple, and is so arranged as to be easy of access for examination and repairs at any time.

In addition to the above, each car is equipped with two pressure gages, one duplex and the other single, upon each platform, for use of the motorman. The duplex gage indicates the pressure both in the high-pressure storage system and in the service reservoir, thus acting as a valuable check upon the efficiency of the reducing valve; the single gage indicates the pressure acting in the jam cylinder when braking, a valuable adjunct for the motorman in careful and effective braking. A pop safety valve is applied to the service reservoir, and set to blow at 90 lbs. for protection to the low-pressure system in case of failure of the reducing valve. The piping used for the high-pressure will be double-extra strength welded wrought-iron, with double extra strength fittings; that under the service pressure (50 lbs.) will be the standard welded wrought-iron pipe. The high-pressure system will be tested to 600 lbs. by hydraulic pressure, while the low-pressure system, including the jam cylinder, must withstand a pressure of 90 lbs.

### THE COMPRESSOR STATION EQUIPMENT

As mentioned above, at the car houses of each of the three lines being equipped for storage air braking, will be located an

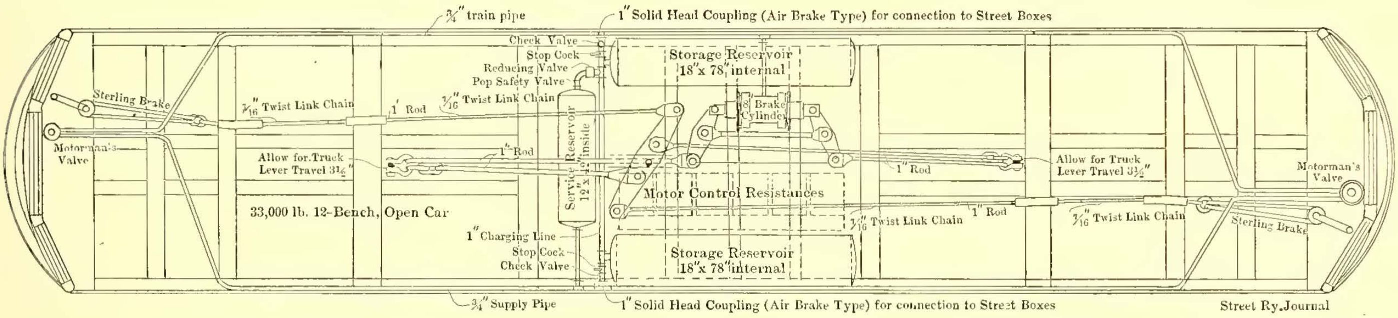



FIG. 1.—PLAN OF THE STANDARD CAR EQUIPMENT FOR THE STORAGE AIR-BRAKE SYSTEM, SHOWING ARRANGEMENT OF RESERVOIR AND PIPING

air compressor plant for supplying the high-pressure compressed air to the cars as they pass. This arrangement of the charging stations at the car houses, where the cars must stop always in passing, is thought to possess great advantages over the use of one large plant located in a central—probably downtown—point, where stops for charging would cause inevitable delays. In this way each car may easily be charged with air while the conductor is making his usual stop at the depot office.

In Fig. 2 is shown the standard arrangement of apparatus and also details of the storage and cooling tanks at one of the compressor stations. The equipment of each station will consist of two belt-driven air compressors, each with a capacity of compressing 100 cu. ft. per minute, two Westinghouse type-56 railway motors, with line shafting and belt connections for driving, and three cooling storage tanks connected in series for delivering air to the cars. Pipe connections are provided for delivering air to the cars passing the depots by means of street boxes, embedded in the surface of the street alongside of each track passing the depot, from which openings hose may be run to the charging coupling on the car; also three similar hose coupling connections are to be provided in each depot for charging the storage tanks while "in the house."

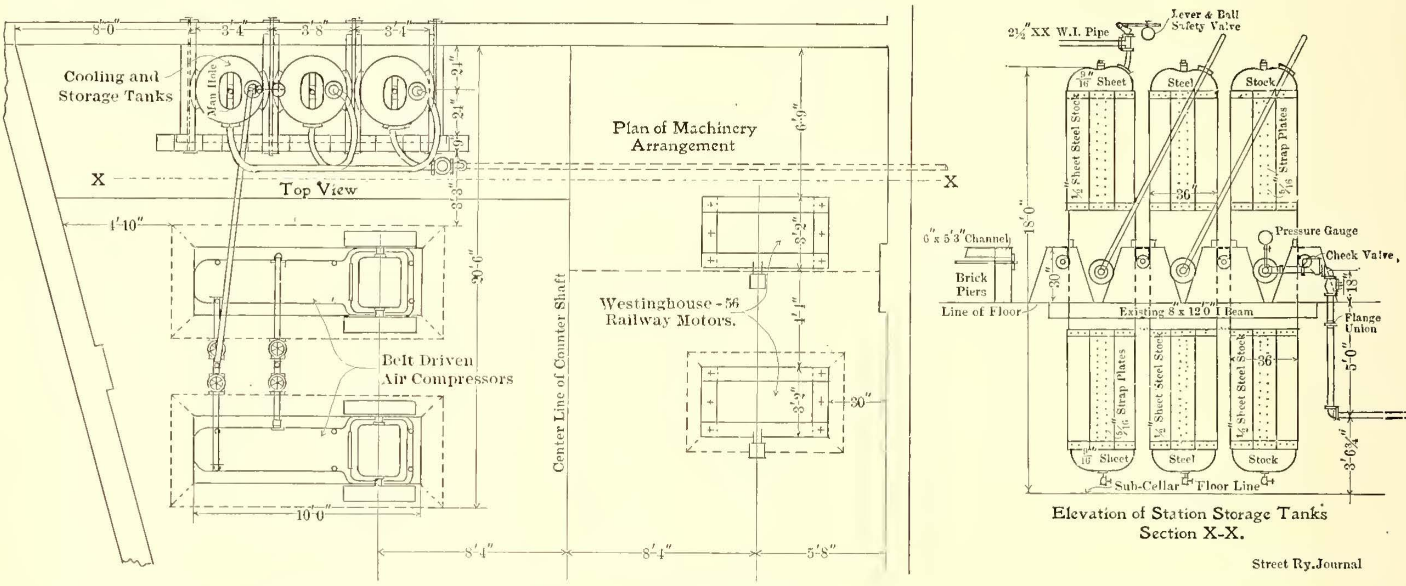



FIG. 2.—PLAN OF THE COMPRESSOR PLANT TO BE INSTALLED AT THE MONTCLAIR CAR DEPOT, SHOWING ALSO DETAILS OF THE STORAGE AND COOLING TANKS

The air compressors are of the two-stage type, with intercooler, the details of one of which compressors are shown in Fig. 3. These compressors are of usual construction, having the intercooler elevated over the cylinders, as shown. They are very carefully provided with cylinder jackets for the cooling of cylinder surfaces; cooling water is passed first through the high-pressure cylinder, flowing thence to the intercooler and out through the low-pressure cylinder, as indicated in the drawing. These compressors are arranged to operate at 100 r. p. m., and will deliver air at a pressure of 325 lbs.; their capacity is rated at 100 cu. ft. per minute at the pressure of 325 lbs. a square inch. Each will be equipped with a pressure gage and two high-pressure safety valves, set to blow at 325 lbs., upon the intercooler. They will be belt-driven from the countershaft located between them and the motors; friction clutches are provided upon the pulleys on the countershaft, so that either motor may drive, or be cut out, and likewise either compressor may be operated at will.

The storage reservoirs at the compressor stations are located adjacent to the compressors, as shown in Fig. 2, and are piped up in series, the air passing from the compressor first into the one at the left, from that one to the middle tank, and thence to the third tank, before passing out to the delivery connections in the street. This general arrangement of the three in series will be very effective in providing an excellent opportunity for the air to cool, and practically rendering the use of mechanical cooling apparatus unnecessary.

It will, furthermore, be noticed in the detail elevation view of the three reservoirs that the air leaves each tank from a point midway down its side, and delivers through a long sweeping bend to the top of the next one, this arrangement being made to provide for free expansion and contraction, due to temperature changes. The left-hand reservoir is provided with a lever and ball safety valve, connected to the delivery-pipe fitting, as shown, and also a pressure gage will be connected to them.

These storage tanks are mounted in an unusual manner, being set vertically with their lower portions projecting into basement of the building, as shown. This arrangement is economical of space, and also provides a convenience of access to all parts. The details of the stands upon which they are supported, as well as the piping, drainage and other connections, are shown in the detail elevation of these reservoirs in Fig. 2.

Fig. 4 shows the details of the iron street boxes which are to be used for enclosing and protecting the hose connections for charging the car storage tanks, when not in use. These boxes are only 8 ins. wide by 42 ins. long, thus requiring very little space in the street, and are arranged so that the cover, when closed, comes flush with the street level. The cover is of ⅜-in. iron plate, very heavily braced to provide freedom from injury. This box is, as shown, of sufficient size to contain 5 ft. of the flexible air hose by which connection is made to the charging coupling upon the cars, besides the necessary cut-out cocks for shutting off the supply.

DESIGN OF THE SYSTEM

Careful attention and study was devoted to the design of the essential features of the storage system by Mr. Carver. Owing to the high pressure dealt with, and the method of handling the two pressures, the principal features of the work of designing the system may be of interest.

In considering the size of the storage tanks which it would be necessary to use upon the cars for carrying the high-pressure compressed air supply, a study was made of the maximum number of applications of brakes which ordinarily would be made in the operation of any car. The service upon the three car lines which are being equipped with this braking system is very similar, so that provision for maximum possible conditions upon any one of the lines would be ample for any of the other lines. It was found that the maximum number of brake applications for a full round trip could not very well be greater than 300, and that an average for maximum service conditions would be about 280; this number is much higher than will normally be expected, but it provides for the extreme conditions of "rush-hour" service with numerous stops.

Further study of ordinary air braking practice under street railway conditions indicated that the average consumption of compressed air per 40-lb. application would be but slightly over 1 cu. ft. per application, an average being assumed at 1.2 cu. ft. per application. Thus it may be seen that the total maximum consumption of air, assuming 280 applications using 1.2 cu. ft. each, will be 336 cu. ft. of free air. This quantity must be supplied from the storage tanks.

As above stated, the storage tanks used upon the cars are to be 18 ins. in diameter and 78 ins. long, the combined volume of the two reservoirs per car being 21.95 cu. ft. These two tanks have a total capacity, at 300 lbs. compressed-air pressure, of 439 cu. ft. of free air. But as the air passes from the storage tanks into the service reservoir only at pressures from 300 lbs. down to 50 lbs., there is available in the storage tanks for braking purposes an amount of air corresponding to that volume at 250 lbs. pressure, or (21.95 cu. ft. volume × 16.66 atmospheres) = 368 cu. ft. of free air, which may be seen to be ample for the total of 280 applications. Dividing this capacity by the amount of 1.2 cu. ft. of free air assumed to be required in the brake cylinder per application, it will be seen that over 300 applications are available, so that a fairly large margin of excess is provided.

In calculating the storage tanks for use upon the cars for strength, a large factor of safety was thought desirable, and they are to be built of 3/8-in. steel stock of an ultimate tensile

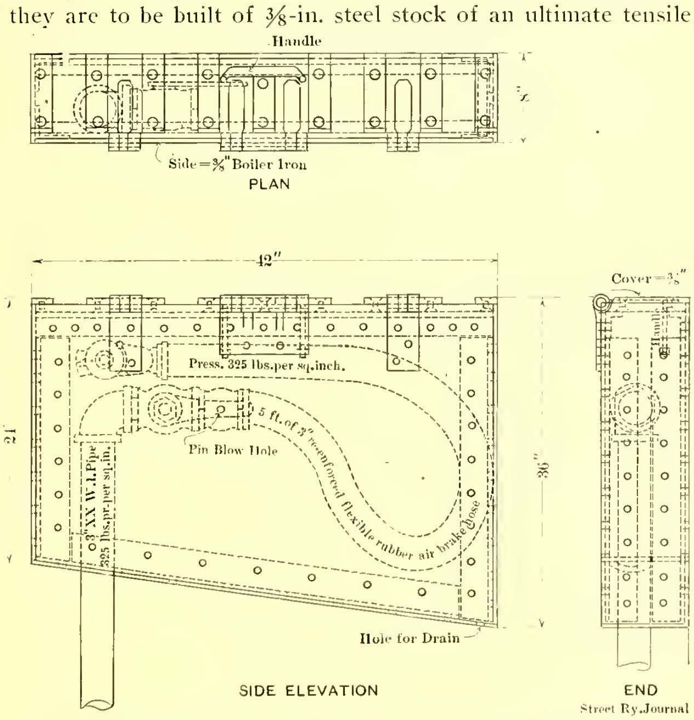



FIG. 4.—DETAILS OF THE SPECIAL STREET BOX TO BE USED ALONGSIDE OF TRACKS IN THE STREET TO RECEIVE AND PROTECT AIR DELIVERY HOSE

strength of 60,000 lbs. per square inch. As may easily be figured, this will provide an ample margin of safety; the working strain due to longitudinal stress was found by the formula,

$$\frac{\text{radius} \times \text{pressure per square inch}}{\text{thickness}}$$

to be 7200 lbs. per square inch, while the strain due to transverse stress was found by formula,

$$\frac{\text{diameter} \times \text{pressure per square inch}}{4 \times \text{thickness}}$$

to be 3600 lbs. per square inch, the combined effect of these two stresses thus amounting to 10,800 lbs. From this it may be observed that the factor of safety amounts to nearly 6.

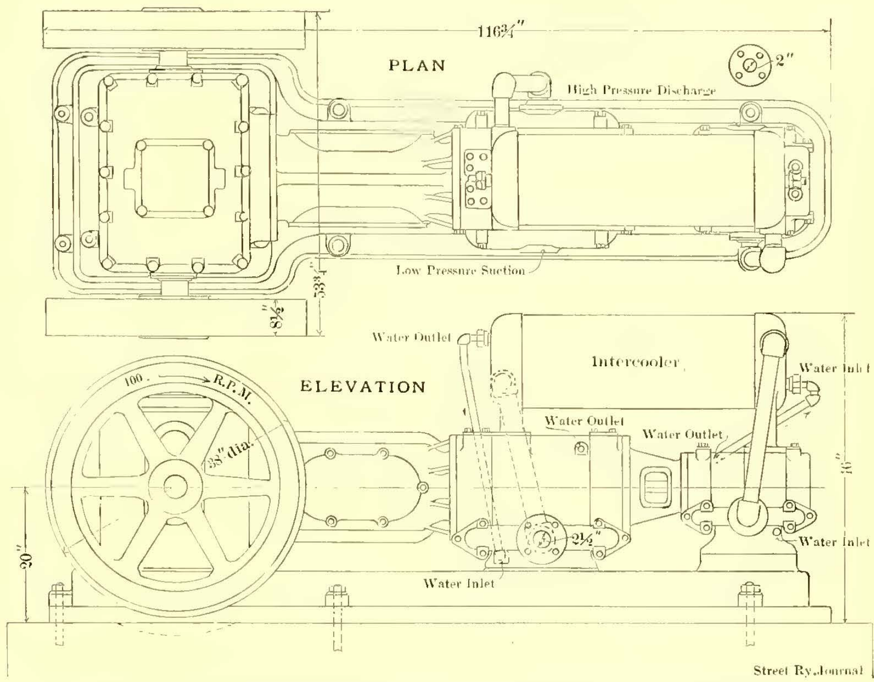



FIG. 3.—THE TYPE OF BELT-DRIVEN, TWO-STAGE INTERCOOLED AIR-COMPRESSORS TO BE USED IN THE COMPRESSOR PLANTS

In calculating the amount of air to be used in charging passing cars, and thus the required capacity of the air compressors and station storage tanks, it was assumed that the minimum possible headway upon which cars would ever be expected to operate would be 2 minutes; inasmuch as the average headway upon these lines is about 5 minutes, it may be seen that this assumption provides for the most extreme conditions of service. If cars pass the compressor station once in 2 minutes, it is evident that, with the 368 ft. required per car to raise the storage tank pressure from 50 lbs. to 300 lbs., it will be necessary for the compressors to supply compressed air at the rate of 184 cu. ft. of free air per minute. Thus it may be seen that the provision of two compressors, as above referred to, each capable of furnishing 100 cu. ft. of free air per minute, will amply provide for this service, and it is more than probable that one will be easily able to take care of the work under ordinary conditions of service.

The compressor station storage tanks are each 36 ins. in diameter and 18 ft. long, as indicated in Fig. 2. Each of these tanks embrace a volume of 127.2 cu. ft., the three having a total of 381.6 cu. ft. The combined capacity of the three tanks at the pressure of 300 lbs., is 7784.6 cu. ft. of free air; but for facilitating the charging of the car storage tanks, the compressors are to be operated at 325 lbs. pressure per square inch, which will give a larger reservoir capacity than at the 300-lb. pressure. The amount of free air which they will contain at 325 lbs. pressure is 8433.4 cu. ft., so that it may be seen that an additional reservoir capacity of 648.8 cu. ft. is provided above the capacity at 300 lbs., by the 25 lbs. of excess pressure. This provides a liberal reserve over the amount contained at the car reservoir delivery pressure, and makes the compressor station capable, in addition to giving the cars complete charges when running on schedule headway, of cleaning up a three-car blockade at the rate of one car per minute without reducing the station reservoir below 300 lbs.; that is, three cars may be charged within a period of 3 minutes without reducing the pressure in the station tanks below 300 lbs.

The station reservoirs are built of ½-in. steel stock, of 60,000 lbs. ultimate tensile strength. The heads are convex, in one piece, and are forged from 9-16-in. steel stock. These tanks have one longitudinal and two circumferential seams, and are tested to 600 lbs. hydraulic pressure. The longitudinal joints are triple-riveted double butt-strap joints, with a rivet pitch of 3⅛ ins., bringing twenty-four rivets in a space of 25 ins., while the circumferential seams are double-riveted lap joints, with similar rivet pitch. The rivets used are all ⅞-in. rivets, the load which will be imposed upon those of the longitudinal seam being 5686 lbs., double shear, and that upon those of the circumferential seams being 4250 lbs., single shear. By similar formulæ, as used for the car reservoirs, it may be seen that the working longitudinal stress is 11,375 lbs., and the transverse working stress 5685 lbs. per square inch. The sum of these is 17,060 lbs., thus making the factor of safety nearly 4.

The National Electric Company, of Milwaukee, Wis., furnished and erected all the station and car equipment; Oliver P. Scaife & Company, of Pittsburg, Pa., made the car storage tanks, and the Niles Boiler Works, of Niles, Ohio, furnished the station storage tanks.

## EXHIBIT ON THE PENNSYLVANIA RAILROAD TUNNEL AND TERMINAL

The Pennsylvania Railroad Company has spent a large amount of money upon its exhibit in the Transportation Building at the Louisiana Purchase Exposition. This exhibit includes a locomotive testing plant, where it is intended to test a number of locomotives during the Exposition season. The things of most interest to the electric railway man, however, are the models showing the New York terminal of that company, and the tunnels under the Hudson and East Rivers. The most prominent thing in this part of the exhibit is a full-sized section of one of the single-track tunnels, two of which tunnels are being constructed under the Hudson River. This section, as exhibited, is shown in Fig. 1. It consists of a cast-iron shell lined with concrete. On each side of the track are terra-cotta ducts for electric wires. There is very little clearance above the top of the car roof in the tunnel, but in that space is located an overhead conductor, which, on the model, is a wide strip of steel supported by porcelain insulators from the concrete roof. There is also a third rail, the location of which beside the track can best be seen in Fig. 2. This third rail has its center 26½ ins. outside the gage line of the track, and its top 2¾ ins. above the track. It is protected by two planks, a 9-in. plank on top and a 6-in. plank at the side. The third rail is supported on vitrified clay insulators. The section of tunnel illustrated in Figs. 1 and 2 is that which is to be used in passing through the silt in the bottom of the river. The track in this section is supported on steel screw piles, which extend below the tunnel to solid rock. The top of one of these steel screw piles, which is under the middle of the track, can be seen in Fig. 1. An I-beam parallel with the ties rests on the screw pile, and this in turn supports longitudinal girders, upon which the ties rest. In Fig. 3 are shown models of sections of the tunnel. That at the right is a three-track tunnel, as constructed under the streets of New York City. In the middle are two single-track tunnels side by side, as constructed in solid rock, and at the left is a single-track tunnel as constructed through solid rock. Fig. 4 is from a photograph of the model

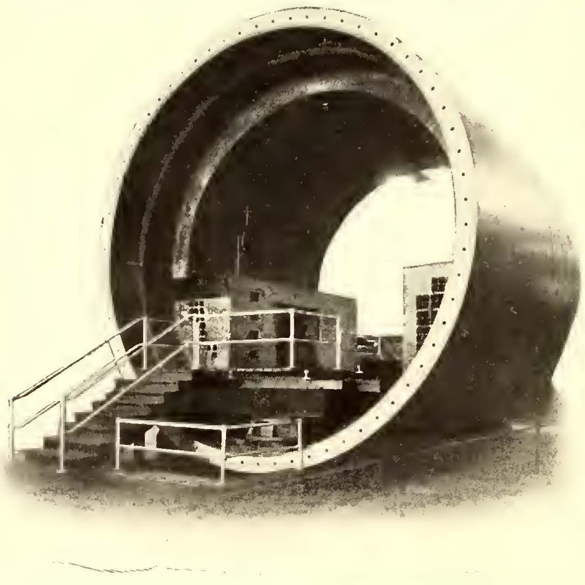


FIG. 1.—MODEL OF HUDSON RIVER TUNNEL

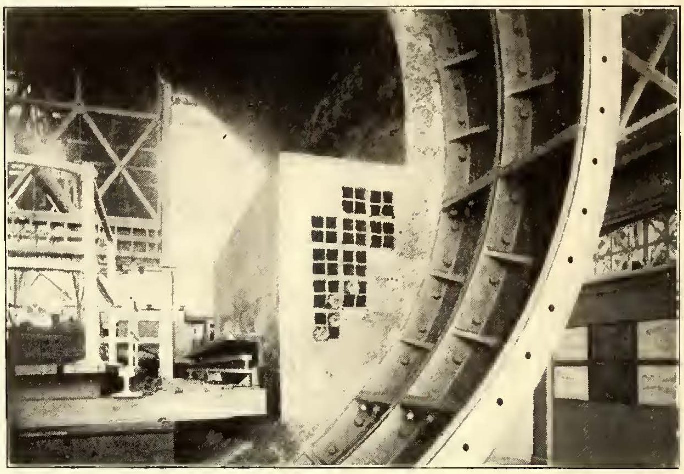


FIG. 2.—PORTION OF EXHIBIT, SHOWING METHOD OF PROTECTING THIRD RAIL

FIG. 3.—MODELS OF SECTIONS OF TUNNEL

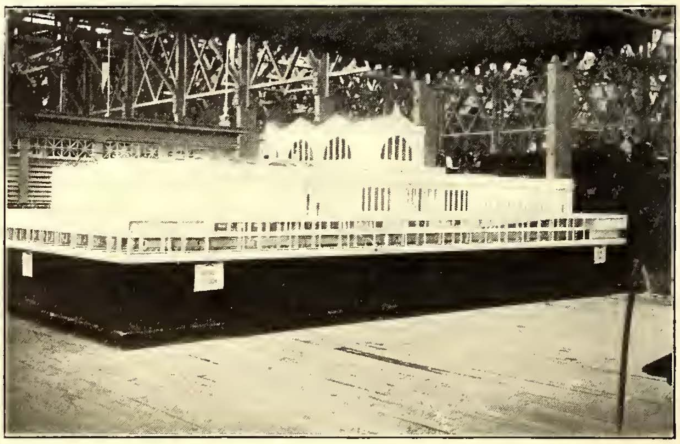


FIG. 4.—MODEL OF PENNSYLVANIA TERMINAL IN NEW YORK CITY

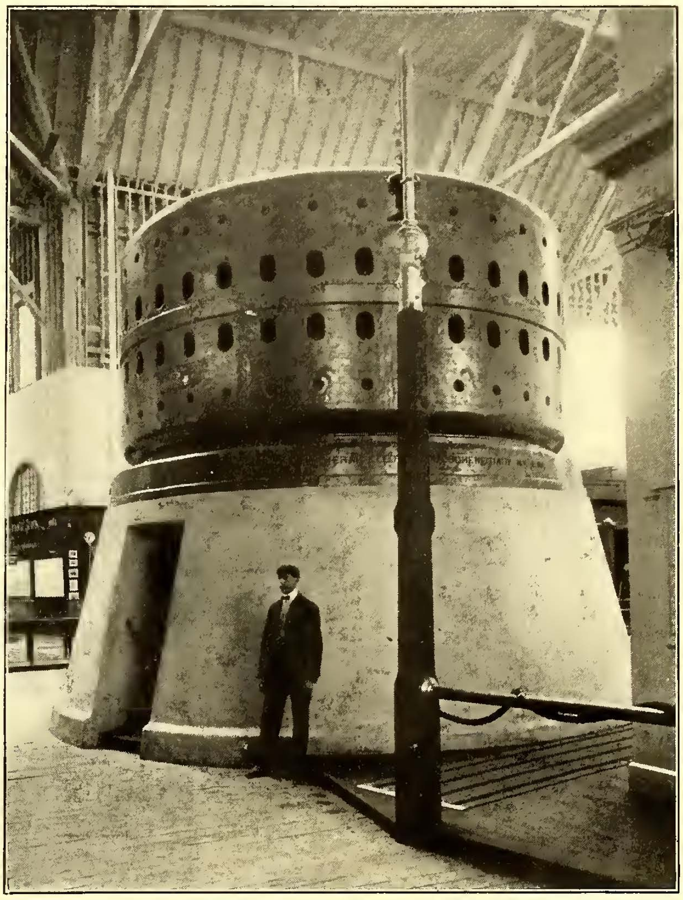
of the great Manhattan terminal which this company is to build between Seventh and Eighth Avenues, Thirty-Third and Thirty-First Streets, in Manhattan, New York City. This model shows the train shed at the bottom and floors above the train shed for depot purposes. On this model trains are shown as being coupled to one or two eight-wheeled electric locomotives, from which the natural inference is drawn that electrical locomotives connected together by the multiple-unit system will be employed with as many locomotives per train as may be necessary. Besides these models there is a model cross section of Manhattan Island, the river beds of the North and East Rivers, and the Long Island and New Jersey shores, showing the character of material through which the tunnel passes on its way from Hoboken to the terminal on Long Island.

## THE GENERAL ELECTRIC EXHIBIT

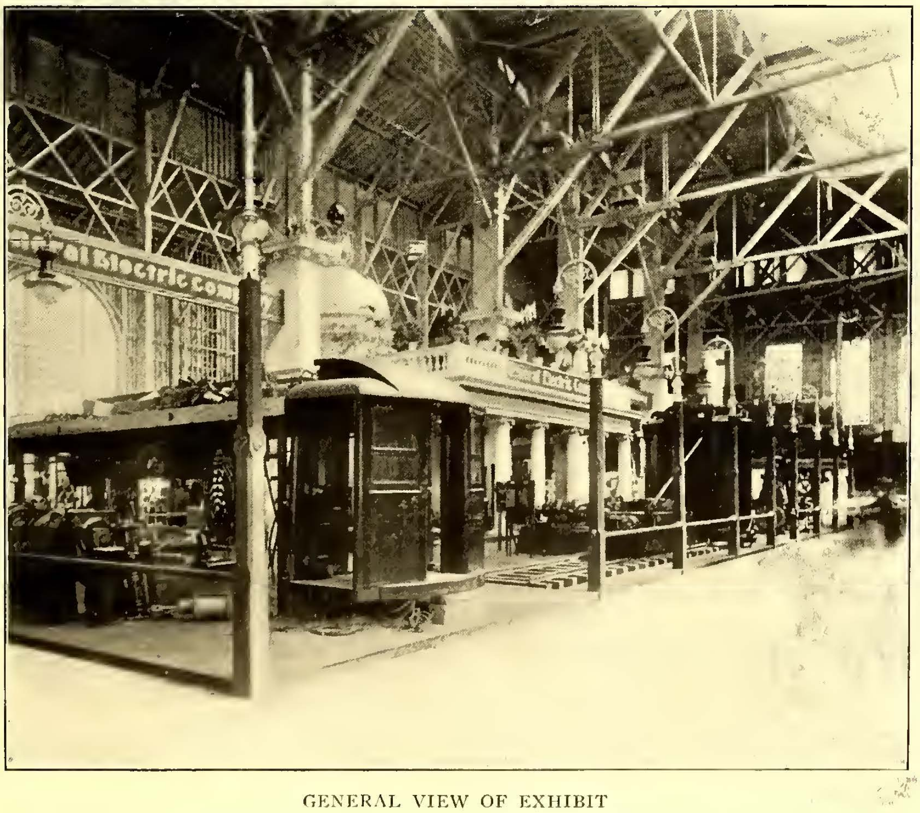
The exhibit of the General Electric Company is, of course, very comprehensive, in fact so much so that it is impossible in a brief article, such as this must be, to do more than touch upon the latest apparatus shown. In the Machinery Building is a 2000-kw Curtis steam turbo-generator, giving 25-cycle, 6600-volt current. Along with the generator is an oil switch and switchboard, just as in a regular central station.

The principal exhibit of this company, which is in the Electricity Building, has, as a landmark, a model of the stationary armature of one of the 10,000-hp generators being built for the Canadian power house at Niagara Falls. The stationary armature model is shown mounted on a concrete foundation, just as in the actual installation. Inside the foundation is an office, where photographs of the General Electric Company's apparatus at Niagara Falls are shown. Five machines of this size are being installed in the Canadian power house at Niagara Falls.

Another one of the "biggest things" shown in this exhibit is a machine-operated oil switch for 60,000 volts. This switch has brick cells, 7½ ft. high, 2 ft. 7 ins. wide and 4½ ft. deep. The switching proper is done in a wooden cylinder filled with oil, the wooden cylinder being supported on high hardwood pins. The largest transformer at the Exposition (capacity 2333 kw) is shown together with two coils for such a transformer, one being partially completed and the other completed. They show the method of coil construction with flat copper strip and strips of insulating material between convolutions.



FULL SIZED MODEL OF 10,000-HP ARMATURE



GENERAL VIEW OF EXHIBIT

A 250-kw air-cooled transformer is mounted over an air chamber, through which an extra volume of air is forced, to illustrate the principle of air-cooled transformers. Sections of transformer coils for 500-volt transformers are shown.

The part of this exhibit which will probably be of most interest to the technical electric railway man is the new Sprague-General Electric multiple-unit controller, as constructed for the Interborough Rapid Transit Company, of New York, with device for automatically regulating the rate of acceleration. This controller also has a new attachment to what is commonly called the "dead man's handle." It will be remembered that the dead man's handle, as heretofore constructed on the General Electric type-M train control system, simply acted upon the controller circuit whenever the handle was released by the motorman. On the new controller the dead man's handle, in addition to shutting off current by opening the controller circuit, also opens the train pipe of the automatic air brake, thereby making an emergency application of the brakes, should the motorman faint at his post, and so release the handle.

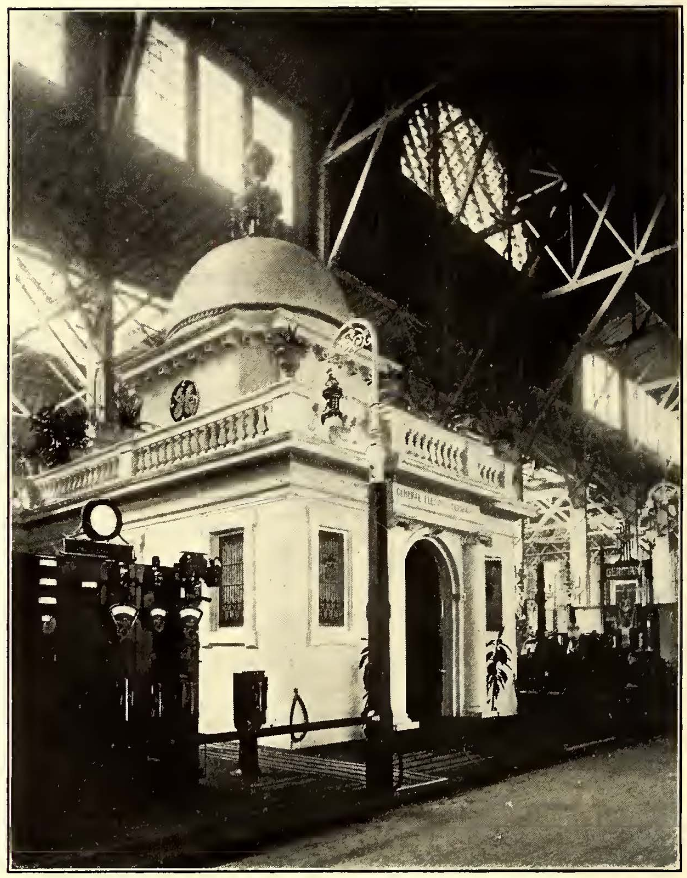
The automatic regulation of the rate of acceleration is accomplished in an ingenious way: The shaft, which is operated by the controller handle, is geared to the controller-drum shaft. Connected with this gearing by a ratchet and pawl are other gear wheels operating a rapidly revolving soft-iron armature,

BRICK CELLS CONTAINING 60,000-VOLT SWITCHES

which revolves when the controller is advanced but not when it is being turned off. The motion of the controller drum can be

60,000-VOLT SWITCH

arrested at any point by the energizing of an electromagnet, which attracts this revolving armature. The upper part of the shaft, operated by the motorman's controller handle, is not rigidly connected to the lower part, which is geared to the controller drum shaft, but is connected by means of a long, spiral spring, which allows the motorman to turn his handle considerably in advance of the controller drum. Consequently, the motorman can simply turn his handle from "off" to "full on" position, and the controller drum will follow as far, and as rapidly, as the magnetic clutch will allow it to advance. The magnetic clutch is energized from a small relay placed in the reverser under the car. This relay is connected in series with the armature of one of the motors. When the current in an armature exceeds a predetermined amount for which the relay is set, it closes the circuit through the magnetic clutch in the controller, and this stops the movement of the controller drum until the current falls below that for which the relay is set,



PART OF THE GENERAL ELECTRIC EXHIBIT

which releases the clutch and allows the controller drum to advance. The automatic device can be thrown out of action if desired by opening the controller.

This controller is shown in connection with two G. E. 69-motors, mounted on a Hedley truck. A model car bottom has been placed at a convenient height for inspection, and the electric contactors of the General Electric train controller system are mounted under it. The new contactors now made with this train control system are much heavier than earlier forms, and are provided with an ingenious casing, which can be swung down to uncover the contactors even though they are mounted very near the ground, so that there is but little clearance under them. The car wiring is done in the latest approved manner according to the new underwriters' rules.

Another railway motor shown is the G. E. 70, such as furnished for the Intramural Railway of the Exposition, the Milwaukee Electric Railway & Light Company and others.

The railway controllers shown in addition to the train controllers are R. 70-a, K. 28-a, R. 17, R. 27 and C. 23-a.

The company exhibits also for the first time its new straight air brake equipment. The General Electric compressors are well known; the chief novelty lies in the motorman valve, which is notched for the guidance of the motorman somewhat similar to a controller.

## NOTES ON THE STEAM TURBINE

BY H. F. SCHMIDT

In order that an engineer of a power plant may be able to operate the machinery in his charge economically, it is not simply necessary for him to know the general principles upon which the engines and other machinery are constructed. It is equally as important, if not more so, that he should understand the losses in the machines, and just how and why they occur, for if he does not understand their causes, he will not be able to do anything to prevent them, or rather to reduce them to a minimum.

That there are losses in the steam turbine is known to every engineer, but in general, his knowledge of them extends no farther than to know that all the available energy in the steam between the upper and lower limits of the working pressure is not realized as useful effect at the shaft. To a great extent this condition of affairs is not his fault, as little or no data have been given in any of the technical papers from which to gain this information. It so happens, however, that the losses in the turbine can be very easily determined and separated in parts, the only data necessary being the curve showing the total amount of steam used by the turbine per hour, the full-load capacity, number of revolutions per minute, steam pressure, vacuum, degree of superheat, and, if possible, the diameter of the wheels, number of buckets and guides in series, number of stages and the pressures in the different stage casings.

The following notes on the losses in a steam turbine are based on a study of the various curves, showing the results of tests made on steam turbines which have appeared in the papers from time to time, and especially an attempt to find out the reason that the total steam consumption curve for all turbines is, for all practical purposes, a straight line, as will be seen by examining the curves here shown. At first it is difficult to see the exact meaning which is attached to this fact, though after a little thought the following explanation will be evident.

First of all, and before discussing the different curves, it is necessary to consider just what happens inside the turbine, for at a glance the only thing apparent is the power actually available at the shaft which can be applied to do useful work. But in addition to this, a very considerable amount of work has been developed which has been lost in the friction of the whole of the machine while revolving in the vapor within the casings, in the windage of the rotating fields, and in the friction of the shaft in the bearings. Further, it will be evident that the steam lost by leakage, radiation from the first stage casings, any losses in the nozzles, loss by the velocity of the steam as it leaves the last row of buckets and friction of the steam in the buckets are all entirely different classes of losses from that of the friction of the discs revolving in the casings, for the latter remains constant at any load, while the first mentioned losses are, for all practical purposes, directly proportional to the load. Hence, it follows that the total, or combined internal and external efficiency of steam turbines remains very nearly constant. This will be further evident by a study of the curves. Let the full line in Fig. 1 be continued till it intersects the base line, then it will be evident that if the horse-power were reckoned from this intersection instead of at the point marked zero, the total steam consumption of the turbine would be exactly proportional to the total horse-power, and the total efficiency of the turbine would remain constant. What is here called the total horse-power will at once be recognized to be practically identical to the indicated horse-power in the case of reciprocating engine, and the power lost in revolving the bucket wheels will be found to correspond to the difference between the indicated and developed horse-power. The frictional resistance in the buckets and guides, the losses by spreading, leakage, etc., may then be considered to correspond to the losses by initial condensation, re-evaporation during exhaust, etc., in a reciprocating engine, while the energy carried away by the steam, due to its velocity as it leaves the last buckets, is almost identical to the loss due to too early an opening to exhaust and failure to expand down to the back pressure.

From what has been said of the losses in the turbine, it will be readily seen that none of the energy which is lost in final velocity of the steam, friction in the buckets, leakage and radiation has ever been transmitted to the moving blades. Therefore, the horse-power represented by the distance from the intersection of the steam consumption line with the base line and the point marked zero will be that which is necessary to revolve the bucket wheels and buckets in the casing. Now, from the results of experiment, it has been found that the weight of steam discharged per unit area of the nozzles is within 2 per cent or 3 per cent of the weight which should theoretically be discharged; hence, if the nozzle is properly constructed, the velocity of the jet will be also within 3 per cent of the ideal velocity , or, in other words, the energy lost in the nozzles will not be greater than 6 per cent.

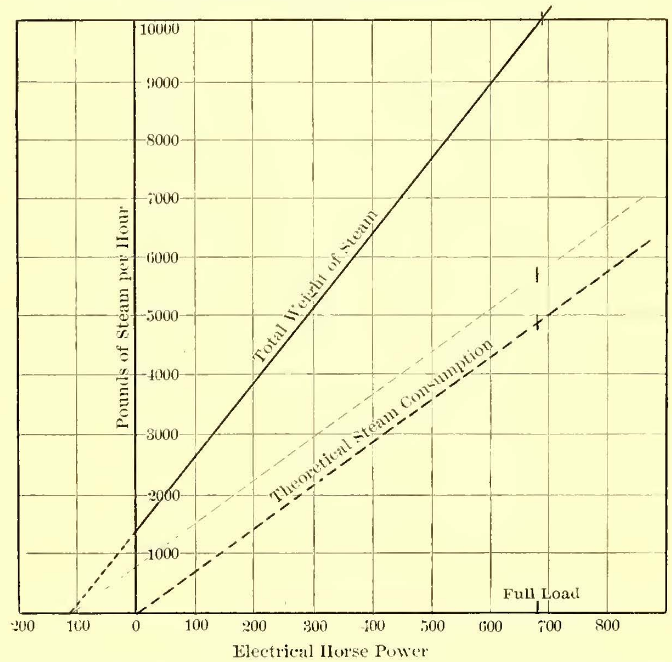



FIG. 1.—DIAGRAM SHOWING THEORETICAL AND ACTUAL STEAM CONSUMPTION OF A 500-KW TURBINE

The energy left in the steam as it leaves the last row of buckets can be calculated quite accurately when the dimensions of the wheels, number of rows of buckets in each stage, number of stages and number of revolutions are known.

From what has already been said it will be evident that if the nozzle losses, wheel losses, radiation and kinetic energy in the steam, due to its final velocity, be added together and subtracted from 100, the result would be the bucket losses in percentage. Referring to Fig. 1 the losses are found to be divided about as follows:

| | Per Cent |
|---|---|
| Work available at the shaft | 53.7 |
| Lost in final velocity of steam | 14.0 |
| Lost in friction of wheels in chambers | 6.2 |
| Radiation | 3.0 |
| Loss in nozzles | 6.0 |
| Losses in buckets and leakage and spreading | 14.8 |
| Windage of generator, exciter and core losses | 1.9 |
| Operation of air pump and circulating pump | 00.4 |
| Total | 100.0 |

The above account of the disposition of the total available enrgy is that shown by the test of the 500-kw Curtis turbine at the Newport station of the Old Colony Railway Company, and includes the generator losses as well as those of the turbine, hence, if a correction is made for these losses the true performance of the turbine will be obtained, and are approximately:

| | Per Cent |
|---|---|
| Work available at shaft | 56.00 |
| Loss in final velocity of steam | 14.00 |
| Friction of wheels in chambers | 6.20 |
| Nozzle losses | 6.00 |
| Losses in buckets and spreading and leakage | 14.80 |
| Radiation | 3.00 |
| Total | 100.00 |

This shows a much better record for the turbine. A further examination of these figures indicates that there are two losses that might possibly be reduced by careful operation, namely, the bucket losses and that due to the friction of the wheels. The other losses are entirely beyond the control of the operator,

| | Per Cent |
|---|---|
| Energy available at turbine shaft | 62.80 |
| Friction of drum and buckets | 6.30 |
| Radiation | 7.00 |
| Loss by final velocity of steam (assumed) | 12.00 |
| Losses in buckets and guides, friction and leakage | 11.90 |
| Total | 100.00 |

The reason that the loss by final velocity of the steam is marked "assumed" is that in the Parsons type of turbine this loss cannot be even approximately calculated, and as it cannot be easily determined by experiment it was necessary to assume it. Consequently, whatever error has been made in this assumption will also be present in the bucket loss which is obtained by subtraction. It is probable, however, that this figure is not far from correct. If any considerable error has been made it is because the value given is too small, although that

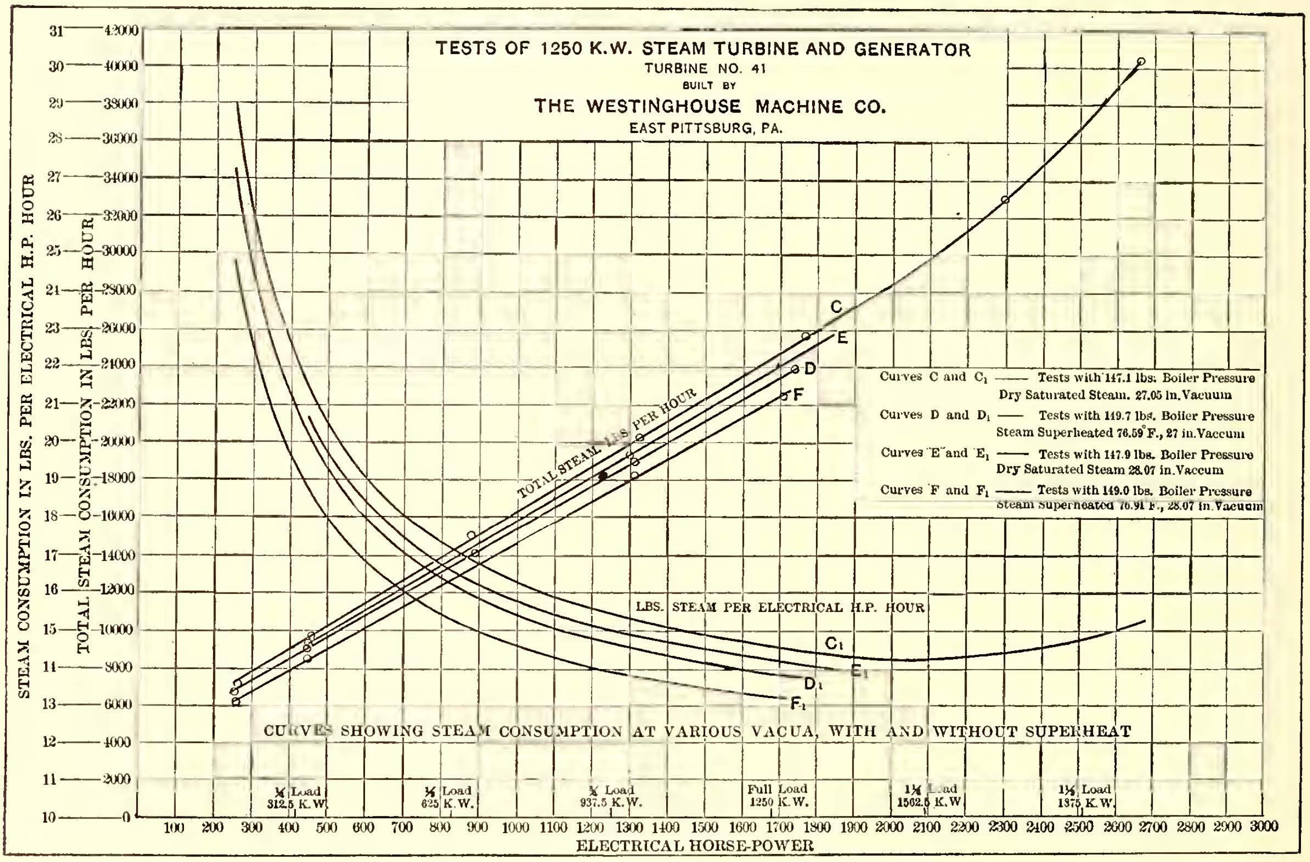



FIG. 2.—TESTS OF A 1250-KW STEAM TURBINE

and practically cannot be reduced by any change in the design. The losses in the buckets may be affected by changing the pressures in the different stages, and this may also lessen the frictional resistance of the discs, but this can only be determined by actual experiment.

Fig. 2 shows a set of curves giving the results of a test on one of the turbines of 1250 kw for lighting the New York subway, and of the Westinghouse-Parsons type. An analysis of the total steam consumption curve of this turbine shows the losses and distribution of the total available energy of the steam to be approximately as given below:

| | Per Cent |
|---|---|
| Energy available at generator terminals | 58.80 |
| Friction of drum and buckets | 10.30 |
| Radiation | 7.00 |
| Loss by final velocity of steam (assumed) | 12.00 |
| Losses in buckets, friction and leakage | 11.90 |
| Total | 100.00 |

Again, correcting this for the generator efficiency and crediting the turbine with the power that was required to operate the air pump, the result will be:

can hardly be, for a consideration of the design of the Parsons turbine will make it evident that the losses in the buckets must be comparatively large on account of the large clearance between the outer edges of the blades and the casing, which affords a very considerable area for the leakage of steam around the blades. It will also be noted that the efficiency of this turbine is a little higher than that of the Curtis turbine which was used for an illustration, but one explanation of this fact may be that the Parsons turbine is two and a half times the capacity of the Curtis. It is a peculiar and very interesting fact that the proportion of the total energy necessary to revolve the rotating members in both turbines is almost exactly the same in both cases, though the form of the rotors is entirely different.

In this turbine there is little or no opportunity for the operator to make any changes in the running conditions which will effect an economy. On the other hand, a study of the losses shows that there is practically nothing that can be done to the turbine to lower its efficiency, which is a very important point in favor of the turbine in general. The same cannot be said about the reciprocating engine, which is sensitive to any slight alteration in the running conditions, such as a change in the valve setting, caused either by wear or made intentionally by the engineer, something which occurs practically every time there is a change in the engine room staff.

Another interesting fact is shown by the total steam consumption curve in the diagram, Fig. 3, which represents three curves drawn arbitrarily for the purpose of illustration.

From what has already been said about this curve it will appear that if there were no losses of any kind in the turbine, the total steam consumption curve would intersect the base line at the point zero, and would be inclined to it as the curve A, which we will assume to represent the ideal conditions. Then let it be assumed that the turbine in question was subject to no other losses than the power required to revolve the rotor in the atmosphere of steam and turn the shaft in the bearings. In this case, the curve of steam consumption would be parallel to curve A, but would intersect the base line at a point, X. B then would be the curve for this turbine. Now, however, let it be assumed that the turbine had ideal bearings and no power was lost in turning the rotor in the steam, other losses, such as leakage, friction of the steam in the buckets and guides and the loss in final velocity being present. Since the steam consumption would be greater, though proportional to the load, the curve would be located like curve C, intersecting the base line at zero. Finally, now, let the turbine be that of curve B, except that it is also subject to all the losses which turbines have; that is, the losses represented by curve C. If, then, the turbine in question has the losses of curves B and C, the curve

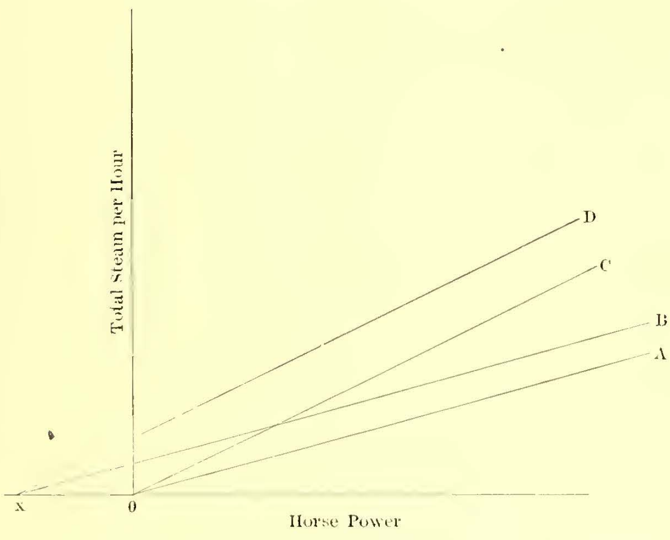



FIG. 3.—TURBINE STEAM CONSUMPTION DIAGRAM

of steam consumption will be a straight line, passing through X parallel to C. The true significance of the steam consumption curve is then (1), that the distance of its intersection from zero represents the power lost in the friction of the bearings, windage of the armature and frictional resistance of the rotor from being revolved in an atmosphere as steam; and (2) that the inclination of the curve to the base line is a measure of the loss by leakage, friction of the steam on the buckets, loss by final velocity, radiation, etc. This one curve, therefore, tells at a glance everything that is to be known about the performance, and the writer would suggest that when summing up the performance of a turbine by a curve, the theoretical steam consumption line be also drawn, by the aid of which a simple inspection of the curve sheet would illustrate the losses graphically, and show where they occurred and their magnitude.

The effect of the degree of vacuum and superheat on the losses in a Parsons turbine is clearly shown by Fig. 2. Referring to this diagram it will be seen that the effect of either superheating or a reduction in the back pressure has, in this case at least, the same influence on the rotation losses, which is indicated by the intersection of the curves E and D at the same point on the base line, but it will be noted that the curve E is steeper than D, which is the superheat performance of the turbine. Now, since the reduction of the rotation losses is small in either case, it follows that the increase in economy by the use of either alone is only partially influenced by the re-

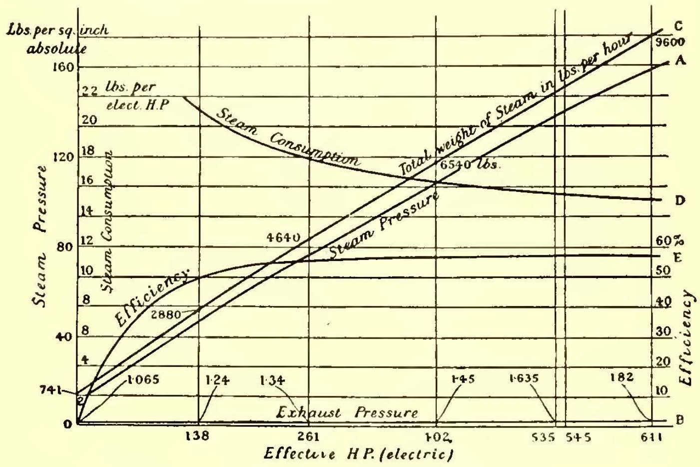



FIG. 4.—TEST OF 500-HP RATEAU TURBINE

duction of the frictional losses, and that the chief cause for the reduced steam consumption is found in the fact that 1 lb. of steam, when either superheated or at a lower pressure, occupies a much larger volume, consequently the proportion by weight which will leak around the buckets will be less than when dry steam or a higher back pressure is employed. This is further substantiated by the fact that the superheating reduces the bucket losses more than the high vacuum, for it is self-evident that an increase in the volume of 1 lb. of steam at the high-pressure end will have a greater effect in reducing the leakage than an increase at the exhaust end of the turbine, for the proportion of area for leakage to that for the passage of steam is probably ten times as great at the high-pressure end as it is at the exhaust. While superheating increases the efficiency of the turbine considerably more than would be expected, the maintenance of a higher vacuum does not better the efficiency in the same proportion as the additional available energy in the steam due to the changed conditions. Curve F presents the results that were obtained when both a higher vacuum was maintained and the steam was superheated.

Fig. 4 gives the data of a test made on a Rateau turbine which was to give 500 ehp at 2400 r. p. m. From the preceding analysis of the losses of the Curtis and Parsons turbines the reader will now be able to examine the losses of the Rateau turbine himself.

In conclusion, it may be said that it is very gratifying to find that a study of the losses in the turbine brings out the facts that have been found in practice, and confirms the reasons that have been given for them. Although the investigation has not pointed out any definite line to assist the engineer to run his plant more economically, it has, at least, shown conclusively that outside of demanding the ordinary care required by all machinery they are not sensitive to any changes in operating conditions which do not affect the pressure and vacuum in the condenser.

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A street railway company in New York State has found it necessary to issue a formal notice to its employees regarding the circumstances under which emergency stops are to be made. It seems that the practice had grown common with the men of making ordinary stops by reversing, thus greatly increasing the wear on the equipment. This method of braking cars seems to have grown entirely too prevalent on a number of systems.

## REPAINTING STREET RAILWAY CARS

BY JOHN C. WEAVER

Railway corporations of the past decade used to vie with each other as how best to paint a car so as to make it attractive to the eye, and while their efforts sometimes led into grievous infractions of the laws of color and taste, the aims of the companies were to be commended. Now, however, the principal object sought is economy, consequently the general appearance of the cars has declined in tone. First, nearly all the finer lines of striping and ornamenting which require any special ability in the workman in their reproduction were gradually eliminated. Then the style of lettering was attacked, and, finally, the body or main color of the car suffered. But a cheaper job in car painting is secured only by a sacrifice of the appearance of the car. If we cut out a number of the surface or preparatory coats, and substitute a lower grade of a certain pigment, we lower the standard of tone. If the surfacer is dropped, a surface is secured which no amount of varnish can smooth out, and the result is cheap in appearance only, for it is very expensive in reality.

The selection of a body, or main color, seems often to be based on its first cost only. This has led to the almost universal adoption of the so-called Tuscan red, and the cheaper grades of yellow. The brilliancy of finish has suffered from this cause, and where once the car painter's art was closely allied to that of the coach painter, it has gradually declined, and is now nearing that of the ordinary house painter.

In the selection of a suitable color for the painting of a railway car, the first consideration is the adoption of a durable pigment, and one which is easily handled. Though all pure colors have a tendency to tone down, they should maintain their purity of tone, and after a service of nine or twelve months should be capable of being thoroughly washed, and after being touched up and revarnished should present a brilliant finish. When revarnished yearly the car exterior should be good for several years' service. The selection of the color should be made by one who is practically familiar with colors, their nature and working qualities, and the difference between fugitive and permanent pigments. After selecting the color of the final coat, the next problem is how to build up the foundation coats, which should be of such a nature as to sustain or hold out the final coat. This again requires practical experience and particular attention, especially in the use of some of the finer colors.

In the selection of a color, if economy is to be considered, the question of time occupied in the painting should be kept in mind. This again is a question for an expert. For instance, a color may be selected which, although cheap in its own cost, would prove to be expensive in the handling, or the preparation of the surface to sustain it, also in the time taken in the drying of the surface of the body color so as to hasten the operation of striping and lettering. Some colors are so slow in drying that any attempt to hasten this process would result in the utter ruin of their beauty of tone. For instance, Tuscan red, pure, is one of the very slowest natural driers. When this pigment is ground up in a vehicle suited to maintain its durability of shade and of proper surface to sustain the varnish coats, it is so slow in drying that in order to overcome this trouble a drier is often used to expedite the work. In this way its peculiar bright purity of tone is often destroyed, and after a few months exposure to the elements the color becomes dull and sleepy. But as Tuscan red is such a kindly opaque body, and so economical in the number of coats needed, it seems a pity it is not given its own natural time to dry, the result would prove so satisfactory in the end. The writer has in mind one or two railroad corporations whose painting department uses Tuscan red. When a newly painted car is put into service in a train of older painted cars, the difference in appearance between the newly painted car and the old ones is so great that the ordinary passenger cannot help but notice it.

White has been largely selected as a body color, no doubt from the general knowledge that white lead is a kindly pigment, is a wood preserver, and is also easily handled by the average painter. All of this is true, but the use of raw lead in the operation of painting a car can be overdone. Too much lead in the under coats is to be avoided, while just enough makes a very durable underground, and is of vital importance, but to bring up a pure white surface requires much skill.

The question of time consumed in the operation of painting a car in a first-class manner in strict order of durability, brilliancy and economy is a varied one, but durability being really an economic question, it has been the writer's experience that proper time allowed in the drying of the undercoats is of the very greatest moment, and that a fast and loose system in this respect should not be allowed under any circumstances. While the usual time required to repaint a car from bare wood to finish is three weeks, this time can be cut down, if necessary, to twelve days, as described below.

Years ago much trouble and friction occurred between the railway companies and the insurance companies, owing to the matter of burning off the old paint, the danger of the gasoline lamp being recognized. If care is used in the original painting it is not always necessary to burn the old paint off in repainting cars, because if the old surface is intact it can be simply rubbed down and repainted. Where this has not been possible the writer has used a Bunsen illuminating gas and air burner, with rubber pipe, which is allowed and endorsed by the insurance companies, and is employed by carriage painters generally.

The work of car painting can be greatly facilitated by the use of the same paints to bring up a surface on a new car, a burnt-off car, or a car painted over the old surface. This can be done by varying the liquid or vehicle used to thin out the paint, but the same thinner can be used for all the coats, except the surfacer coats. By this method a uniform system of work, and one very simple in application by the ordinary workman, can be secured. What is more important, however, the painter can produce a uniform system of under coats. Such a plan is economical in quantity of paint used, and if systematically applied will dry out as one complete whole coat. This is not a small thing to accomplish, owing to the different drying qualities of the finishing colors used in railway car painting. For instance, the writer made 152 tests of a certain pigment before he succeeded in bringing it under his control. The surfacer, or rough stuff, also cost much experiment and patience to perfect it. The process of the application of the system is as follows:

First day, priming coat; second day, puttying and filling; third day, three coats surfacer; fourth day, rubbing out surfacer; fifth day, first coat foundation body color; sixth day, second coat foundation body color; seventh day, third coat or finishing body color; eighth day, striping, ornamenting and lettering; ninth day, first coat durable body varnish; tenth and eleventh days, varnish drying; twelfth day, second or finishing coat of durable body varnish.

It will be observed that in this system no rubbing or surfacing varnish is used. The finishing coats of colors are applied in such a manner and with a certain fine grade of brush as to produce a perfectly smooth surface, rendering a rubbing varnish unnecessary, and the omission of the rubbing varnish renders the surface of the work more durable. Of course, care must be exercised in the selection of a high grade of durable body varnish.

It will also be noted in this system that with the exception of the surfacer 24 hours are allowed between each coat of paint and drying of the surface after rubbing, and 48 hours between each coat of varnish. Cars painted in this way, with the addition of one coat of varnish yearly, will present a surface free from cracks and perfect in tone of color six or seven years.

The writer desires to impress the fact that moisture in the operation of painting is a deadly enemy of success, and where possible, the paint shop should be well heated and ventilated. It should also be well lighted, and should be so far elevated above the earth as to be above the natural moisture which arises from the ground, especially in the night.

## HIGH TENSION TRANSMISSION FOR ELECTRIC RAILWAYS*

BY W. J. DAVIS, JR.

The subject given me to-night is a very broad one, and I will not attempt to cover the whole field, but will confine myself to the consideration of a few of the very latest of the prominent high voltage systems of transmission.

In the early days of power transmission at high voltage, failure of the simplest parts of the system, namely, the overhead lines, proved to be the chief and most persistent source of interruption to the service, whereas the generators, transformers and switching appliances, although calling for greater skill in design, responded successfully and uniformly to the work expected of them.

This condition was due to the fact that line construction details were neglected for the more complex and attractive problems arising in design of apparatus and the study of electrical phenomena. The frequency of line troubles soon attracted engineering talent to investigate the causes leading thereto, with the result that defects were in due time eliminated, and it is now possible, with modern methods of construction and the perfected appliances available, to transmit with safety and reliability at potentials as high as 60,000 volts.

The electrical and mechanical strains existing in wires, insulators and poles are all capable of accurate calculation, rendering the line as open to economical design as a steel bridge or other structure, and calling for the same degree of engineering ability. In attacking a problem it is necessary to know

(1) The character of the service.
(2) The distance.
(3) The amount of power to be transmitted.
(4) Its commercial value per kilowatt-hour.
(5) The topography of the country to be traversed.
(6) Local conditions as to right of way.

The first four items are usually independent of the transmission lines and serve to fix the frequency, voltage and size of wire, while items 5 and 6 determine the route and the design of the poles.

Having the above information, the first step is to decide upon the size of wire and coincidentally the transmission voltage. Aside from electrical or economical factors, the wire must have sufficient section to be mechanically strong against breakage. For lines exceeding 50 miles in length the wire should not be smaller than No. 0 B. & S. if solid, or No. 1 B. & S. if stranded wire is used. Under 50 miles No. 2, and under 10 miles or 15 miles No. 4 wire may be safely employed. Where the voltage is limited by local conditions, the size of wire is economically fixed as that for which the annual value of the power lost plus interest and depreciation on the line investment is a minimum. It may be shown mathematically that this minimum condition occurs when the two items are equal. The most satisfactory and quickest way, however, to find the proper size of wire is to solve each problem graphically, making calculations of cost of power, maintenance and interest on investment for several sizes and plotting the sum of the results as ordinates to cross section of the wire as abscissas. The size of wire most economical under the conditions of load and voltage assumed is then found at the minimum point of the curve as shown in Fig. 1.

The general practice where local conditions permit is to fix upon the minimum size consistent with mechanical strength, and adapt the voltage thereto, so as to give the most economical operating costs, care being taken in comparing the various voltages to include in the annual interest and maintenance charges, the interest and maintenance on the increased cost of transformers, switchboard, lightning arresters and line material upon the basis of equal factors of safety against electrical strains.

The standard voltages most frequently found in interurban railway work in the United States at present are 13,200, 16,500,

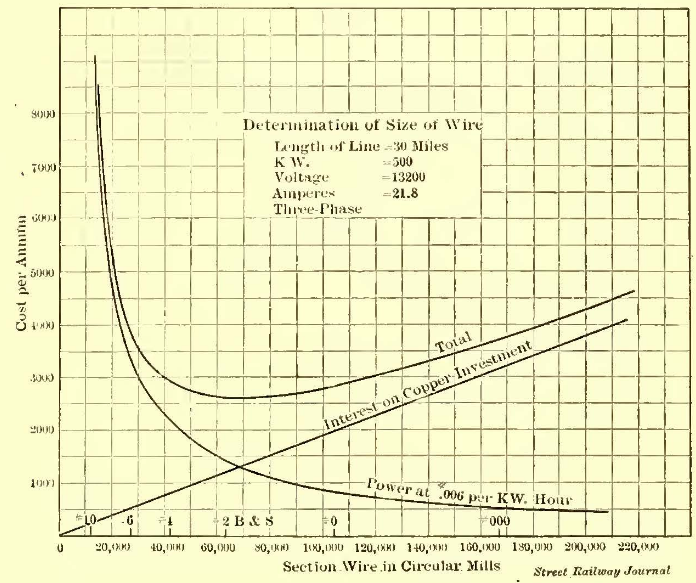



FIG. 1.—DIAGRAM SHOWING METHOD OF DETERMINING MOST ECONOMICAL SIZE OF WIRE

22,000 and 33,000 volts. In water-power transmission 44,000 and 66,000 volts are in successful use.

### REGULATION

In calculating a line, consideration must be given to regulation in voltage at the receiving end. This is a function of character of load, its power factor and the capacity and reactance constants of the line. It is well to remember that in rotary converter installations the synchronizing power is a direct function of the line loss, and it is, therefore, necessary to keep the latter within certain limits determined by experience and tests in order to prevent "hunting" or dropping out of step under overload. The maximum resistance loss between any two synchronous machines should not, as a rule, exceed 15 per cent for frequency of 25 cycles, or 10 per cent for frequency of 60 cycles. The use of reactance in circuit with the rotary converter permits of compounding for high tension line loss by means of resonance, the rotary converter acting as a condenser, with a capacity varying in proportion to the series field current. A 15 per cent artificial reactance will permit compensation for 10 per cent energy lost in line and transformers. Where the load is composed of induction motors the only limitation is that due to speed regulation and maximum torque of the machine, the latter varying inversely as the square of the voltage, so that 20 per cent energy drop will give 36 per cent decrease in maximum ouptput.

### CONNECTIONS

There are now in common use four methods of supplying transformer sub-stations from high-tension lines. These we may designate as:

(1) The continuous system, where the transformer leads are simply tapped into the line.

(2) The section system, which, as its name implies, consists in dividing the line at sub-stations into two or more parts,

*Paper presented at meeting of the New England Street Railway Club, May 27, 1904.

(3) The individual system, where each sub-station has its own feeder, or set of feeders.

(4) Duplicate lines.

The general scheme of connections for the above systems is illustrated diagrammatically in Fig. 2. Of these the section system is to be recommended for single lines, as it permits ready location of a fault and a break in the line does not necessarily mean the complete shut down of the system. Even in cases where there is only one point on the line receiving power, it is well to section the line where the distance of transmission exceeds 30 miles to 40 miles. For complex systems where a large number of sub-stations are fed from a single power house,

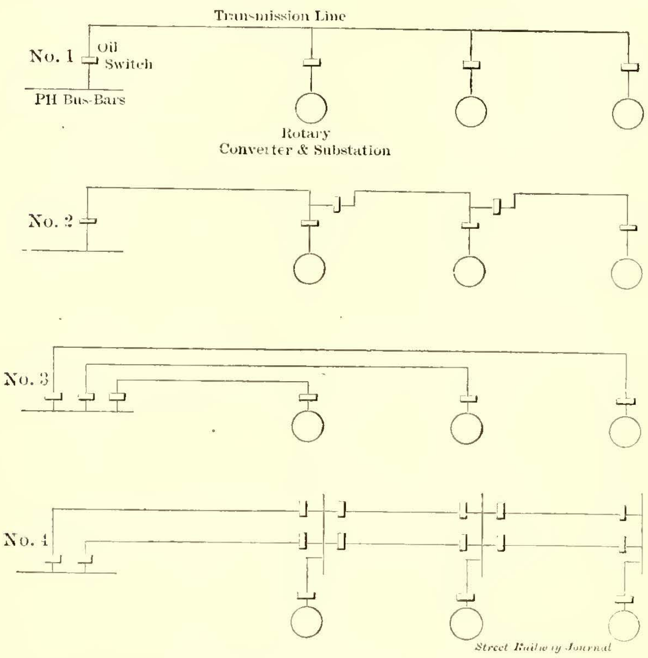



FIG. 2.—DIAGRAM SHOWING DIFFERENT METHODS OF SUPPLYING TRANSFORMER SUB-STATIONS.

sometimes individual feeders and sometimes duplicate lines will be found advisable, the choice depending upon local conditions.

CONSTRUCTION

Experience has shown that the transposition of wires in a high-tension line is an unnecessary complication. Such transposition is supposed to reduce induction in contiguous telephone circuits, but frequent transposition of the telephone wires, say every 300 ft. or oftener, placing them 6 ft. to 10 ft. below the lowest high-tension wire, is preferable and necessary in any case.

The allowable distance between wires varies with the voltage and length of span. There is a certain minimum distance, however, fixed by necessity of avoiding short circuit due to flying leaves and twigs, or to large birds attempting to pass between the wires in flight. This distance is about 18 ins., and in many localities preferably 24 ins. The concensus of good American practice appears to favor the following spacing:

| | Inches |
|---|---|
| 60,000 volts | 80 |
| 30,000 volts | 40 |
| Under 20,000 | 18 to 24 |

The conductors on the Guanajuato (Mex.) line, transmitting at 60,000 volts, are spaced 78 ins.; on the Bay Counties (Cal.) line, 55,000 volts, 84 ins.; the Cauvery line (India), 30,000 volts, 40 ins.; Niagara Falls line, 22,000 volts, 24 ins.

The majority of transmission systems in America use wooden poles spaced 100 ft. to 150 ft. apart. The tendency of late, however, is to use steel poles or towers, spaced 300 ft. to 500 ft. apart. The increased spacing reduces the number of poles, insulators, cross arms and other material, making the cost of the line with steel pole construction approximately equal to wooden pole construction, especially where the voltage is high and where the transmission line is run on its own right of way, and the poles are not, consequently, required for supporting an overhead trolley construction. The chief advantages of the steel pole construction are long life and possibly less cost of maintenance, although at present we have not had sufficient experience to determine whether the latter item is of very great importance. It is claimed that the steel poles are much more susceptible to damage by lightning, and repairs on such damage are, of course, more expensive. The latest example of steel pole construction is found in the line of the Guanajuato (Mex.) power and transmission plant, running from Guanajuato to Zamora, total length being 101 miles and total energy transmitted about 3000 hp. These poles are spaced on an average of 440 ft. apart, and the wires are suspended 42 ft. from the ground. The general arrangement of the wires is in the form of an equilateral triangle with 78-in. sides, and the line is divided into three sections so as to facilitate location of fault. The towers are built of angle-iron, and were constructed by the Aer Motor Company. In Cauvery, India, a combination pole is used, consisting of 17 ft. of iron piping, 6 ft. of which is imbedded in the ground. A piece of timber, 7 ins. in diameter and 17 ft. long, is inserted in the socket of the steel section. This construction is to be commended in climates such as that of India, as by it is secured great durability with the added advantage of decreased liability to injury by lightning.

INSULATORS

Insulators are required to have sufficient electric strength to withstand puncture at the working voltage to which they will be subjected, and to be of such general dimensions as to preclude possibility of leakage or arcing over to the pin. The first requirement is dependent upon the quality of glaze and thickness of the porcelain. Where the porcelain is very thick, cracks or other defects not evident on inspection are likely to exist, causing failure during test. An improvement in construction is secured by making the insulator in two or more parts, which may be inspected and tested separately and afterward assembled with suitable form of cement. Experience with various materials in this country has shown good Portland cement to be about the best binder available. It has been found that lead will crack the insulators, due to unequal expansion, and that sulphur is likely to melt under the influence of the hot summer suns. In Europe excellent results, I understand, have been obtained with a mixture of ten parts of litharge and one part of glycerine, but I have been unable to find any record showing the superiority of this mixture over Portland cement. Under 20,000 volts insulators may safely be made in one piece from 20,000 volts to 40,000 volts in two pieces, and from 40,000 volts to 60,000 volts in three pieces.

In the early part of the art insulators were constructed very much after the practice then prevailing in telephone and low-voltage lighting work, and consisted of a glass or porcelain piece with hole threaded to receive a wooden pin. A great many defects resulted owing to mechanical weakening ot the insulators through poor bearing surface existing between the insulator and pin, producing unequal strains and also by burning of the wooden pin through leakage. These defects have been eliminated by the use of malleable iron pins fastened into the insulator with Portland cement.

## ELECTRIC RAILWAY FOR TIENTSIN, CHINA

The Compagnie Internationale de l'Orient has obtained a concession from the Chinese Government permitting it to install electric street car lines and electric lighting in Tientsin, the port of Pekin. The company has been trying to obtain this concession for two years.

## STANDARD LOCATION OF THIRD RAIL FOR ELECTRICAL OPERATION*

BY F. M. WHYTE AND A. S. VOGT, COMMITTEE

The committee found that very little could be accomplished concerning the standard location of third rail, because various steam railroads about New York City which were considering, and which have considered, the question of electrical operation, had representatives, either as commissioners or individual officers, considering the subject more thoroughly and having more authority than could be delegated to a committee of the Master Car Builders' Association. These representatives of the various railroads, after much consideration of the subject, have fixed upon a location for third rail, which is very apt to be standard in the electrical construction on steam railroads about New York City, and this location is shown in Fig. 1. Some of the railroads near New York City, which will be operated electrically, have adopted a location for third rail slightly different from the location shown in Fig. 1, but the difference is so slight that the equipment which is constructed to take current from the third rail located as shown in Fig. 1 will operate satisfactorily over the construction with the slight variation referred to. It is possible, then, to consider the location shown in Fig. 1 as the most pronounced standard for location of third rail, and one which, no doubt, will be followed more or less closely by such roads as may take up, in the future, electrical operation. The location of the third rail having been determined as in the foregoing, the next is the question concerning proper protection for the third rail. This protection will be different on different railroads, and the different construction for this protection will affect the rolling stock clearance to a greater or lesser degree. The construction of this protection will probably be determined upon by each road independent of the others, and, having been determined upon, it will be incumbent upon those who design rolling stock for use over railroads where the third rail is used to make the equipment clear the particular third-rail installation over which the equipment will be operated.

The Pennsylvania Railroad and the Long Island Railroad have determined upon certain clearances which will be required for passenger car equipment, freight car equipment and locomotive equipment which will run over their electrical installation, and these clearances are indicated in Fig. 2. It is probable that members of this association will need consider only the clearances prescribed for passenger car equipment and for freight car equipment, but clearance for locomotive equipment is also shown, in order that the same may be upon record.

The New York Central & Hudson River Railroad Company has determined upon certain clearances which will be required for all classes of equipment, and these are shown in Fig. 3.

It is possible that a composite diagram, showing the maximum dimensions which will clear both the Pennsylvania, the Long Island and the New York Central installation, will be of service to those members who may be interested in designs of equipment which can be operated over any of the railroads mentioned, and for their guidance Fig. 4 is added, showing this composite clearance diagram.

Probably the Master Car Builders' Association cannot adopt any of these clearance diagrams as standard, and the most that can be expected to be accomplished by the labors of this committee is the placing upon record the clearances of the third-rail installation, so far as such installation has now been determined upon, at least so far as has come to the attention of your committee.

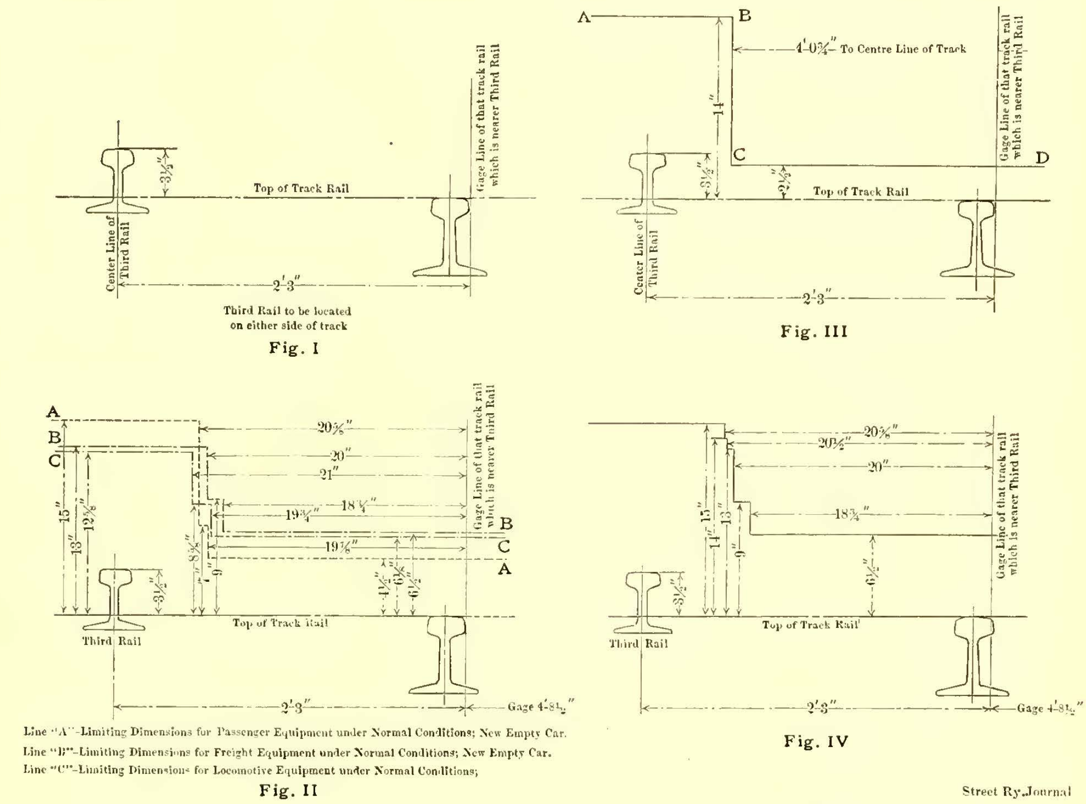



DIAGRAM SHOWING STANDARD LOCATION OF THIRD RAIL RECOMMENDED BY MASTER CAR BUILDERS

* Report presented at the Master Car Builders' Convention at Saratoga, June 22, 1904.

## FIRST TRACKLESS TROLLEY IN PRUSSIA

A trackless trolley line is being built by the community of Monnheim, to be the first of its kind in Prussia. It will run from Monnheim to Langenfeld, and will be about 2½ miles long, with two short branches intended for freighting purposes. The roadway from Monnheim to Langenfeld is about 23 ft. wide, with a good basaltic cover about 15 ft. in width, running almost in an air line, with the exception of a few curves. A special contrivance for coupling will be provided in order to keep an exact rut of all the cars. The power will be conducted to and from the cars by means of two rotary poles, placed on the top of the cars, and sliding blocks enabling the train to give way from 10 ft. to 12 ft. For entering farmyards lying close to the road there will be used, instead of the regular wire, a connector and flexible cable 50 ft. to 70 ft. in length, by means of which the current will be transmitted to the motor car. The trains will consist of an electric locomotive for drawing two or three cars, driven by two electric motors of from 25 hp to 40 hp. The conducting crew will have its place on the locomotive. The cars for carrying freight have a capacity of about 5 tons. Some of the cars will be open and some closed, and all will be fitted with brakes. Couplings will be provided for attaching farm wagons.

## THE PROBLEMS OF THE MASTER CAR BUILDER ON THE ELECTRIFIED STEAM ROAD*

BY H. H. VREELAND

On an occasion like this, and in this company of gentlemen devoted to a special art, still full of the enthusiasm that has made them a recognized factor in the development of American railroading, nothing, it seems to me, could be more fitting than for an outsider identified with the craft, in the only relationship possible, that of a purchaser of cars, to call attention to the magnitude of certain forces now at work tending to a revolution intimately affecting every man interested in the business of building and maintaining rolling stock; and so I venturously contribute a word or two. It will not be expected of me, in the company of so many others more competent for such a discussion, to say anything on the technical side of what seems to me to be the new problem presented to you as a craft. Formally and informally I have no doubt the subject has, from time to time, received attention, but it may be that men immersed in the details cannot detect with the same promptness tendencies that are obvious to a sympathetic onlooker; and, hence, I presume in this company to say what I have in mind.

It is true, too, that in a broad generalization of the kind I make, it would serve no good purpose and only confuse the main idea I wish to insist on, to go into a discussion of all the causes involved in this problem. I only desire to state what is obvious before discussing the details of a magnificent revolution now under way, at which I may call—without, I hope, giving offense to brother members residing further west—the greatest railroad center in America, to wit, New York City, which is bound to affect in the immediate future the personal fortunes of all of you. In and about that center there is now in progress of installation a practically new means of propulsion, as applied to steam railroads, an incident of which will be the virtual combination of two heretofore separate and distinct activities, the maintenance and efficiency of which is to be in your charge. With the introduction of electricity at the New York termini of the New York Central Railroad, and possibly the Pennsylvania Railroad, there will come into use a new class of vehicle, i. e., the electric motor car, each with individually-contained power apparatus, and the intimate association between the vehicle and the mechanism of its propulsion is so close as to make the divorcing of them practically impossible. The day when the motive power was sent to a round-house, and the inert rolling stock to a yard or shops, is at an end. A young man who aspires to shop efficiency must, in the very nature of things, find himself equipped to handle both. In a single stroke many sacred old methods—as, for instance, of lighting and heating—are abolished, along with the engine that has now gone to the eternal round-house; they are no longer of interest. They are one with those other twin nuisances—smoke and cinders—and the safety and maintenance of the new appliances by which they are furnished have been suddenly thrown, as a new responsibility, on the craft of car building.

From this it will be seen and appreciated how much higher is the demand that will be made upon you in the immediate future. When I say you, I include the journeymen car builders, forming that valuable recruiting army from which men for important station can be graduated. This great revolution in motive power will not only tax you, but every man down the line. Tracks, switches, round-houses and repair shops will need, under these new conditions, men with considerably more than the rudimentary knowledge that has heretofore sufficed, and it is the duty of all of us having the direction of those activities wherein our life is cast, to drive this truth home, in order that it may be fully appreciated, and that those who are with us may recognize, if they wish to progress, the new necessity that is upon them.

*Address delivered at the Convention of the Master Car Builders at Saratoga, June 22.

To my way of thinking, not only for the benefit of the business as a business, but for the individuals engaged in it to the last number, a revolution is going on which might profitably be insisted on with a slight note of alarm, in order to fully awaken the mind to the subject. Every other revolution—I use the term for want of a better one—that has taken place in the matter of railway equipment, has been, so to speak, a gradual one, and men have had time to slowly adapt themselves to altered conditions. The basis has been all along practically the same, and the successive revolutions (if we are to continue using the term as expressing an idea) have been, at best, mere modifications and improvements along a given line. This is not the case, as you will see, if it is considered for a moment what the present change involves. There is an absolute annihilation, not only of the present means of power, but the substitute for that power instead of being centralized and capable of isolation, is so associated with the rolling stock as to make it, as I have said before, an integral part of it which must, in the necessity of things, be given into your charge. There has been very little preparation for this change, which adds over night to the requirements of your craft the elements of an art with which none of us is any too familiar.

All of your roads, and particularly these two great railway corporations that I have mentioned, as soon as they have installed electric traction in New York, will be handing over to their shops these new hybrid combinations, which are neither all cars nor all locomotives, but something of both, and it will take more than expert carpenter or blacksmith to keep them in order.

For proof that I have not overstated the magnitude of the change under discussion, I will give, in tabulated form, the total present electric generating capacity located at New York, so divided as to show at a glance the amount in operation at the present moment and that contracted for for near future delivery.

ELECTRIC GENERATING MACHINERY IN OPERATION OR CONTRACTED FOR TO TAKE PLACE OF STEAM LOCOMOTIVES IN VICINITY OF NEW YORK CITY

| | In operation | | Contracted for | |
|---|---|---|---|---|
| | Kilowatts | Equivalent horse-power | Kilowatts | Equivalent horse-power |
| Manhattan Railway ..... | 48,000 | 72,000 | 6,000 | 9,000 |
| Brooklyn Elevated Lines. | 20,000* | 30,000* | | |
| Interborough (Subway). | | | 48,000 | 72,000 |
| Long Island Railroad.... | | | 16,500 | 24,750 |
| New York Central Railroad .................. | | | 40,000 | 60,000 |
| Total .................. | 68,000 | 102,000 | 110,500 | 165,750 |

* Estimated.

It will be noticed from this table that it is proposed to substitute for steam on the Interborough, the Long Island, and the New York Central roads 165,750-hp units, or 63,750 units more than the Brooklyn elevated lines and the Manhattan Railway are at present developing. This all shows that within the next two or three years you are to have turned over to your care much of the machinery by means of which this tremendous volume of energy is to be translated into work, for adjustment on the vehicles you make and repair.

All this brings me to what, after all, is the most interesting element in the change relating, as it does, to the individual worker. Academic and scientific men have done their work. Their problem has been solved—yours is yet to be. As I look the field over, this seems to me to be, for the men involved in this trade, no small matter. Into your keeping is to be handed over the successful adjustment and disposition of the machinery the scientific men have invented and adapted, and on your efficiency depends the validity of the investment of millions of dollars and virtually the whole onus of reforming the method by which the most important part of the business of any civilized people—that of transportation—is conducted. It is well to bear in mind, too, in considering this subject, that the demand to be made upon you is very sudden. The changes which have resulted in standardization have been so gradual as to place no very serious handicap on the slow man. He could educate himself as he went along and easily keep abreast of the advance. Now there is to be made upon him a sudden demand affording smaller opportunity for the gradual acquirement of efficiency. The demand must be answered at once, or the man failing to answer must inevitably fall back. I have in mind to point out that what the situation needs is preliminary preparation, so that when the demand arises the men may be already equipped. You know that in examination for entrance to universities a man may answer all the questions he is able to, and then be kindly furnished with a list of what are called "conditions." These "conditions" cover the subjects in which he is deficient, and he is mercifully allowed to repair his defects, due credit being given for the subjects in which he is perfect. In other words, he is allowed to standardize all his information to some fixed height. Unfortunately for us in the strife of industrial life, no such charity is extended. There are no "conditions." The demand is made on a man when the emergency arises, and if he fails to qualify at once he is, in the picturesque language of the Marquis of Queensbury, "down and out." It is some one else's turn next. And so I come to point out what I have for years recognized as a great necessity in all kinds of railroad work, and that is, preparedness. Slowly, year by year, with the enlargement of the necessities of a great business like transportation, its demand upon the individuals employed becomes more and more exacting. As I look over the field and see the individual railroad employee virtually taken from his old employment and placed in the midst of an entirely new set of conditions, demanding qualities of mind and intelligence greater than that called for by a chief engineer fifty years ago, I am impressed.

If these suggestions and generalizations of mine shall have the effect of stimulating the ambition of any man down the ranks to prepare for the moment when the demand is made upon him, they will have served their purpose.

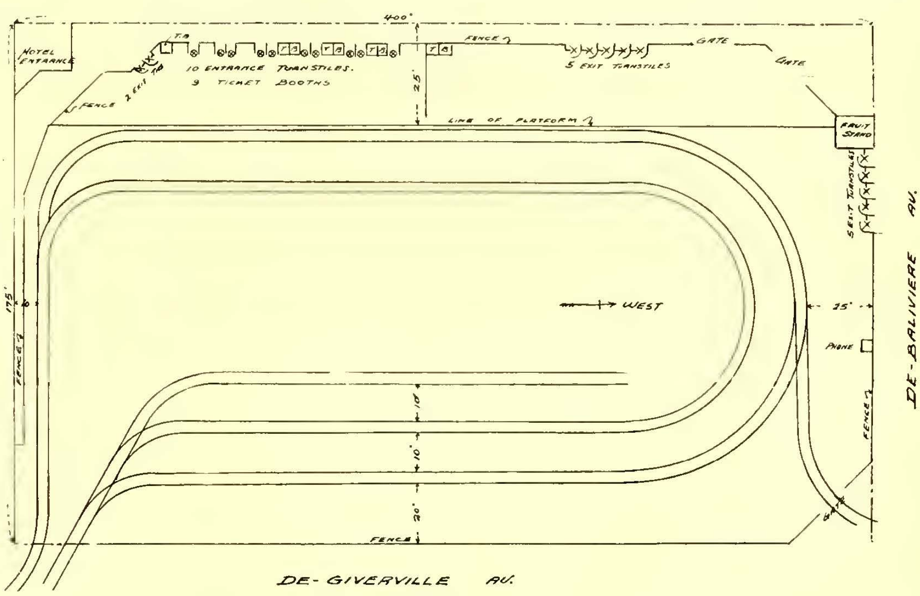
## THE INTERURBAN STATION AT LOUISVILLE.

Plans are being prepared for the new interurban terminal station of the Louisville & Interurban Railway Company, in Louisville. As yet only the general plan of the structure is known. It will be three stories high, the two upper floors to be used by the Louisville Railway Company for office purposes. The ground floor will be used solely for the operation of cars. It is probable that the Louisville & Interurban will share the ground terminal with the Louisville & Eastern. The Louisville & Southern Indiana also is willing to operate into the station, though the negotiations between that company and the Louisville & Interurban are as yet only tentative. Then there is a possibility of the Kentucky Traction Company and the Ohio Valley Traction Company also making terms to use the station. The tracks will be so laid as to pemit both east and westbound cars equal facilities. The north end of the building will be devoted to a ticket office, baggage room, news stand, toilet rooms and other conveniences required by passengers in waiting. The south end of the building will be taken up with sidings, on which cars will be stored when out of use.

## THE OLIVE STREET TERMINAL AT THE WORLD'S FAIR

In the Street Railway Journal of May 14, 1904, the location of all the street railway terminal loops at the Louisiana Purchase Exposition were shown. The arrangement of the details of the largest, or Olive Street terminal, near the main entrance, is now shown in the accompanying engraving. This loop being the one which receives the heaviest travel, because the cars of the Olive Street line, which enter it, take the most direct route to the city, was the first one to be fully completed. The other loops, on account of different conditions, require different treatment.

The Olive Street loop, which is here illustrated, is entirely enclosed by a high board fence except where the cars enter, which is at the northeast or most remote corner of the terminal. As seen by the plans, there are two complete loops within the terminal and one storage track. There is also a single-track entrance at the northwest corner, through which cars can be




OLIVE STREET TERMINAL AT THE WORLD'S FAIR

brought from large storage yards, three blocks north, at Delmar and De Baliviere Avenues. The exit turnstiles and the next gates are located at the southwest corner of the terminal, near the point where the cars usually unload. Passengers must purchase tickets at the ticket booths before entering the terminals, and in entering must pass through turnstiles and exhibit their tickets. It will be noticed that the ticket booths and turnstiles are alternated, so that there will not be too much congestion at one point.

At the Delmar terminal, which is directly across the street from this Olive Street terminal, no attempt has been made to fence in the terminal, or to require purchase of tickets before boarding the cars, because in this case the cars enter the terminal from the street at a point near where the crowds would enter the terminal, and in case of heavy traffic people would be likely to board the cars before they entered the terminal, making any attempt to require the purchase of tickets before entering the cars, useless.

By an order of the St. Louis Transit Company, which went into effect June 1, each man gets a day off every two weeks. Mr. McCulloch, the general manager, has organized what are known as relief crews on all the lines. These crews run alternately in place of each regular crew on every line on a certain day, thus allowing one regular crew to lay off a day in about two weeks. The holiday is not optional with the men, but most of them seem to like the arrangement.

## THE MELAUN RAIL-JOINT

BY ARTHUR BUSSE

The first trial of the Melaun rail-joint was made about three years ago on Potsdamerstrasse, one of the most important lines of the Grosse Berliner Strassenbahn, of which the writer is engineer. At that time, owing to the laying of a new asphalt pavement on that thoroughfare, the worn-out rails between the Kurfürstenstrasse and Bülowstrasse were replaced by grooved rails with bottom fish-plates and half-joints. On this occasion about 100 m (328 ft.) of track were equipped with Melaun joints, of which several views are shown in Fig. 1.

The joints are applied as follows: Where the rail ends meet

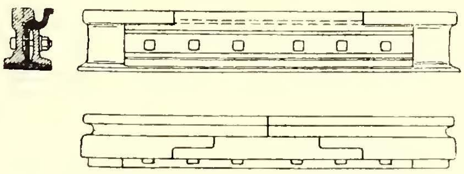


FIG. 1.—SHOWING ORIGINAL CONSTRUCTION OF RAIL-JOINT

the head of each rail is milled off, as shown in Fig. 1, for a certain distance back of the joint. An angle-plate is then used on the outside, whose head is rolled similar to the head of the rail and whose foot rests on the base of the rail in the usual way. The inwardly projecting head of the angle-plate does not rest on the top of the rail, there being a space between it and

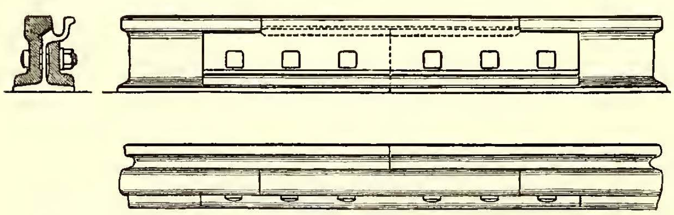


FIG. 2.—SHOWING LATER CONSTRUCTION OF RAIL-JOINT

the top of the web. The angle-plate is maintained in its vertical position by a horizontal rib, which bears against the web of the rail, and also by the vertical abutting surface of the dove-tailed rail head, so that the plate cannot get out of alignment. The inner angle-plate is held in place by bolts in the usual way. In laying the trial track the rail ends were not butted together, but were laid with spaces between ends from 2 mm to 3 mm (.078 in. to .12 in.) wide.

As stated before, this joint was laid at a point subjected to very heavy traffic, but in spite of this it has given entire satisfaction during the three years it has been service. The asphalt has shown no breaks at the rail-joints, and the bolts have not been tightened. Nevertheless, all longitudinal joints in the tread surface are so tight that they are not visible. Almost all the joints, also, even the half-transverse joints, which were not entirely closed at the time the rails were laid, have become perfectly closed by the movement of the cars running over them. Measurements recently carried out with an instrument, by means of which the condition of the alignment at the joints is accurately measured, have proved that the tread of the joint presents an even surface; on the other hand, all the other joints laid in the same street three years ago with base angle-plates and mitered joints were found to be badly worn out.

The Melaun joint is not only applicable to new track but may also be used to replace worn-out rail-joints without taking the old rails out of the pavement.

In the repairs carried out in Berlin last summer, the construction of the joint was changed, as shown in Fig. 2, that is, without the dove-tailing in the tread and with head of the angle-plate extending the entire width of the tread surface. The head was inserted so tightly that the joints were closed at the start. Experience has shown that overlapping is unnecessary, as the strains on the Melaun joint are uniform throughout even without overlapping. By leaving the overlapping out the joint can be constructed much more cheaply and easily.

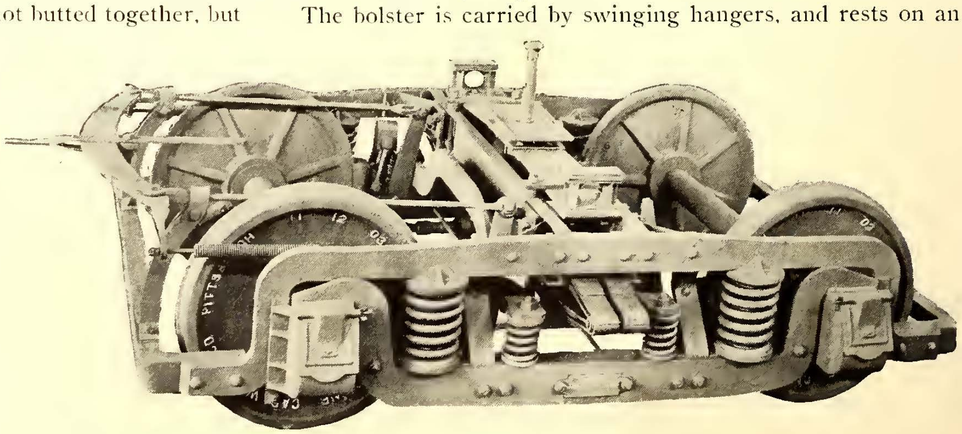
Over 6000 of these joints have now been laid on old rails in Berlin. While the cost per joint is somewhat high, the good results thus far achieved with the joint have induced the Grosse Berliner Strassenbahn to continue its use on a large part of its track reconstruction.

## NEW TYPE OF TRUCK

The accompanying illustration shows a new type of truck, one of which was recently put in service on the Youngstown & Sharon Railway, of Youngstown, Ohio. The truck was designed by W. G. Price, who has also patented the new features contained in it. Arrangements have been made by which this truck will be constructed at the works of the Standard Steel Car Company, at Butler, Pa.

This truck, as will be seen, constitutes quite a departure in design from any heretofore used. The side frame is formed of one piece of rolled open-hearth steel, which is pressed to an inverted U-form, so as to provide pedestals, which are guided by the lugs on one side of the journal boxes. There are no pedestals on the other side of the journal boxes; the boxes are held in place by being bolted and rigidly secured to the equalizer bars. The pedestals are protected from wear by a covering of steel, which is riveted to them and which slides between the lugs on the journal box. This wear piece carries a bolt at the lower end which acts as a stop to the upward movement of the frame. The side frames are connected by angle-shaped end frames and channel transoms, which are secured by large hydraulic-driven rivets. The transoms are also connected to the side frames by diagonal braces.

The bolster is carried by swinging hangers, and rests on an



NEW TRUCK ON YOUNGSTOWN & SHARON RAILWAY

elliptic spring of a new type. The wheel base of the truck is 6 ft. 4 ins., and the space required for the motors limits the spring to a double elliptic having leaves 3½ ins. wide. The length of the spring is 37 ins., and in order to carry the load it was necessary to use six leaves. As a three-leaf spring is much easier riding than a six-leaf spring, the leaves were divided so as to form two independent springs, each having three leaves, one spring of three leaves being outside of the other, but both being secured by the same bands, as can be seen in the engraving.

The brake-shoes are hung from brackets, which are secured to the equalizer bars, and have no connection with the truck frame. Brake beams are not used. The brake hangers and pins are held in contact with each other by strong coil springs, so they cannot rattle.

The motor suspension bars rest on coil springs, which are carried on the equalizer bars. Smaller coil springs, located between the equalizer bars, resist the upward thrust of the motor. The support of the brakes and motors is upon the equalizer bars, so they have no connection with the truck frame. This, it is claimed, will prevent the noise and vibration of the brakes and motors from reaching the car body. The equalizer bars are rigidly connected across the truck by small channel bars, which prevent the tilting of the equalizer bars by the pull of the brake hangers. The brake-shoes, being carried by the equalizer bars, are always the same height on the wheel and do not move up and down, as they do when hung from the truck frame. This construction permits of a much closer adjustment of the shoes to the wheels.

The journal boxes and bearings are of the M. C. B. type. The boxes are planed inside to one exact width, and the bearings are planed to a width 1-32 in. less than the boxes. As the boxes are rigidly connected by the equalizer bars the maximum movement of the axles away from or towards each other is thus reduced to 1-16 in. This construction also permits of a very close adjustment of the brake-shoes, and increases the efficiency of the brakes, as the wheels cannot give away to the brake-shoe pressure.

The trucks are very light for the required strength. They have no castings under tensile strain, and, except the wheels, there are no gray iron castings. The journal boxes are malleable iron. The side frames, being solid forgings without welds, should be very safe against breakage. This construction permits the truck frame to be lifted entirely away, so as to leave the wheels, motors and brakes connected in operative position, which may be of some advantage when repairs are required.

The space between the equalizer bars and the truck side frame permits the use of equalizer springs 12 ins. long, which, in combination with the improved elliptic spring in the bolster, insures a very easy riding truck.

## CONVERTIBLE CARS FOR MERIDIAN, MISS.

Five convertible cars of the Brill type were recently delivered to the Meridian Light & Railway Company, of Meridian, Miss., by the American Car Company, of St. Louis, Mo. An interesting part of the furnishings of these cars are screens made of glass in stout frames, which may be fastened to the backs of seats between those occupied by white persons and colored. These screens may be noted by examining the illustrations.

The general dimensions of the car are as follows: Length

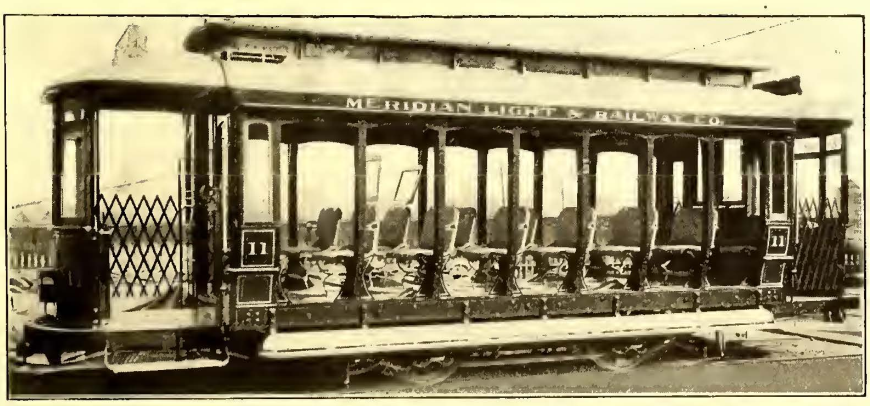

CONVERTIBLE CAR READY FOR WINTER SERVICE

over end panels, 20 ft. 7 ins., and over crown pieces, 29 ft. 7 ins.; from end panels over crown pieces, 4 ft. 6 ins.; width over sills and plates, 6 ft. 11¼ ins., and over posts at belt, 7 ft. 9 ins.; sweep of posts, 5 ins.; from center to center of posts, 2 ft. 7 ins.; thickness of corner posts, 3¾ ins., and of side posts,

INTERIOR OF CONVERTIBLE CAR, SHOWING GLASS SCREENS AT THE END

3⅜ ins.; size of side sills, 4¼ ins. x 7¾ ins.; sill plates, 8 ins. x ⅝ in.

The interiors are finished in cherry with birch ceilings. The seats are 33⅛ ins. long, leaving the aisle 17¾ ins. wide. Portable vestibules are used, and the entrances to the platforms are furnished with folding gates. The guard rails at the sides slide inside the posts. Instead of grab handles on the side posts the seat brackets are made in such a form as to serve that purpose. The height of platform steps from track is 15½ ins., and from steps to platform 12 ins. The running boards are 18⅞ ins. from the track, and from board to car floor 13¾ ins. Angle-iron bumpers, folding gates, round-corner seat-end panels, platform and conductors' gongs and sand-boxes are included in the equipment. The cars are mounted on No. 21-E trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. The motors are of 38-hp capacity.




CONVERTIBLE CAR ARRANGED FOR SUMMER USE

## TALEQUEGA PARK

Talequega Park, at Briggsville, in Attleboro, Mass., is on the line of the Bristol County Street Railway, and is 10 miles from Taunton, Mass., and 11 miles from Pawtucket, R. I., with direct electric railway connections with both cities. The park was first opened to the public two summers ago, and proved so popular that changes and improvements made imperative after the close of the 1903 season, saw it open this year as one of the best equipped amusement resorts of its kind in all New England.

The ground that the park now occupies was formerly a farm, and is 30 acres in extent. Enclosed by a high wire fence it is entered either through the front driveway gate or by the steps of a handsome new Casino. Visitors who come by way of the electrics receive a ticket that, with 5 cents additional, gives them the freedom of the grounds and all that is offered in the way of amusements. The general admission price is 10 cents.

The Casino which, as just stated, was opened this year for the first time, is quite elaborate. The lower story, built against the side of a knoll, is used as a transfer station by passengers traveling between any two points on the line and not directly connected. Cars are also stored here. Space has been reserved as well for bowling alleys and a billiard and pool room. Upon the first floor are a large kitchen and dining room with several private, or at least less public, apartments leading out of them. The decorations, the furniture and all the accessories are in a quaint mediæval style. This floor lies level with the top of the knoll, and is surrounded on all sides by a broad veranda, affording a beautiful view of the surrounding country. The balconies of the second floor are just as extensive. There is a dance hall upon this floor, and it has been so arranged that it opens directly out upon the verandas, an arrangement that is very convenient and has proved most popular.

Across from the Casino and not in the present park, six acres of land have been acquired for baseball grounds.

Within the park proper are to be found many attractions besides those that the Casino offers. There is the open-air vaudeville theater that already seats 600 people and will soon be enlarged. It is situated among a little clump of pines, with which the grounds are plentifully supplied, and adds greatly to the natural charm.

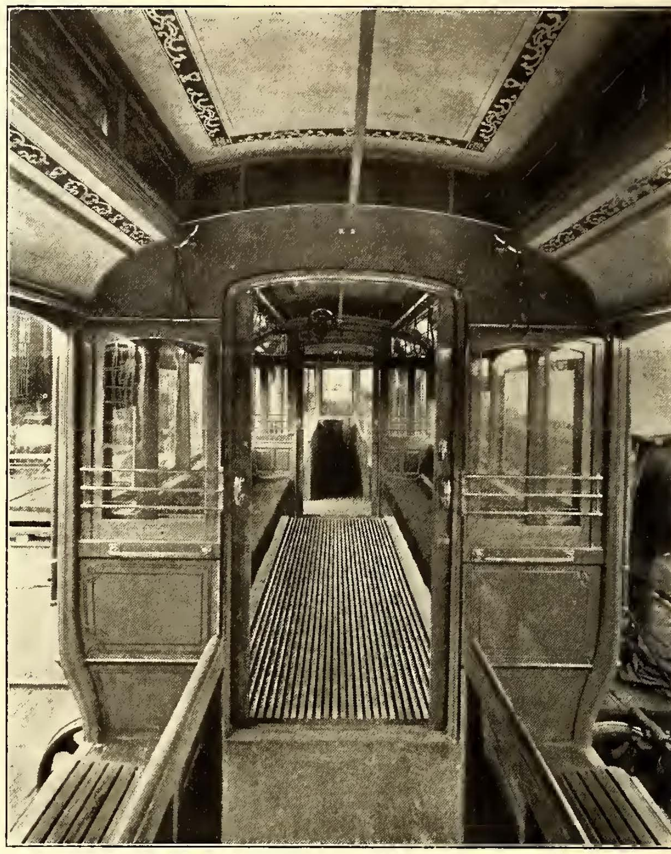
Three acres further on have been flooded to form a lake, which is used in summer for rowing and in winter for skating. The park is lighted by 1600 incandescents, and some of these lights have been placed among the trees, which rise out of an artificial pond with somewhat of a weird effect, especially at night. A platform has been built in the center, and here fireworks are shown upon special occasions. A small menagerie is also popular.

Refreshment stands are not lacking, and shady nooks have been provided in abundance. At 10:30 in the evening the theater closes, but there is a half-hour after that before the grounds are cleared.

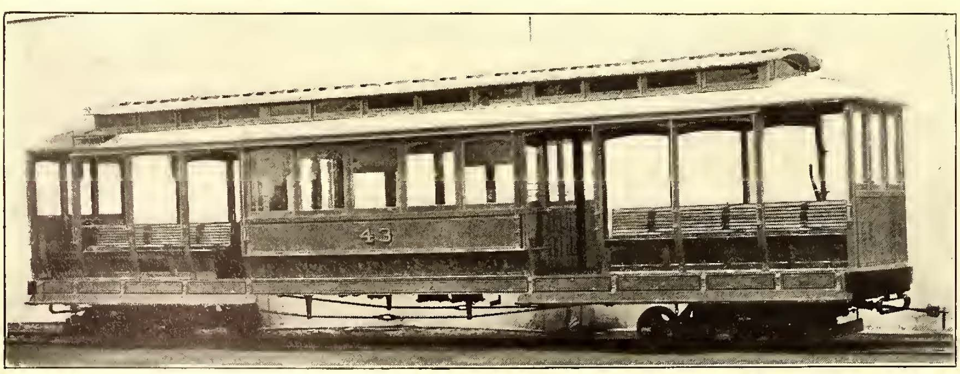
The park was laid out by Edward M. Bevins, of Gloucester, Mass.

## AN INTERESTING TYPE OF CALIFORNIA CAR FOR CORONADO

The interesting type of California car shown in the accompanying engravings has just been completed by the J. G. Brill Company for the Coronado Railroad Company, Coronado, Cal. The closed compartment, which is 14 ft. long over the end panels, has longitudinal seats and stationary windows. The open parts are 14 ft. long from the panels over the vestibules. In the open parts the seats are placed longitudinally and back to back with a space of 2 ft. 1 in. between. The motorman stands in this space, and there is also room for several standing passengers. This seating arrangement and the straight-fronted vestibules are unusual. Both the open and closed parts of the car are finished in ash, of natural color, with decorated birch veneer ceilings. The long-leaf yellow pine side sills are 4¾ ins. x 7 ins., and are plated on the outside by 8-in. x ¾-in. steel. The white oak cross joists are 3½ ins. x 5⅞ ins. The truss rods are made of 1-in. Norway iron. The corner posts of the closed compartment are 3¾ ins. thick, and the vestibule corner posts 3⅝ ins., the side posts of the closed compartment are 2¼ ins. thick, and in the open 2¾ ins. The distance from the tread of steps to the car floor is 12 ins., and from the rail-head to the step 21 ins. This latter height is allowable, because passengers mount from platforms. Among the builder's specialties are gongs, sand-boxes and radial draw-bars. The trucks carry 38-hp motors, and are of the "Eureka" maximum traction type, with solid forged side frames. The wheel base is 4 ft.; diameter of wheels, 30 ins. and 20 ins., and axles 4 ins.



VIEW SHOWING ARRANGEMENT OF INTERIOR



EXTERIOR OF CALIFORNIA TYPE CAR USED IN CORONADO

## STANDARD UNIFORM FOR PACIFIC ELECTRIC RAILWAY TRAINMEN

After carefully considering for some time the merits of different styles of uniforms for its trainmen, the operating officials of the Pacific Electric Railway Company, of Los Angeles, Cal., have adopted one which possesses several good features as well as being very neat and serviceable. The specifications for the uniforms require that they be made of Burlington cloth, with five-button sack coat, having round corners, six-button vest without collar, and pants to match goods. The coat has three buttons on sleeves, two large inside pockets, two small inside pockets, two large outside pockets, one large outside upper pocket and one small punch pocket. The initial letters of the company in silver braid are sewed on each side of the coat collar. The pockets are not reinforced, and should a man leave the service of the company, by removing the buttons and letters he would have a suit of clothes that would be very presentable for ordinary civilian wear—something that cannot be said of the uniform with reinforced pockets.

The specifications further state that all uniforms are subject to inspection, and the company reserves the right to reject any. No second-hand uniforms are accepted unless inspected by the superintendent of the division. The company has been using nickel-plated buttons, but has now adopted aluminum ones, as nickel and gold-plated buttons were found to tarnish quickly in that locality.

The old breast-plate badges that were used have been abolished, and in their stead neat metal number badges adopted for the sides of the cap. These numbers are stamped plainly on metal pieces about 1½ ins. x ¾ in. in size, and as the raised surfaces of the numbers are polished and have a dark background, they can be seen even farther than the breast-plate badge. One trouble with the latter was that the black paint on the indented number could be easily scratched out by the men, so they could only be read at a short distance. Another feature of the cap numbers is that as there is one on each side of the cap they can be seen in almost every position, and also when a breast-plate might be hidden by a crowd.

On the front of each cap is a thin metal plate, bearing simply the word "Conductor," or "Motorman." This is held in place by a silver cord. The style of cap used consists of a skeleton frame, and with each cap are furnished two white duck covers and oil covers for use in wet weather. The duck covers are kept laundered by the men.

The general appearance of this uniform on the men, with white cap, silver letters on the coat collar, and no heavy metal badge to wear a hole in the coat, is a very pleasing one, and it has called forth several compliments from the traveling public. One especially commendable feature of the uniform is the cap number badge, which is certainly to be preferred to the badge hanging by a leather strap from a coat button, which can be so easily removed by the trainman and put in his pocket should he have any trouble with a passenger and desire to conceal his identity.

The uniform mentioned above has also been adopted as the standard for the trainmen of the Los Angeles Interurban Railway Company, a corporation closely allied with the Pacific Electric Railway Company.

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The Blue Grass Traction Company, of Lexington, Ky., has made arrangements with J. B. Haggin to have Elmendorf Farm, his beautiful private estate on the line of the road, and one of the finest in the country, thrown open to visitors on certain days each week. Only a short distance from the farm the company has laid out a small park, where a dancing pavilion has been erected and other amusement features provided. Thus the company offers its patrons combined amusement and educational features, the like of which is probably not offered by any other street railway company in the United States.

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## THE WORKING HOURS OF MOTORMEN IN GERMANY

The somewhat anomalous condition of hours of street railway employees in Germany has already been mentioned in these columns, a condition brought on by the fact that the conductors often receive tips from passengers for information and other services. This makes them advocates of long hours. The motormen, on the other hand, want short hours, and claim that they are rendered unfit for the proper performance of their duties if overworked.

Several of the State authorities have drawn up a number of rules regulating the employment of motormen, basing their right to do so on their responsibility for the public safety of streets. The working time in large cities is, of course, much shorter than in the small towns and country districts, where the motormen are not required to give such constant attention to their duties. An idea of what the authorities require in the large cities may be obtained by examining the following ordinance, which went into effect in Dresden on March 14, 1904:

> Motormen and other employees must not be employed more than 200 hours during a period of three weeks, nor for more than ten hours a day without an intermission of two hours. Even where such intermission is given the total number of working hours a day must not exceed twelve. Once in every seven days the working day may be increased to fourteen hours. There must be an interval of at least eight hours following a day's work. Lay-offs of a half-hour or less are to be counted as working time. Motormen and signalmen must be granted at least three resting intervals of twenty-eight hours each, within every three weeks.

It is probable that in no case in Germany have rules been made regulating the working time of conductors, as the authorities apparently do not hold the former so responsible for the public safety as the motormen. The railway company is the only one which suffers if the conductor is too tired to tend to his duties properly. In general, the working time of conductors is from 1 hour to 1½ hours more than that of motormen on the same line.

The laws relating to the hours of motormen are not the only ones by which the authorities regulate the internal affairs of street railway companies. Lately some other rules have been issued with reference to advertisements in cars. The windows as well as the exterior sides of the car must not be used for advertising matter, nor are dull or colored windows permitted. The only advertisements allowed on the outside of cars are those relating to the routes.

Returning to the subject of motormen, one of the questions brought up at the February meeting, in Essen, of the Rheinisch Westfälische Strassenbahn Betriebsleiter-Vereinigung (Street Railway Managers Association), was, "Should a manager always suspend a motorman who has had an accident until the case has been finally settled in the courts, or should he judge each case on its own merits?" It is plain that there are two sides to this question. If the motorman is retained in the employ of the company while the case is on trial, and another accident occurs to him, it will be brought up as strong presumptive evidence of negligence in the first accident, and the manager would be censured for not having discharged the motorman immediately. Should, however, a new man be employed in the interim, the likelihood of accidents resulting is much more probable than if the other man is retained, as the latter would naturally be very careful to avoid another accident. Of course, if the motorman had shown gross negligence in a number of cases he should be discharged at once. The convention decided unanimously that each case required separate treatment, and that it would, therefore, be a mistake to suspend the motorman in every instance.

## FINANCIAL INTELLIGENCE

Wall Street, June 22, 1904.

### The Money Market

The question of the money supply has ceased to occupy the prominent place in financial discussion that it did up to a short time ago. This is because of the feeling of certainty that money rates are going to continue at their present low level for at least a number of weeks to come. There are not a few critics who think that even when the crop moving demands are well under way no appreciable advance in rates will occur. The harvest requirements are the only thing now in sight to draw at all heavily on the redundant stores of capital in the New York market. Gold exports are over for the season, the Treasury is paying out more on its ordinary disbursements than it is taking in on revenue collections, and, finally, scarcely a week goes by but what checks for a million or two millions are paid out by the local sub-Treasury on account of arrivals of new gold. Under these several influences reserve holdings in the banks are piling up at an extraordinary rate, and surplus reserve has risen to the unusual figure of $38,000,000. This is the largest total for the season in ten years. In view of this remarkable accumulation of idle capital there is plainly good ground for believing that the usual autumn outflow to the interior will have comparatively little effect. Two changes might occur later on which can now only be ranked as possibilities. One of these is a revival in general business, and the other the renewal of speculative activity, through both of which the demand for bank money might become much more active, causing in the end a rise in money rates. But as matters stand at present the opinion of bankers is best expressed in the eagerness of which long-time loans are being offered at purely nominal figures. Six months' accommodation is easily obtainable at 3 per cent, and loans extending over the first of the year are made at 3½ per cent. For sixty and ninety days 1¾ to 2 per cent is the best that the market affords, while call money is going begging on the Stock Exchange at 1 per cent.

### The Stock Market

Interest in the week's proceedings on the Stock Exchange has centered largely in the remarkable financial plan announced by the Southern Pacific Company. With the details of the proposal for a $40,000,000 new preferred stock issue the public is now familiar; its bearing on the immediate financial situation is the point of most concern. Professional Wall Street has greeted the announcement very coldly, and has accepted the view that it is something decidedly unfavorable for the holders of present Southern Pacific stock; the financial representatives of the company have, on the other hand, contended that the time had come to pay off the floating debt amounting to $30,000,000, and that this was a necessity in order to pave the way for refunding the high interest-bearing obligations into a long-term, low-rate bond. They claim that a 7 per cent stock issue, for which the stockholders should have the privilege of subscribing, is a much sounder method than either an issue of new bonds at a high rate interest or a flotation of stock carrying lower dividends for which the services of a banking syndicate would be required. At this writing it is uncertain what the final effect of the episode will be upon the market. Sanguine critics profess to see in it a mark of confidence in the general financial outlook from high financial quarters, while those of less cheerful temperament regard it as a decisive check upon the improvement in prices which appear to have gained a vigorous start a week ago. At all events, speculation for the rise has quieted down visibly within the last few days, and trading has again become inactive. So far as any tendency is shown, it is upward rather than downward. Liquidation, it is now seen, is over, and will not start up again unless outside affairs take some unexpected turn for the worse. A large short interest has not yet been entirely covered, and while there is no outside buying to speak of, these covering purchases from time to time are sufficient to keep the market strong. More interest is felt in the crop reports than in the political conventions. The possibility of a chill preceeding the Democratic meeting at St. Louis on the sixth of July is not ignored by cautious persons. But the apparently slight chances for the nomination of a candidate committed to radical principles, prevents this matter from having any practical effects on financial calculations. A decided improvement has occurred in the condition of all the growing crops, and it is on this chiefly that the hopes of better things in Wall Street now rest.

A further sharp advance in Manhattan Elevated and exceptional weakness in Metropolitan issues have been the incidents of the week in the local traction dealings. A good deal of the buying in Manhattan has been for investment, and this, as well as the rise in the price, proceed from the conviction that if the Interborough Company is able to pay dividends to its own stockholders out of the surplus earnings of the elevated lines, the 7 per cent on Manhattan is assured for all time. No new reason that is at all satisfactory has appeared for the weakness in Metropolitan shares. There have been various stories of an impending bond issue, of a reduction in dividends, and of somebody depressing the stock in order to acquire a commanding interest in the property. But all of this is pure Wall Street gossip. It looks now as if there has been real Metroplitan stock for sale for some time, and that the professional traders using this selling as a basis have been able to raid it successfully. Brooklyn Rapid Transit stock, and all the associated bonds, have made the highest prices this week that they have recorded for some time. The large increase in the company's earnings is still the main incentive for buyers.

### Philadelphia

The only movement of consequence in the Philadelphia market during the week was the advance in American Railways. The stock was bid up on light transactions from 43¼ to 46, at which latter figure several hundred shares changed hands. In connection with the rise, a good deal was heard about the increasing earnings of the property, but no definite explanation other than this appeared. About 250 shares of Consolidated Traction of New Jersey sold at 67½, an advance of 2 points from recent prices. Philadelphia company common was dealt in in a somewhat smaller quantity than usual, between 38¼ and 38½. There were no sales of the preferred during the week. The advance in Philadelphia Traction continued, the stock rising to 96⅝, but later easing off to 96¼. Philadelphia Electric was dull around 6. Union Traction sold between 50 and 50¼. Fifty shares of Rochester Passenger preferred went at 100 and a small lot of Pittsburg preferred at 49.

### Chicago

It is said that strong interests are buying quietly into the underlying shares of the Union Traction Company. North Chicago has sold this week at 79, and West Chicago at 45, but the dealings in both issues have been much lighter than in the previous weeks. Metropolitan Elevated is reported to be making an excellent showing in its traffic for the month of June. The management expect to open a new down-town terminal early in July, and it is calculated that the road will at once feel the return of a large travel formerly driven from it by the congested conditions prevailing. Close friends of the company are talking of the strong probability of its resuming dividends on the preferred stock in August. They argue that 5 per cent at least will be shown as earned for the fiscal year. These anticipations explain the recent strength in the stock, which has sold freely this week again as high as 57. Metropolitan common has changed hands between 20½ and 20¾, Northwestern common between 17 and 17¼, and a small lot of Northwestern preferred at 46. South Side has been notably strong, 100 shares selling at 91 ex the quarterly dividend of 1 per cent.

### Other Traction Securities

The feature in the Boston list has been a further advance in Boston Elevated from 147½ to 151½ on fairly large dealings. This stock is up now more than 10 points as compared with a few weeks ago. It has been accumulated for no new reason, but apparently through better appreciation of the investment merits of the property. After selling at 19, Massachusetts Electric common declined to 18 on sales of 100 shares. It dropped to 17½, but later returned to 18. Only a few sales occurred in the preferred stock at 70 and 71. West End common was dealt in moderately between 90¾ and 91, while transactions were reported in the preferred at 111. In Baltimore the market for United Railway securities has not recovered from the shock given it by the recent passing of the coupon on the income bonds. These bonds made a new low record during the week, getting down from 44¼ to 41⅝. One hundred shares of the stock sold at 5⅞. The general mortgage bonds, after reaching 90¾, declined to 90. A sale of Augusta Street Railway 5s took place at 100¼; no other transactions in the other street railway issues, sometimes active in Baltimore, were reported on the week.

On the New York curb, Interborough Rapid Transit made a new high price, selling up to 120. About 9000 shares were dealt in last week on the advance from 115. Five hundred Washington Railway & Electric common sold in all at 15½. Nassau Electric 4s were very active, both on the curb and the Stock Exchange, gaining another point to 83½. One bond of the Washington Railway went at 78.

Cincinnati Street Railway suffered a decline at Cincinnati last week. It opened at 145 and fell gradually to 142½, sales of about 600 shares. Cincinnati, Dayton & Toledo made gains, opening at 22⅛ and closing the week at 23⅝. There were small sales in Cincinnati, Newport & Covington common at 28½, and the preferred at 85½, both old prices.

At Cleveland the demand for Cincinnati, Dayton & Toledo continued strong. The low at 22¾ and the high 24. Cincinnati interest are said to have increased their holdings by about 4500 shares during the past week, and the available supply in Cleveland has been reduced to a few hundred shares, the balance being closely held. Old prices prevailed on Cleveland Electric, Northern Texas and Syracuse, with but few sales. Northern Ohio Traction & Light 4s sold at 56, and there was a demand at a little under that price. A small lot of Miami & Erie Canal bonds sold at 12½, the lowest price on record.

At Columbus, the Columbus Railway preferred sold at 106½, and the new Railway & Light advanced to 36¾, a dividend being predicted for this stock in the near future. Columbus, Buckeye Lake & Newark Traction is in demand at 91, and Columbus, Delaware & Marion preferred at the same price.

At Toledo last week there was considerable trading in Toledo Railway & Light, and it showed a decline of from 19½ to 19. Detroit United sold at 60½, and Toledo & Western at 14.

### Security Quotations

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

| | Closing Bid June 14 | Closing Bid June 21 |
|---|---|---|
| American Railways | 43 | 44½ |
| Aurora, Elgin & Chicago | a14 | a14 |
| Boston Elevated | 147 | 150 |
| Brooklyn Rapid Transit | 48⅝ | 48¾ |
| Chicago City | 175 | a175 |
| Chicago Union Traction (common) | 5¼ | — |
| Chicago Union Traction (preferred) | a30 | a30 |
| Cleveland Electric | 70½ | 69 |
| Consolidated Traction of New Jersey | 66 | 67 |
| Consolidated Traction of New Jersey 5s | 105¼ | 105¾ |
| Detroit United | 61 | 66¾ |
| Interborough Rapid Transit | 118¼ | 118½ |
| Lake Shore Electric (preferred) | a30 | — |
| Lake Street Elevated | 3¼ | — |
| Manhattan Railway | 148⅜ | 148½ |
| Massachusetts Electric Cos. (common) | 18¼ | 18 |
| Massachusetts Electric Cos. (preferred) | 70 | 70½ |
| Metropolitan Elevated, Chicago (common) | 20½ | 18½ |
| Metropolitan Elevated, Chicago (preferred) | 56 | 55 |
| Metropolitan Street | 114½ | 110⅞ |
| Metropolitan Securities | 80 | 76¼ |
| New Orleans Railways (common) | 9 | 9 |
| New Orleans Railways (preferred) | 27½ | 27½ |
| New Orleans Railways, 4½s | — | 74 |
| North American | 84 | 85½ |
| Northern Ohio Traction & Light | 13 | 13 |
| Philadelphia Company (common) | 38¼ | 38⅝ |
| Philadelphia Rapid Transit | 12 | 11¾ |
| Philadelphia Traction | 96¼ | 96½ |
| St. Louis (common) | 13½ | 13 |
| South Side Elevated (Chicago) | 91½ | 90½ |
| Third Avenue | 120½ | 119 |
| Twin City, Minneapolis (common) | 93½ | 94 |
| Union Traction (Philadelphia) | 50 | 50¼ |
| United Railways, St. Louis (preferred) | 57 | 56½ |
| West End (common) | 90½ | 90¾ |
| West End (preferred) | 111 | 109 |

a Asked.

### Iron and Steel

Although a more hopeful feeling seems to prevail in some quarters of the iron trade, it is hardly based on anything substantial according to the testimony of recognized authorities. On the contrary, reports have come to hand this week of numerous mills, active in the spring, which are doing nothing now. All branches of the industry are quiet, and the outlook favors continuation of the dullness throughout the summer. Opinion differs as to whether or not further price concessions will be necessary, but close observers agree that there are no signs immediately in sight which would suggest any decided turn for the better. Quotations are as follows: Bessemer pig iron $12.85, Bessemer steel $23, steel rails $28.

### Metals.

Quotations for the leading metals are as follows: Copper 12½ and 12¾ cents, tin 26¼ cents, lead 4¼ cents, and spelter 4 13-16 cents.

## NEW YORK CENTRAL CUTS RATES TO MEET TROLLEYS

The New York Central Railroad last week made a reduction in fare of 25 per cent to points along the Auburn & Syracuse Electric Railway, a competing line. It is understood that like reductions will be made at other points in the Mohawk Valley where the New York Central Road is parallel with the trolley lines.

## PHILADELPHIANS BEHIND INDEPENDENT COMPANY IN BALTIMORE

It is now disclosed that Philadelphians with important holdings in electric railways in different parts of the country are behind the Maryland Electric Railway Company, which has an application pending before the City Council of Baltimore for a franchise for an electric railway in that city. Clarence Wolf and W. R. Benson, of Philadelphia, the former of whom is a member of the banking firm of Wolf Brothers & Company, are now in Baltimore in the interest of the company. Mr. Wolf also is a large stockholder of the Philadelphia Rapid Transit Company, and Mr. Benson is an experienced street railway man, having been general manager of the Hestonville Railway Company, of Philadelphia. Besides Mr. Wolf and Mr. Benson, who, as just stated, are in active charge of the affairs of the company, Charles A. Porter, of Philadelphia, and William A. Walker, of New York, are interested in the company. Mr. Walker formerly was a director of the American Tobacco Company, but is unknown in the traction field. Not so, however, with Mr. Porter. He is connected with the Fairmount Park Transportation Company, operating an electric railway in Fairmount Park, Philadelphia, and is president of the Long Island Electric Railway Company. Those back of the company see in Baltimore a lucrative field for operations, and are determined to carry out the project if anything like equitable terms are offered by the City Council for the privileges they seek.

## CANADIAN STEAM ROADS BUY ELECTRICS

The Grand Trunk Railroad has completed the purchase of the Hamilton, Grimsby & Beamsville Electric Railway and the Canadian Pacific Railway is reported to have arranged the purchase of the Niagara, St. Catharines & Toronto Railway. In the case of the Grand Trunk purchase, the price at which the electric company's stock was taken is understood to have been $200 a share. Although the final arrangements in this deal were only completed a few days ago, the Grand Trunk has assumed full charge. Already A. H. Myles, C. H. Myles and Robt. Ramsay have retired as directors, and in their stead have been elected J. W. Nesbitt, K. C., J. G. Gould and Jos. Dixon, all Grand Trunk representatives. No changes have as yet been made in the officers. The Hamilton, Grimsby & Beamsville Company operates 23 miles of standard gage line laid with 50, 65 and 70-lb. girder and T-rails The authorized capital stock of the company is $200,000, of which $113,300 is outstanding. There is an authorized issue of 5 per cent bonds to the amount of $100,000, of which $85,000 has been issued. The road was placed in operation Oct. 18, 1894, and extending from Hamilton to Grimsby and Beamville, traverses a region most fruitful, and has enjoyed a large freight business.

The Niagara, St. Catharines & Toronto Railway is a converted steam line, and is a model of its kind. It is built almost entirely over private right of way, and operates a through freight service in connection with the various steam roads. There are freight sidings into as many as fifty manufacturing plants. The company also has its own private telegraph and telephone lines. In short, it is operated entirely on the basis of a steam road. The authorized capital stock of the company is $1,000,000, of which $925,000 has been issued. Bonds to the amount of $710,000 are authorized, but only $394,000 has been issued, of which $116,000 is in the treasury.

## ANOTHER CHICAGO FRANCHISE PROPOSITION

The local transportation committee of the Chicago City Council has sent the following communication to the Chicago City Railway, defining its position as regards franchise extensions:

This committee is willing to consider the completion of the "tentative ordinance" for the Chicago City Railway Company on the basis of a fixed term in commutation of all the rights of the company in the streets under its unexpired grants including its claims under the ninety-nine-year act. The commuted or average term on which this basis would be, say, about twelve years. The ordinance should give to the city the right, upon the expiration of the commuted term or of any subsequent year up to twenty years, to deal freely with the tangible property of the company on the basis of its fair value—that is (a) to purchase it, or (b) to require its sale to another corporation. The grant, if on this basis, is to carry less compensation for the commuted term, with greater compensation after its expiration for such time as the company may thereafter operate under it up to twenty years from the date of the ordinance.

## TROLLEY VERSUS STEAM

Ray Morris has contributed to the current "Atlantic Monthly" an interesting article entitled "Trolleys Versus Steam," in which he reviews the growth of the electric railway since 1890, and discusses the effect of electric competition with the steam roads. He takes as his authority for the increase of 1637 per cent in trolley lines since 1890, the census bulletin on electric railways, and in discussing this remarkable growth reviews the reasons why New York, Chicago and other large cities similarly situated, have not reaped the benefits of the trolley lines. As examples of the development that has been so general Mr. Morris takes several Western roads that connect two or three good-sized cities. His first reference for purpose of comparing steam and electric traffic is to the Lake Shore & Michigan Southern, and the electric railway operating between Cleveland and Oberlin, Ohio, 34 miles west. In 1895 the Lake Shore & Michigan Southern carried 104,246 westbound between these places, and 98,588 eastbound passengers. The competition of the electric roads, which at this time had commenced building a network of lines around Cleveland, was so severe, that in 1896 the steam road carried 68,000 pasengers less between the points named, and in 1902 carried a total of 91,761 as against 203,014 seven years before. Between Cleveland and Painesville, 29 miles, and intermediate points, the Lake Shore & Michigan Southern carried a total of 199,292, or an average of 16,608 a month in 1895, and 28,708, or an average of 2392 a month in 1902. In other words, the steam road carried more passengers in two months, during the formative period of the electric lines, than it did in a year after they were completed and had developed their traffic between the competitive points.

The following table summarizes these results, showing the surprising traffic losses which the steam roads have sustained. The lower average fare on the New York, Chicago & St. Louis indicates the effort made by that company to compete with the electric road for the business, but the falling off in number of passengers carried shows how futile this effort has been.

LAKE SHORE & MICHIGAN SOUTHERN

Passengers carried between Cleveland and Oberlin, and intermediate points:

| | Westbound | Eastbound | Total | Average per month |
|---|---|---|---|---|
| 1895 | 104,426 | 98,588 | 203,014 | 16,918 |
| 1902 | 46,328 | 45,433 | 91,761 | 7,647 |

Passengers carried between Cleveland and Painesville, and intermediate points:

| | Westbound | Eastbound | Total | Average per month |
|---|---|---|---|---|
| 1895 | 97,460 | 101,832 | 199,292 | 16,608 |
| 1902 | 13,106 | 15,602 | 28,708 | 2,392 |

NEW YORK, CHICAGO & ST. LOUIS

Passengers carried between Cleveland and Lorain:

| | Total Passengers | Revenue | Average Revenue |
|---|---|---|---|
| 1895 | 42,526 | $25,523 | 60c. |
| 1902 | 9,795 | 4,379 | 44c. |

Mr. Morris also refers to the ability of the electrics to create traffic where none seems to exist, citing the Detroit, Ypsilanti, Ann Arbor & Jackson as a remarkable instance. In closing his article he refers to the futility of the cut rate as a means of checkmating the electrics, and also calls attention to the policy of the New York, New Haven & Hartford toward electric competition, and to the tendency in England toward the electrification of the steam lines.

## BRITISH REQUIREMENTS OF UNDERGROUND ELECTRIC ROADS

The following are the requirements of the British Board of Trade in regard to the precautions to be taken against the risk of accidents by fire on underground electric railways, and contained in an order issued last month:

A.—STATIONS AND PERMANENT WAY

1. Sleepers to be of hard wood, not creosoted, and to be laid in concrete or ballast, and covered with a layer of gravel or finely broken stone free from dust, the ballast to be finished to a level surface, so as to form a convenient roadway for passengers in case of emergency. If ballast is not used, the space between the rails to be covered with granolithic slabs, or slabs of a similar material, to form as wide a roadway as possible for passengers. No timber planks to be used.

2. Tunnels to be provided with lights capable of being turned on from the stations at either end of each section, and if necessary, at some intermediate points. The lighting circuits to be independent of the traction supply.

3. Separate entrances to and exits from each platform of the stations to be provided, and to be situated as nearly as possible in the middle of the platforms.

4. All stairways, passages and exits from the stations to be conspicuously lighted. Not less than 25 per cent of the lights in these places to be supplied from independent source. If necessary, the exits to be made more conspicuous by the use of colored lights, in addition to white lights.

5. Platforms not to be made of wood, and woodwork to be eliminated as far as possible from signal boxes, lifts, offices, &c., below ground.

6. Efficient hydrants, hose and fire prevention appliances to be provided.

7. Ventilating ways to be provided wherever possible from the station and the tunnels to the surface.

B.—EQUIPMENT

8. Cars to be constructed of metal; woodwork to be reduced to a minimum and to be non-inflammable. Hard wood to be used in preference to soft. Interior fittings, panels, seats, &c., to be of incombustible material.

9. No main electric cable to be carried through the train, and motors to be placed on the front and rear carriages only. No motor to be situated in the middle of the train.

10. Means to be provided at both ends of every train to enable passengers to alight from the cars in case of emergency. Oil lamps to be carried in every train.

11. India rubber or other inflammable insulating material to be avoided as much as possible, and the outer covering of cables to be uninflammable material that will not give off smoke.

12. Means to be provided for enabling a driver at any part of the tunnel to put himself into telephonic communication with the adjacent stations.

Herbert Jekyll,
Board of Trade (Railway Department), May, 1904.

## ALLIS-CHALMERS TURBINE CONTRACT

The Transit Development Company, acting in behalf or the Brooklyn Rapid Transit Company, has just placed a contract with the Allis-Chalmers Company for a 5500-kw turbine, to be direct connected to a 25-cycle 750 r. p. m.., three-phase alternator, wound to give either 6600 volts or 11,000 volts. This equipment is intended to be installed in the enlarged Kent Avenue power station of the Transit Company. It is the second generating outfit ordered for this station, the Westinghouse interests having recently secured a contract for a 5500-kw turbine and generator. The Kent Avenue plant, it is expected, will ultimately have a capacity of not less than 66,000 kw.

## FURTHER MANILA CONTRACTS

Further interesting contracts were awarded last week for various equipment for the power house, etc., for the 40 odd miles of electric traction system at Manila, Philippine Islands, which road is now being hastened to completion by J. G. White & Company, of New York. The boilers for the power station will be of Babcock & Wilcox build. There will be six boilers of 400 hp capacity each. The steel work for the car house and shops will be shipped by the United States Steel Corporation. The Western Electric Company has been allotted the contract for the telephone system to be used for dispatching the cars. The Charles E. McInnes Company, of New York, will supply the bracket fittings, etc.

## MR. SWIFT, OF AMERICAN SYNDICATE, ON RAILROADS IN THE PHILIPPINES

In this letter dated Manila, P. I., May 19, to the New York Globe and the Chicago Record Herald, and printed in those papers a few days ago, William E. Curtis quotes Charles M. Swift at considerable length regarding the latter's plans for securing steam and electric railway grants on the island. It will be recalled that Mr. Swift is interested in the street railway system now building in Manila, and that associated with him in his various enterprises on the island are the Westinghouse interests, J. G. White & Company, of New York; Frank Buhl and Peter L. Kimberly, of Sharon, Pa.; W. C. McMillan, W. T. Gray, of Detroit, and others. Although Mr. Swift, as previously noted in the STREET RAILWAY JOURNAL, is now in New York, some statements accredited to him by Mr. Curtis seem worthy of mention here. According to Mr. Curtis, Mr. Swift while here will lay before the Government at Washington an offer to build the entire 700 miles of railroad recommended to be constructed by an engineering commission organized by Secretary Taft when he was Governor of the island. This commission recently reported in favor of three routes:

1. From Manila to Aparri, 336 miles; highest point in altitude, 3750 ft.; 4000 ft. of tunnels required; 20 miles of canyon work; maximum grade, 3½ per cent; cost, $6,675,602.
2. From Daigupan to Laoag, 168 miles through flat country, but a good many bridges required; maximum grade not more than ½ of 1 per cent; cost, 3,367,036.
3. From Manila to Batangas; 69 miles through flat country, sugar, rice, coffee and hemp lands; maximum grade not more than 1½ per cent; cost, $1,097,457.

These three lines the commission thought most important and recommended their immediate construction, and their recommendations have been approved by the commission and have been laid before Congress by Secretary Taft.

Mr. Curtis quotes Mr. Swift as saying:

"Such lines can be built and equipped for $30,000 a mile, and can be operated by electricity wherever water power can be utilized, and by steam elsewhere; and the gentlemen with whom I am associated are prepared to undertake the work and develop a system of 700 miles, more or less, of first-class, up-to-date American railway, with frequent fast trains. I have looked over the ground personally and am enthusiastic on the subject, but the first thing is to get politics out of the affair. The trouble in the Philippines now is too much politics and too little trade, and everybody concerned must agree upon certain propositions before anything serious can be done. * * *

"At present the greatest need of the Philippines is transportation. The islands are capable of producing several times as much rice, copra, hemp, tobacco, sugar and other products as are now grown. Hundreds of thousands of acres are uncultivated, because there is no way of getting the products to the market except at a prohibitive cost. They are now brought in by bullocks. It costs as much to haul hemp 25 miles as it does to raise it, so that away from the streams and the seacoast the best land in the world is absolutely worthless. A first-class railway system, supplemented by the proper water transportation, will solve the problem and ought to bring about almost instant prosperity to the people. It will certainly increase the exportable products many fold, and there is a demand for everything that can be raised here.

"There are other considerations also. A railway from Manila to Bagio would take people out of the tropics and in six hours put them into a country as cool, healthy and attractive as the Adirondacks. But good hotels are equally necessary. The Government can afford to sink $150,000 a year in encouraging the establishment of good hotels, for without them you cannot get people to come here, and as long as the people will not come, the islands will have a bad reputation, and the much-needed immigrant with capital and energy and brains will stay away. And he is needed here very badly. If we are allowed to build the proposed railways we will put up good hotels as a part of the railway system at every place they are needed and will see that they are well kept.

"My investigations have been confined to Luzon, and before I make my report to my associates at home I do not care to go further into details, but I can say that we are willing to undertake the proposed railroads. We have that much faith in the future of these islands."

The Philadelphia Rapid Transit Company is following the suggestion of the Department of Health of that city, and is substituting rattan for the plush covering of the seats in its winter cars.

## MANUFACTURERS' COMMITTEE OF THE A. S. R. A.

The organization of manufacturers appointed at the last meeting of the American Street Railway Association, and sometimes known as "the Supply Men's Committee," has been enlarged according to the powers given the committee at Saratoga, and now consists of ten gentlemen, as follows: Daniel M. Brady, chairman, president Brady Brass Company; George J. Kobusch, president St. Louis Car Company; John A. Brill. vice-president J. G. Brill Company; J. R. Lovejoy, manager railway department, General Electric Company; Arthur Hartwell, sales manager, Westinghouse Electric & Manufacturing Company; James H. McGraw, president STREET RAILWAY JOURNAL; William B. Albright, director Sherwin-Williams Company; W. J. Cooke, vice-president McGuire-Cummings Manufacturing Company; Fred S. Kenfield, president Street Railway Review; Scott H. Blewett, general agent American Car & Foundry Company.

The headquarters of the committee are at 95 Liberty Street, New York. As there is to be no separate exhibition of street railway apparatus at the convention of the American Street Railway Association this fall in St. Louis, the work of the committee will not be very large this year, but an organization has been effected, and the committee will be able to do such work as may be required of it at the next convention of the association.

## BRAKE EQUIPMENTS FOR THE SUBWAY

The Interborough Rapid Transit Company, operating both the subway and elevated lines on Manhattan Island, recently placed an order for the brakes, including motor compressors and governors, for the 200 new steel cars they have been building to operate in the subway. These brakes are understood to be of the Westinghouse quick-action, automatic type, employed on steam railways, with their minor additions necessary to adapt them to trains operated by multiple unit control. The compressors and electric pump governors are to be of the Westinghouse Traction Brake Company's standard type, and will be of the latest form, embodying a number of improvements which this company has recently made in these portions of its apparatus.

## BROOKLYN "BOUNCERS" MAKE MANY ARRESTS

The "bouncers" employed by the Brooklyn Rapid Transit Company to protect its patrons from assault at the hands of rowdies, and to force the rougher element of the Brooklyn Bridge crowd to a realization that consideration must be shown others, are doing a lucrative business, but are steadily decreasing the number of rowdies by their vigilant work. On Monday, June 20, thirty-eight men were arraigned before Magistrate Breen, charged with jumping through the windows of the bridge cars at the Manhattan end of the Brooklyn Bridge. A fine of $2 was imposed in each case, and the Magistrate said that hereafter a fine of $5 would be imposed in such cases, and if that was not sufficient to stop the nuisance, he would increase it to $10. The previous Sunday fifty-five arrests were made at the Manhattan end of the bridge. Magistrate Dooley, before whom a batch of climbers was arraigned, was not as lenient as Magistrate Breen. He fined the men arraigned before him $10 apiece. The "bouncers" are also getting in good work at Coney Island. Every Sunday sees a batch of offenders gathered in there and placed in the keeping of the Coney Island police. The conditions at Coney Island, however, are not as good for window climbing as are those at the bridge.

## ROCHESTER RAILWAY & LIGHT COMPANY ORGANIZES

The Rochester Railway & Light Company, of Rochester, N. Y., which has consolidated the railway and lighting interests of the city, has organized as follows: Henry D. Walbridge, of New York, president; Frederick Cook, chairman board of directors; E. W. Clark, Jr., and Granger A. Hollister, vice-presidents; William M. Eaton, treasurer and general manager; George E. Hardy, secretary and assistant treasurer; James T. Hutchins, superintendent of electrical department; George A. Redman, superintendent of water power; Albert H. Harris, attorney; Frederick Cook, C. N. Clark, Henry D. Walbridge, Granger A Hollister and Albert H. Harris, executive committee.

The directors of the company are: Frederick Cook, Henry D. Walbridge, Granger A. Hollister, E. W. Clark, Jr., Anton G. Hodenpyl, Alexander M. Lindsay, Edward Bausch, T. W. Finncane, A. O. Fenn, E. H. Satterlee, Henry A. Strong, C. M. Clark, George W. Archer, James Richardson and Albert H. Harris.

## ANNUAL REPORT OF THE NURNBERG-FURTHER STRASSENBAHN

The Nurnberg-Further Strassenbahn, of Nurnberg, Germany, purchased by the municipality in June, 1903, has recently issued its report for 1903, which contains some interesting data on traffic conditions in one of Germany's most famous cities.

The total length of all lines was 27.65 km (16.6 miles) and the number of passengers carried 20,400,000, of whom nearly 10 per cent traveled free, because they were municipal employees or people voluntarily serving charitable organizations. This traffic was carried on 109 motor cars and 87 trailers, seating a total of 6600. The gross income was 1,750,688 marks ($437,672); total expenses, including depreciation and interest charges, 1,697,589 marks ($424,147), and ratio of actual cost to gross income, 48.7 per cent. The income per car-km was 28.9 pfgs (12 cents per car-mile), and operating expenses per car-km 14.2 pfgs. (5.9 cents per car-mile). The power station generated 3,159, 100 kw-hours, at a cost of 5.15 pfgs. (1.28 cents) per kw-hour.

## AUSTRALIAN TRACTION PROJECT

Australian advices state that the proposals to construct an electric traction system in Essendon and Flemington, suburbs of Melbourne, have at last received the sanction of the Victoria Government authorities.

The scheme is fostered by A. E. Morgan, at one time Premier of Western Australia. The municipal authorities of the districts concerned will obtain an order in council for the construction of the tramways, thereafter transferring their powers to Mr. Morgan, who undertakes to commence the erection of the power house within three months, to start the remaining works within nine months, and to have the lines within operation within twenty-one months from date of the transfer, which is expected to be made without delay.

The Australasian electrical engineering and contracting firm of Noyes Brothers, which represents the Westinghouse and Brill interests in the Antipodes, is after the contract for the construction and equipment of the lines, which it is estimated will represent an initial expenditure of some $500,000.

## NEW PUBLICATIONS

Trolley Wayfinder, 80 pages, paper. Price 10 cents. Birdseye View of the Trolley Roads in New England. Price 10 cents. Published by the New England Street Railway Club.

The book mentioned contains maps and time tables, with distance travelled and fares charged, of all of the principal electric lines in New England, and should be found of great convenience to the traveling public. To those who want a birdseye map of the territory traversed, the map mentioned will appeal. Both publications are excellent instances of what may be done in popularizing through excursions, and are a great credit to the club.

The Manual of Statistics, 1904. 1,040 pages. Price, $5. The Manual of Statistics Company, New York.

This manual is now in its twenty-sixth year, and, as in previous years, a large part of the book is devoted to the statistics of steam railroad, the larger street railway and industrial corporations. An important feature of the book is also the stock and bond quotations of the different stock exchanges, giving high and low for each of the last three years. There is also a comprehensive index with 3000 titles.

## STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 14, 1904

762,297. Third Rail Insulator; Henry L. Fritze, Jersey City, N. J. App. filed Oct. 27, 1903. The base plate is cemented into insulating material covered with a rubber pad, mica disc, and cover bolted together, all metal enameled.

762,318. Conductor and Collector for Electric Railways or Tramways; Donald Kempf, Buenos Ayres, Argentina. App. filed Mar. 11, 1903. The third rail is grooved for the reception of a number of sharp-edged disc collectors.

762,319 Contact Box and Conductor for Electric Railways or Tramways; Donald Kempf, Buenos Ayres, Argentina. App. filed Sept. 23, 1903. Details.

762,342. Railway Track Structure; Edward Ott, Johnstown, Pa. App. filed Oct. 22, 1903. Relates to novel means for fastening wear-plates in position.

762,375. Apparatus for Removing Snow from Railway Tracks; De Witt A. Beaudette, San Francisco, Cal. App. filed Feb. 10, 1904. Adjustable deflecting wings attached to a car truck for drawing the banked snow at the side of the track onto the track where it can be reached by a rotary snow plow.

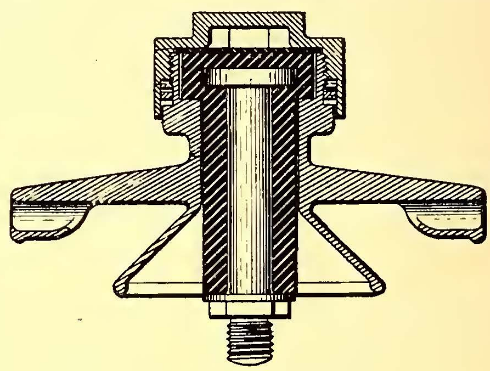
762,379. Trolley Wheel; John S. Briggs, Los Angeles, Cal. App. filed April 25, 1903. A spring mounted in the tread of the wheel to give yielding contact with the wire and avoid sparking.

762,668. Car Traction Device; Samuel C. Webb & Isaac Weil, Monongahela, Pa. App. filed Sept. 26, 1903. A coupling device for connecting cars to a traction cable, consisting of a wheeled clamp secured to the cable and having a connection which directly engages the clamp, and a rail or guide for the clamp arranged to rotate the clamp laterally at curves.

762,749. Trolley; Rowley K. Ortt, Reading, Pa. App. filed Nov. 4, 1903. The trolley wheel is swiveled on ball bearings to turn laterally to accommodate itself to kinks in the wire.

762,768. Rail; Louis Steinberger, New York, N. Y. App. filed Dec. 16, 1903. The third rail is L-shaped in cross section and saddled upon a support which permits it to rock.

762,769. Support for Rails; Louis Steinberger, New York, N. Y. App. filed Feb. 11, 1904. An ordinary T-rail is so mounted as to permit of certain freedom of movement.



PATENT NO. 762,791

762,791. Trolley Hanger; Montraville M. Wood, Schenectady, N. Y. App. filed Dec. 15, 1902. Details of construction.

762,823. Trolley Wheel; Stewart J. Hamlin, Allegheny, Pa. App. filed Mar. 29, 1904. Two trolley wheels mounted in tandem in a pivoted yoke.

762,831. Trolley Base; Peter D. Milloy, Buffalo, N. Y. App. filed Mar. 29, 1904. Details.

762,840. Feed Wire Connection; George L. Osborn, Boston, Mass. App. filed Sept. 2, 1902. A flat plate adapted to be soldered to a rail, a downwardly-projecting neck disposed at approximately right angles to the plate and a cup for the end of the feed wire formed at the lower end of the neck on the side opposite the plate.

## PERSONAL MENTION

MR. LEE MESSENGALE has been appointed master mechanic of the East St. Louis & Suburban Railway Company, of East St. Louis. Mr. Messengale has recently been connected with Rossiter, MacGovern & Company, of New York, and previous to that was master mechanic of the St. Louis Transit Company.

MR. HOWARD F. GRANT, resident manager of the Seattle Electric Company, of Seattle, Wash., has returned to that city after a trip to the East, during which he was in consultation with Stone & Webster, of Boston, the managers of the company. In making the trip Mr. Grant visited New York, Buffalo, Toronto and other cities, and stopped at St. Louis for several days to see the exposition.

MR. NEWTON W. BOLEN has resigned as general superintendent of the North Jersey Street Railway; Elizabeth, Plainfield & Central Jersey Street Railway, and Orange & Passaic Valley Railway Company's lines of the Public Service Corporation, of New Jersey, to accept a position under Mr. W. W. Wheatley, as general superintendent of the Mexico City Tramway Company's lines in Mexico City, Mex. Mr. Bolen was connected with the Brooklyn Rapid Transit Company in the capacity of division superintendent before he became connected with the Public Service Corporation. His successor in the Public Service Corporation has not yet been chosen.