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Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 138,800 copies, an average of 8165 copies per week.

Running Cars on Schedule Time

It was only a few years ago that electric railway apparatus was constructed in a much less thorough manner than now, and consequently often got out of order and caused delays to cars. As the public has had numerous experiences with delayed city cars, due frequently in all probability to street blockades, it was almost natural to associate unreliability with interurban electric railway systems when they developed. Car equipment, line construction and power-house machinery, however, are now built in such a manner that there is no more occasion for cars being off schedule time, than there is for steam trains. But on some lines delays are so frequent that the public is justified in retaining its idea of unreliability of electric service in general. The importance of keeping cars on the schedule does not seem to be realized. Trivial matters are permitted to interfere with the running time. Electrical apparatus is kept in such a condition that accidents are frequent. Construction work or freight trains are allowed to cause lay-overs and numerous other causes result in cars being run at such times that the public can place little dependence on the time card. If anything will cause exasperation on the part of the passenger, it is to run several blocks for a car and then be compelled to wait 10 minutes or 15 minutes for its arrival, and after all probably miss a connection with a steam road, due to the fact that the electric car was behind time. American people want cars and trains to be run on time, and the company that is lax about keeping them on schedule will lose a good many fares.

To some managers it may appear impossible to keep to the schedule. But it can be done, and is done on many roads. If frequent delays occur, a record of delays should be kept and the causes determined. If investigation shows the electrical apparatus at fault, the shop management should be called to account. It may be that the cause is due to the fact that the equipment is ready for the junk pile. If so, new apparatus should be obtained. Possibly the trainmen are not trying as they should to keep cars on time, and if this is the case a few dismissals will usually better conditions. We believe after all that the fault can always be remedied if proper effort to do so is made by the management, and certainly where it exists, prompt measures should be taken.

Schedule Time and Through Cars

The broadening requirements of through transportation make it especially important that foreign cars be given every facility for completing their journeys on time, and while discussing this question of schedules, it may not be amiss to refer to this subject in its relation to through cars.

On many of the interurban lines in the Middle West, the limited service shows an excellent profit, but even if this was not the case, the reputation which a road gets in the way of well handled connections is far from valueless. Progressive managers are looking at this question of foreign cars in a very broad-minded manner, for they realize that every person who can be induced to come to their cities is a source of possible revenue. The street railway company which does not receive with open arms every passenger delivered to its lines, regardless of whether he arrives by a through car, afoot, or on a beast of burden, deserves to lose fares. It seems trite to urge the importance of operating through cars on time and over

the shortest feasible route, but many companies fail to do this. Most managers, having an expert knowledge of how to handle the passenger traffic of electric railways, will agree that a through interurban car is about the last piece of rolling stock which should be permitted to meander about town before it reaches its destination and run the risk of blockades, in the hope of picking up a few chance local fares. A steam road, or an interurban with a private right of way, can afford to deviate more or less from a straight line in entering a city, but the aimless wandering through crooked streets, which characterises the last two or three miles of some other interurban routes, is absolutely fatal to the enjoyment of fast time, as well as correct schedules, between terminals.

Time is often wasted in changing crews at the limits of receiving systems, and finally, the stops in the local run are often so numerous that long delays occur in getting through to the end of the route. It is essential that the public should understand that through interurban service is express in character, and it is a question if a movement to reduce the stops in the local part of a through interurban run might not be successful, if its real advantages were presented to the public and its representatives.

Official Inspection Trips

At the present time there is a most gratifying community of interest between electric railway men in different parts of the country. It is not easy to say just what has been the most potent factor in establishing broad relations between officials of widely separated companies, but it is certain that the street railway associations, State and national, and the technical press are, to a large degree, responsible for the esprit-de-corps which prevails to-day in the electric railway field. Another important factor is the evolution of equipment from the old horse and cable systems to the highly specialized electric machinery, which constitutes the essential motive power of the modern street railway.

Progress in the development of equipment has been so rapid that few established roads have been able to adopt all the latest improvements in power plants and rolling stock as soon as they have become available. It has almost invariably been the case that some one company has, for a short time, been the first to exhibit a representative commercial installation of a new design of apparatus, and has thereby become an object of interest to operating officials all over the country. The result has been that, in many cases, the officials most concerned have been encouraged to visit other roads, and there is no doubt that inspection trips of this sort are of great value if their full opportunities are utilized. Then, too, the enormous growth in the rated capacity of equipment and the multiplication of street and interurban railway mileage all over the country in the last two decades has necessitated improved methods of manufacture, and has had a tendency to stimulate the growth of the great manufacturing plants as units, capable of a tremendous output per year, the product of a single establishment representing the widest range of equipment, from a machine screw to a 10,000-hp turbine. Visits to these manufacturing plants for the purpose of studying new forms of equipment, discussing operating difficulties, and following up the production of apparatus under contract, are coming to be more and more frequent among electric railway officials, and the mutual breadth of view which results from personal contact between the operating man and the designing engineer is bound to be of lasting benefit to the entire electric railway industry. Periodic visits of heads of departments to other roads for the purpose of studying practice is a corollary to the proposition of the desirability of visiting manufacturing establishments. The cost of such inspection trips by responsible officials is a small matter in comparison with the potential advantages which await the arrival of the department head or general officer, who is anxious to give his road the benefit of a thorough study of the most modern methods and experience.

The Electric Locomotive in Increasing Train Loads

Considerable attention has been attracted in railroad circles to the 1905 report of the Pittsburg & Lake Erie Railroad, a Vanderbilt property, which shows that the average train load last year on that road was 1107 tons. The phenomenal character of this figure is indicated by the fact that the average for the United States is only a little over 300 tons. A few other high average train loads are: Bessemer & Lake Erie, 937 tons; Lake Shore & Michigan Southern, 654 tons; Chesapeake & Ohio, 585 tons; Great Northern, 576 tons; Norfolk & Western, 531 tons, and Erie Railroad, 440 tons. The train loads on the Pittsburg & Lake Erie Railroad have gradually increased since 1896, when the figure was 443 tons, and have been attained only by the expenditure of large sums for track betterments, both from operating and capital accounts. In 1904 the expenditure from operating expenses alone, chargeable to betterments, amounted to $4,310,706, and for several years past they have been over $2,000,000, while during the last four years the stock has been increased from $4,000,000 to $10,000,000.

Our object in calling attention to this record, which the "Commercial and Financial Chronicle" properly calls a noteworthy achievement, is not to consider it from the standpoint of steam railroad economics, but to touch upon these questions of heavy train loads and track capacity from the side of possible electrification. Modern steam railroad methods are decidedly in the direction of long freight trains, in spite of the fact that this step requires heavier and more powerful locomotives, reduction of grades, lengthening of curve radii and strengthening of bridges and viaducts. Nevertheless, the attendant economy is found to be so great as to warrant the extraordinary expenses which have been undertaken in these directions to accomplish results similar to those gained on the Pittsburg & Lake Erie. If that is the case, it would seem that electricity certainly has a field in "pusher" as well as in suburban service. If it should seem desirable to operate in long trains there is practically no limit to the length of the train, provided a distributed motive power is used. The train weight is thus made independent of the draw-bar capacity, and even within practical limits of the curves and grades, assuming the power is derived from some cheap natural supply. This field for the electric locomotive, although discussed before, seems to have been somewhat overlooked in the great attention which has been directed to the possibilities of electrical power for suburban and rapid transit service. But in view of the efforts being made by steam railroad companies toward longer trains, the fact that electrically it is feasible to haul a longer train than is possible with any steam locomotive should not be forgotten.

The Electric Locomotive Question

Three contributions to the discussion of the design of the New Haven single-phase locomotive have appeared since our issue of last week. Two of them take the form of contributed discussions of the paper by Mr. Lamme before the New York Railroad Club, printed in the STREET RAILWAY JOURNAL for March 24, 1906, and form part of the printed proceedings of the club, which have just been issued. The third discussion is upon the performance of the locomotive as outlined in the descriptive article in our issue of April 14. It is from the trenchant pen of Mr. Sprague, and is published in another column. All consideration of the electric locomotive is interesting, but these three articles are particularly so as they bear directly on much mooted points. Mr. Sprague's criticisms are directed principally toward the performance of the locomotive at slow speeds and yard work, in which he believes it will show low efficiency and abnormal heating. He also calls attention to the great weight in proportion to the capacity of the locomotive, when compared with the New York Central machine.

Mr. McClellan's notes can be said to be neither entirely for nor against the theses presented by Mr. Lamme, and relate to the entire subject under consideration, although, inferentially, he is in favor of single-phase traction. He first makes a vigorous plea for a high distributing voltage, states that a third-rail is no place for such a high potential as is necessary in railway work, and believes that in case of wreck there is less danger with a high than with a low voltage, as the former will be killed by a ground more rapidly. Then, after referring to certain other advantages of high voltage, which he believes can best be secured by a. c. distribution and which includes a reduction of collection troubles, and the low cost of being liberal with copper, he refers to the desirability of operating motors in parallel to keep the load on the motors balanced. He thinks that there may be some difficulty in making repairs on the New Haven armature without having to press off the driver and concludes with a plea for the property of tenacity; that is, for a locomotive which will pull with all its might without doing itself harm, whether the load is too great or not. The present steam locomotive engineer, he sententiously remarks, has no nursing to do other than to look out for his drivers.

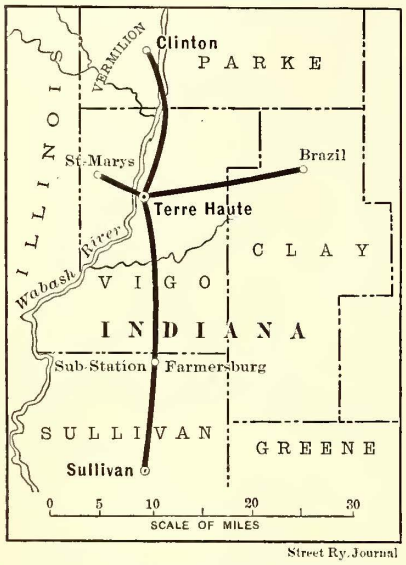
Mr. De Muralt's spirited defense of polyphase traction raises an entirely different set of questions from those offered by either Mr. Sprague of Mr. McClellan. There is no doubt that both the single-phase and d. c. locomotives meet more readily the requirements of those who are used to operating steam locomotives than does the polyphase locomotive with its constant-speed characteristics. As Mr. De Muralt points out, the series motor in its output characteristics resembles the steam locomotive, and in so far it warms the heart of the railway man who wishes to change as few elements of operation as possible. What the ultimate situation might be is quite another matter, for constant speed characteristics might prove valuable if they were fully utilized. But for the present, and for ordinary passenger service, it certainly is working along the line of least resistance to introduce locomotives with series characteristics, as in the d. c. and single-phase types. At one point Mr. De Muralt certainly has the best of the argument, and that is in connection with the effect of difference in diameter of drivers upon the loading on the motors. As Mr. De Muralt explains, the difference in loading from this cause can be corrected, while a 6 per cent or 7 per cent variation would also be likely to play the mischief even with continuous-current motors. In the matter of weights the polyphase motor has the advantage, so far as experience now goes. It must not be forgotten, however, that most polyphase traction motors take the trolley voltage directly into the stators, which might well prove objectionable in utilizing some of the voltages which are now being proposed. The feeling against the polyphase motors for heavy traction is not due to lack of appreciation of their valuable qualities, so much as to distrust as to their applicability for the reasons already stated.

One of the points raised by Mr. De Muralt against the single-phase motor calls for comment by those familiar with the machine. In his judgment, a single-phase locomotive will be very likely to get into trouble in starting on grades from the burning out of the short-circuited coil in spite of the high-resistance leads. This would certainly be a very unpleasant contingency, but it is one that Mr. Lamme can hardly have overlooked in design and on which he will probably be heard. Mr. McClellan raised an analogous point in calling attention to the need of power to hold on and pull, whether the load is too great or not. This a polyphase locomotive can come nearer to doing than any other type of electrical engine. The question practically, however, is whether the New Haven single-phase locomotive will have this property in adequate degree—if so, more is unnecessary. This is one of the things that must be settled by long continued, hard service on the road, and it is one to which the engineers will give very close attention in the earliest stages of electrical operation. In fast passenger service it may never come up seriously, but when electrical freight haulage comes, matters of ultimate adhesion and traction power rise to great importance.

In one respect we find a decided agreement between Mr. Lamme and his critics, although together they represent the three diverse policies of d. c., single-phase and polyphase working. This is their advocacy of higher working potentials, and to it we add a hearty Amen. It is all very well to explain the virtues of low-voltage distribution, but however ingenious the defense of the status quo may be, it utterly fails of being convincing. As to how many thousand volts should preferably be employed there may be justifiable difference of opinion, but that we should stop measuring them in hundreds can, in the fact of recent progress, hardly admits of discussion. What can be done with direct current at reasonably high voltage remains to be seen. The work of Thury and others abroad makes it clear that, at least up to units of moderate size, high-voltage, direct current is feasible for certain purposes. It is equally true that many objections to direct-current operation for railway work disappear when the voltage is increased to three or four times that at present in use. Whether other difficulties will be encountered is yet to be determined, and we are very glad to record that work on the problem is being rushed actively forward both in this country and abroad. As for the New Haven locomotive, this much is certain: we shall not have to wait long for practical information about its operative qualities. It cannot be long before it will be put on the New Haven road, and its performance will be watched by a thousand eyes, friendly and unfriendly.

EXTENSIONS AND IMPROVEMENTS OF THE TERRE HAUTE TRACTION & LIGHT COMPANY

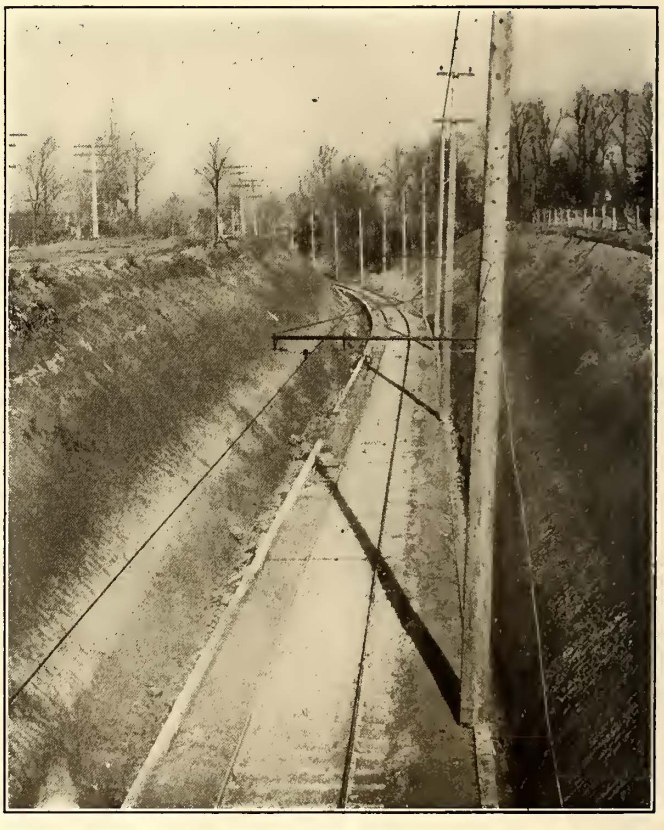
Quite an extended article, descriptive of the city and interurban railway system in and about Terre Haute, Ind., was published in the Street Railway Journal for Feb. 4, 1905. Since the publication of this article, the interurban system has been extended, new cars have been purchased, and the output of the Water Street power station has been increased by the installation of a 1500-kw Curtis steam turbine.



MAP OF TERRE HAUTE SYSTEM

TRESTLE BRIDGE ON ST. MARY'S LINE

VIADUCT UNDER VANDALIA RAILWAY, ST. MARY'S LINE

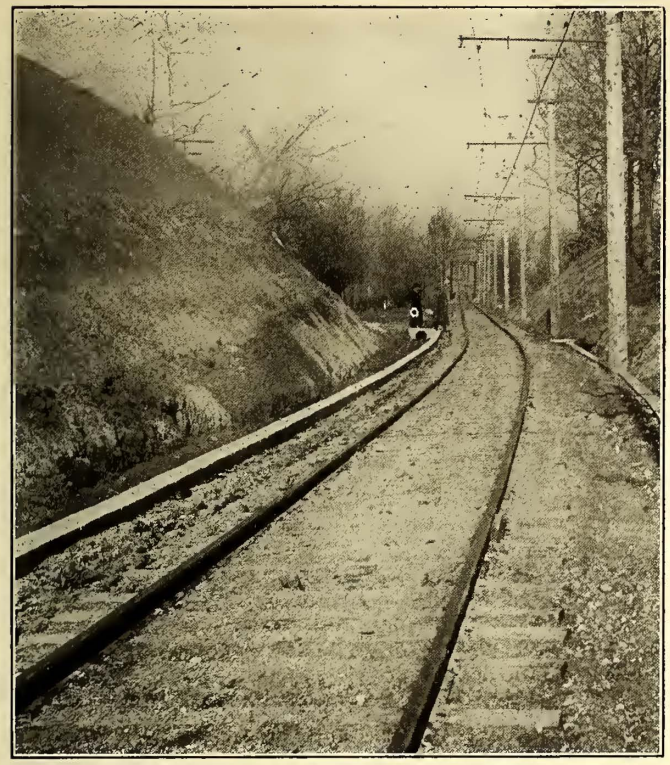


CUT ON SULLIVAN LINE, WITH CONCRETE PROTECTION

The Terre Haute Traction & Light Company operates both the city and interurban systems, and has interurban lines leaving the city in four directions. The lines north to Clinton and east to Brazil, were described in the article referred to. One of the new lines extends northwest to St. Mary's, about 5 miles distant, while the other will eventually reach Sullivan, a mining town of 6000 people, 26 miles directly south of Terre Haute. At present, cars are being operated on the latter line as far as Shelbourn, 6 miles north of Sullivan. This line is constructed on private right of way 50-ft. wide for the entire distance, with the exception of portions in the towns; and, for the greater portion of the distance, it parallels the tracks of the Evansville and Terre Haute Railway, which railway has heretofore been the only outlet for the towns along the route of the new extension.

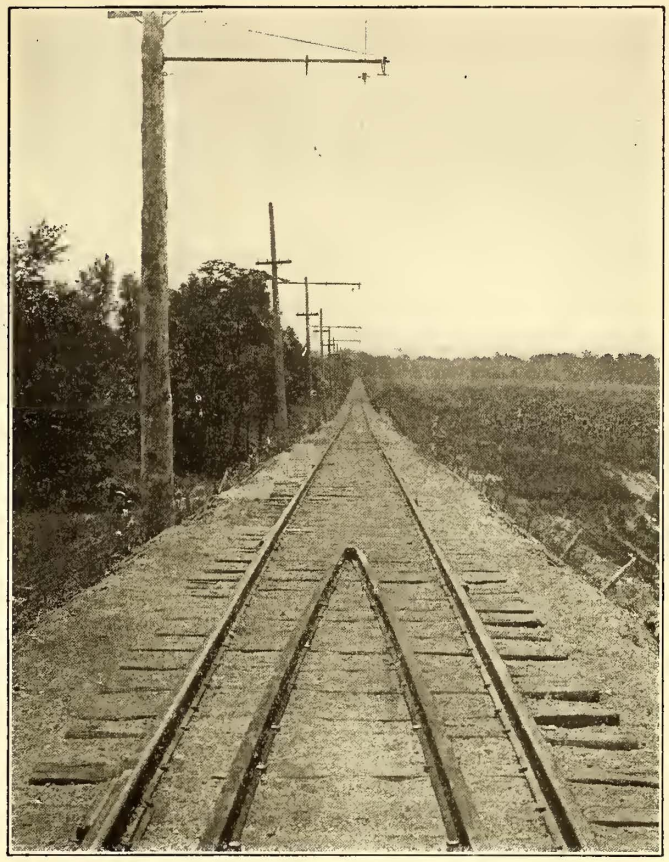
The track of the electric line is laid with 70-lb. rails 30-ft. long, fastened together with Weber rail joints. The ties are of chestnut, and the road is well ballasted with gravel. With the exception of one grade of 2 per cent, there are no grades of consequence on the line. The curves are of long radii, and there are very few that will not permit the cars to be operated around them at full speed. Other than at one place near the city limits of Terre Haute, no excessive grading

was encountered. One of the illustrations shows a view of the cut at this point, and the concrete work alongside the track to prevent washing. There were, however, several places where, in order to cross ravines and waterways, special construction was necessary. At one point a steel

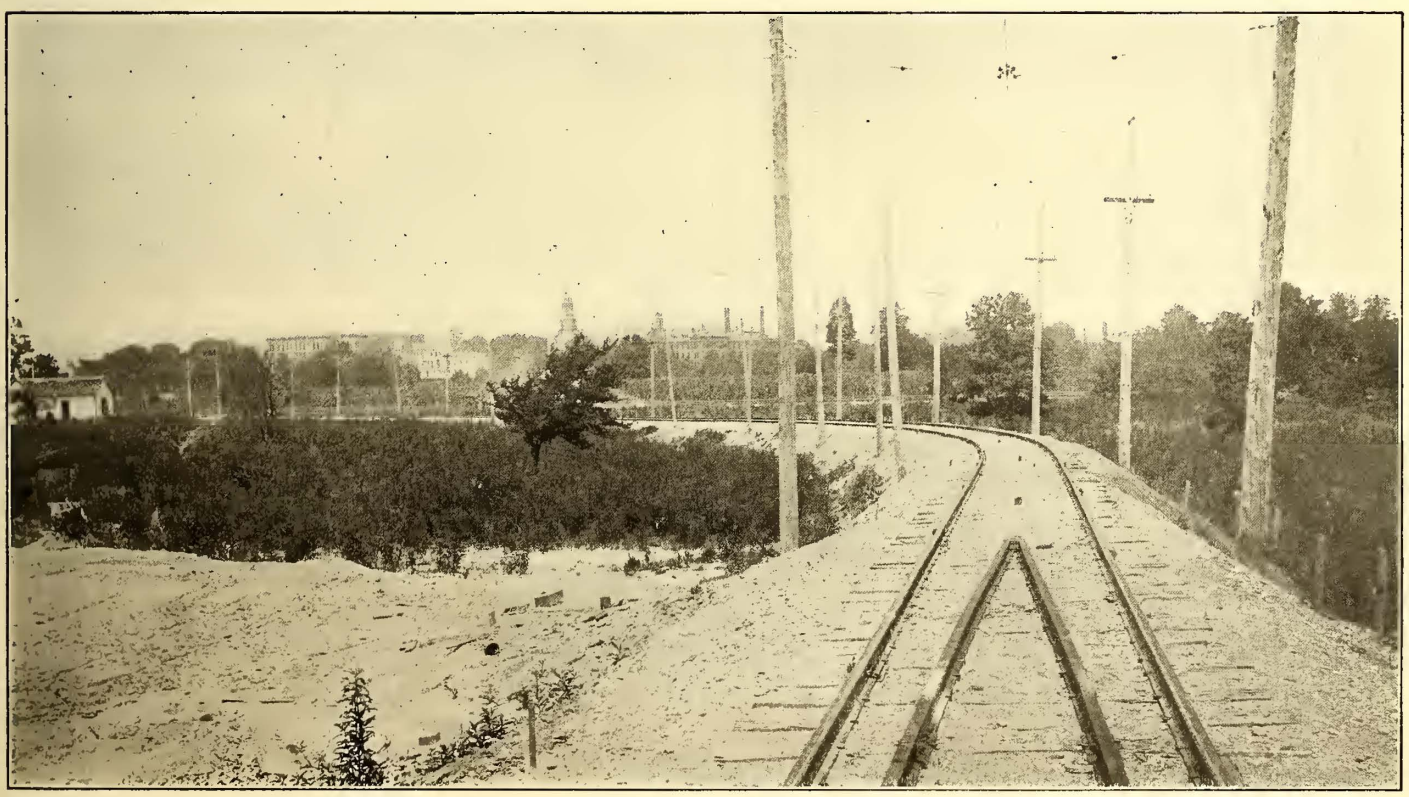


CUT ON SULLIVAN LINE, SHOWING CONCRETE WORK TO PROTECT GRADES FROM WASHING

these structures, there are on the line, four wooden trestles having a total length of 320 ft. The largest is about one



APPROACH TO BIG FOUR CROSSING



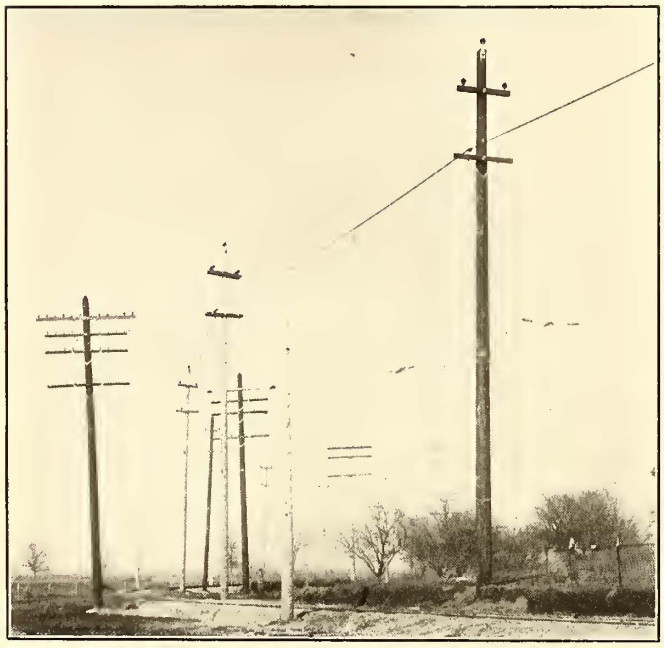
CURVE JUST BEFORE REACHING BIG FOUR CROSSING

structure 120 ft. long was built, and at four other points steel girders each 15 ft. in length were erected. For all of these, abutments of concrete were provided. In addition to

mile north of Farmersburg, where the road crosses a ravine of considerable depth.

Bracket construction is employed for the overhead through-

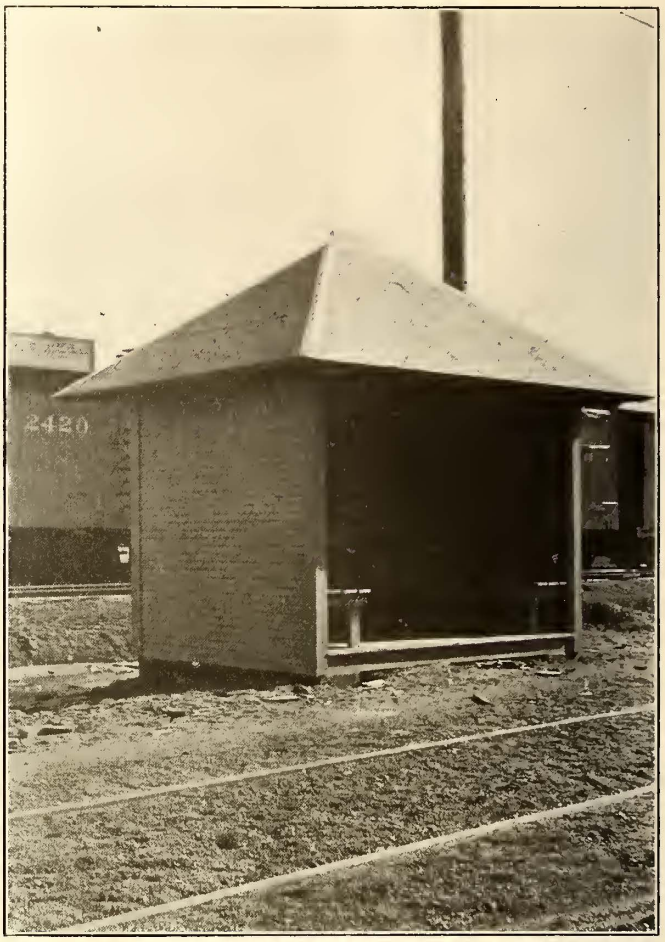
out the length of the line except at curves and through towns where the trolley is supported by span wires. The poles are placed 100 ft. apart, and are 40 ft. high. In addition to the brackets, these poles carry on a four-pin cross-arm below the bracket a direct-current feeder and two tel-



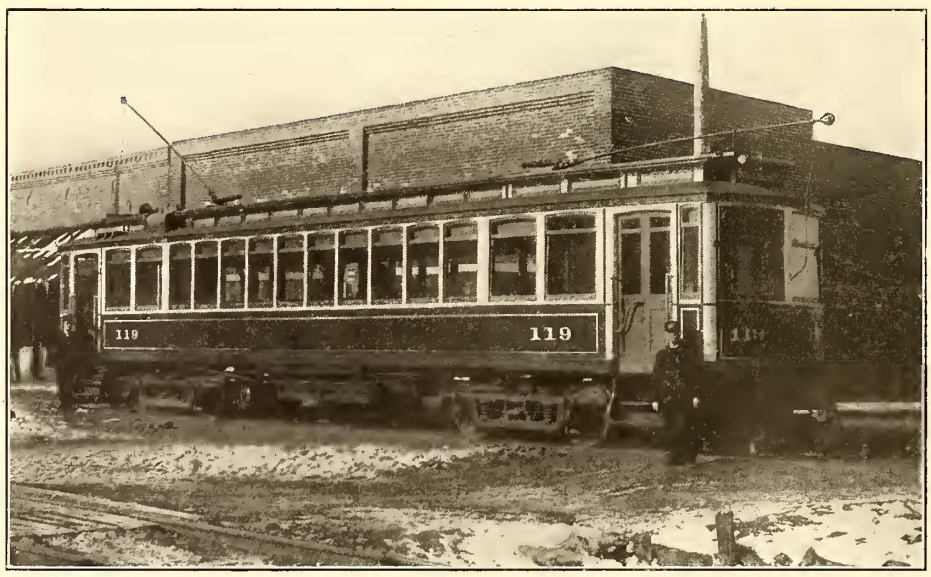
CROSSING OF TELEPHONE LINE WITH TROLLEY WIRES BELOW AND HIGH-TENSION WIRES ABOVE

ephone wires. The high-tension wires feeding the only sub-station on the line, that at Farmersburg, are carried one on the top of the pole, and the other two on a cross-arm a short distance below. Brackets of the Ohio Brass Company manufacture, type B, support the single No. 00 trolley.

Some unusual features are encountered in the high-tension feeder system supplying the sub-station at Farmersburg. Two-phase current is obtained from the buses tieing the Water Street and the Ninth Street stations together. Because of the numerous telephone and electric light wires, it was deemed advisable to carry the current at a comparatively low voltage to the outskirts of the city. The two-phase circuits of 0000 copper wire are carried on poles varying from 65 ft. to 45 ft. in height from the Water Street power station though alleys to a point about 1½ miles distant on the outskirts of the city, where the transformer house shown in one of the accompanying illustrations is located. This house is of brick, with a temporary end of corrugated iron



TYPE OF WAITING STATION ON SULLIVAN LINE

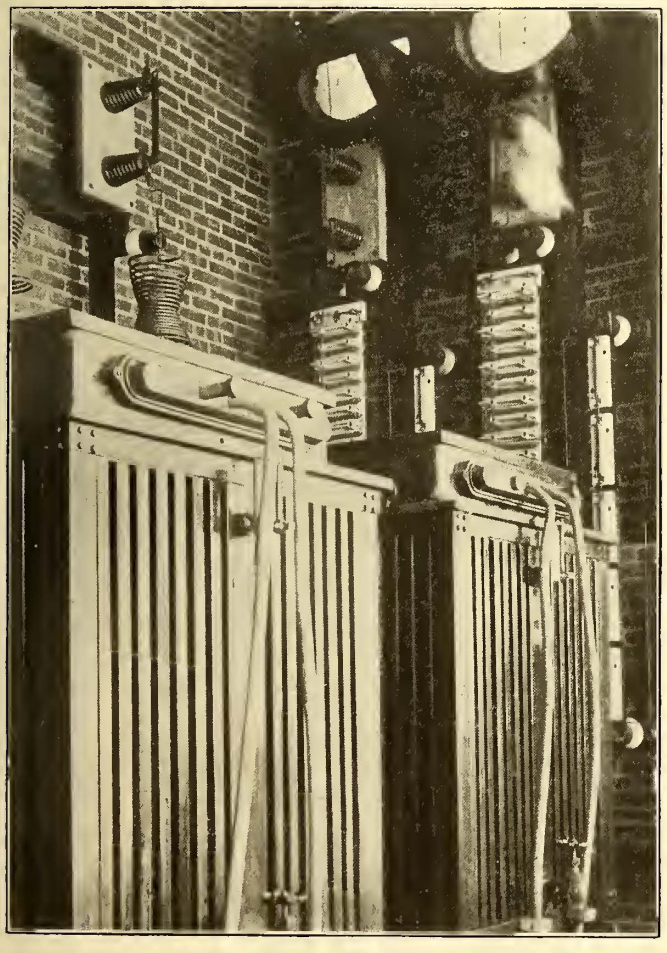


STANDARD CAR ON SULLIVAN LINE AT SHELBURN TERMINUS

to permit of future extension. In addition to lightning arresters and choke coils for both the incoming and outgoing lines, the building contains two two-phase to three-phase Scott connected transformers, each of 175-kw capacity, which step-up the voltage to 22,000 volts. Each of the outgoing high-tension feeder wires pass out of building through 12-in. drain tiles built in the walls. The inner ends of these tiles are provided with a plate of thick glass, in the center of which is a 3-in. hole through which the wire passes. As a protection against rain or sleet, a wood canopy is built over the outer ends of the tiles, as shown in the illustration of the transformer house. After leaving the transformer house, the wires are carried across the contry on a 45-ft. pole line in a south-eastern direction for about a mile to the car line, and thence to the sub-station at Farmersburg on the pole line supporting the trolley.

The Farmersburg sub-station equipment is housed in a brick building measuring 22 ft. x 56 ft, half of which is used as a freight station for Farmersburg. This arrange-

ment results in considerable economy, as it permits the station operator to serve as station agent as well. The sub-station is of 300-kw capacity, one Westinghouse two-phase rotary converter being installed. All the apparatus is contained in one room. The high-tension lines are brought into the building through vitrified tiles, in a manner already described in connection with the transformer house. The arresters of the GE-type are located on a wood frame below the entering wires, while the choke-coils are on the wall immediately above the two transformers. These latter are of the oil-cooled type, each of 165-kw capacity. The secondaries are carried under the floor to the rotary converter as are the d. c. leads from the converter to the switchboard. This board consists of a machine panel carrying a two-phase synchroscope, power-factor meter, and the necessary starting switches for the induction-starting motor on the rotary converter shaft, and a feeder panel upon which are mounted the usual volt and ammeters, and a 600-amp. Thomson recording wattmeter. A 500,000 circ. mil feeder is carried from the Ninth Street power house in Terre Haute to a point some distance south of the Farmersburg sub-station. This one cable feeds the whole line, it being supplied

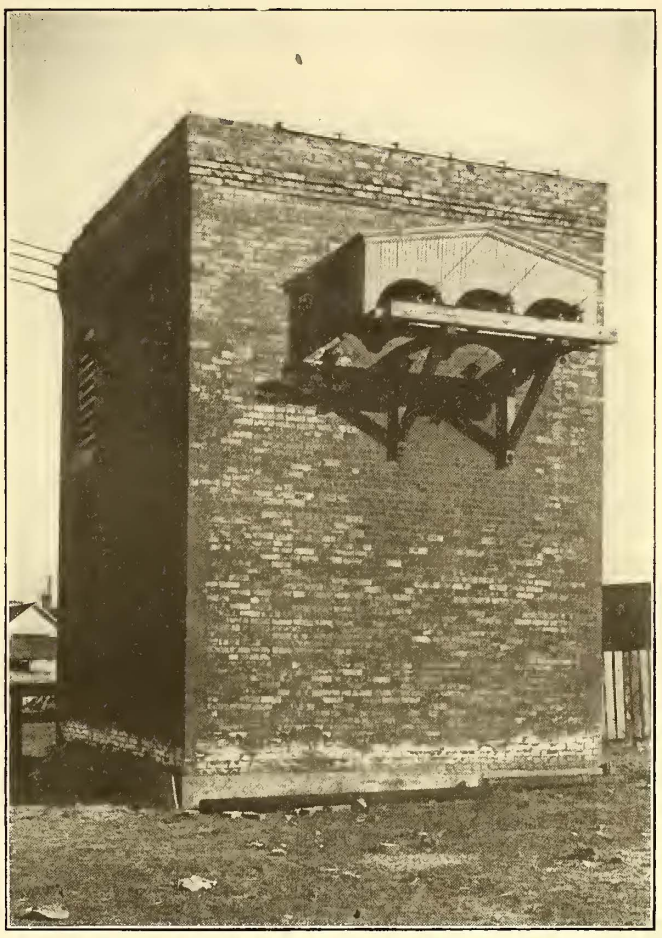


DISCONNECTING KNIFE SWITCHES, LIGHTNING ARRESTERS AND TRANSFORMERS IN THE FARMERSBURG SUB-STATION

with current from both the Ninth Street station in Terre Haute and the sub-station described.

THE ST. MARYS LINE

About 5 miles northwest of Terre Haute, is located a Catholic school for girls known as St. Marys-of-the-Woods. The school was founded more than fifty years ago, and during its existence the town of St. Marys has grown up near it. This village is the terminus of the interurban line west out of Terre Haute. The Wabash River forms the Western boundary of Terre Haute proper, and the tracks of this western extension are carried over the river on an iron bridge recently erected by the county at a cost of $271,000. For a mile beyond the river, the tracks are laid on the south side of the highway on a fill made by the company, but for the remainder of the distance to St. Marys,

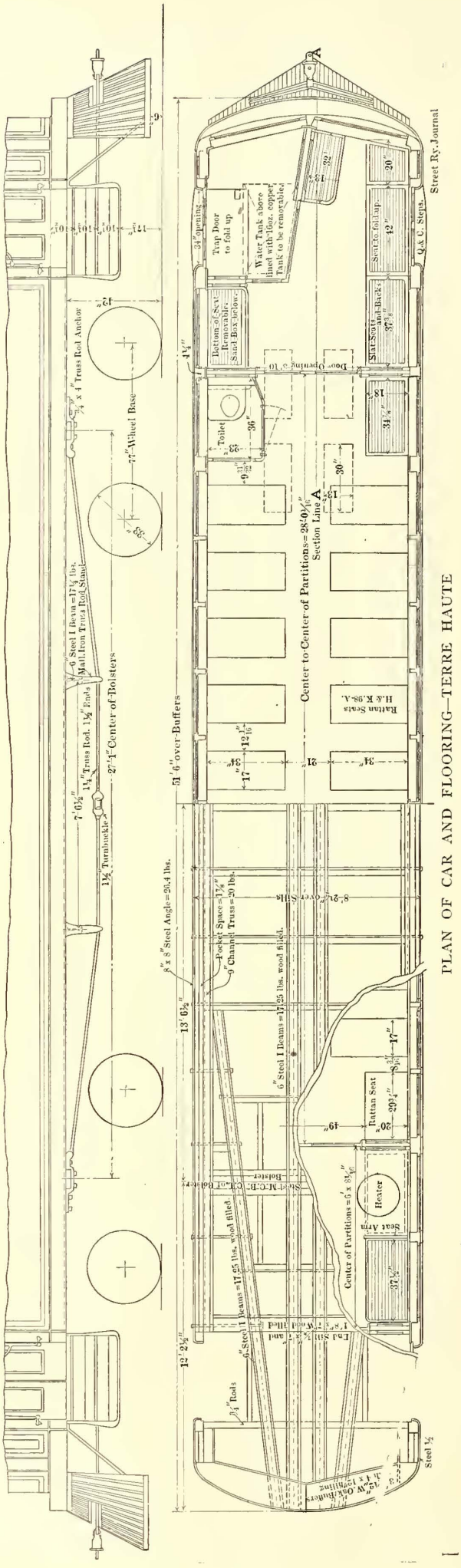


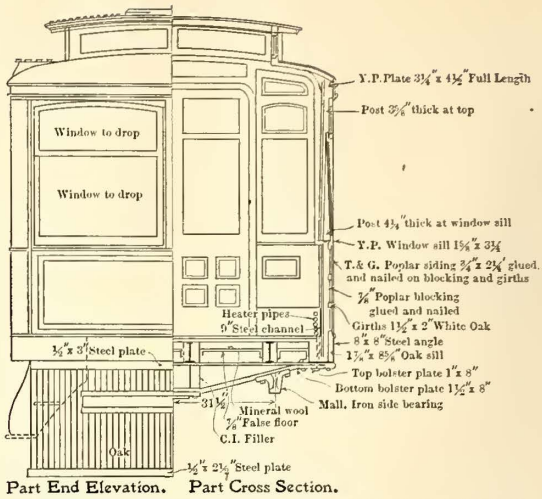
TRANSFORMER HOUSE LOCATED IN THE OUTSKIRTS OF TERRE HAUTE

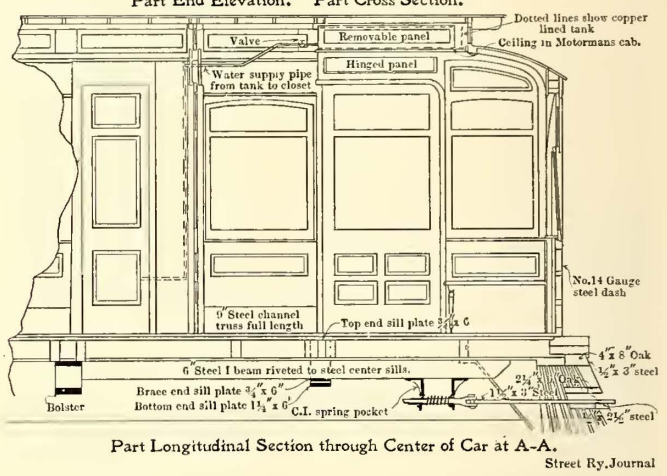
the line is on a private right of way. Grade crossings of steam roads have been avoided altogether. The tracks of the Vandalia railroad are carried over the line on a concrete viaduct, while a steel girder 120 ft. long carries the line over the Big Four tracks. In addition to these structures, there is on the line one wooden trestle 180 ft. long. This west line is fed direct from the Ninth Street power station in Terre Haute by means of a 500,000 circ. mil cable, which extends to a point approximately one and one-half miles from the end of the line. The track and overhead construction is practically the same as that on the southern division already described. About one mile of the track nearest Terre Haute, however, is laid with 60-lb. rails.

TRAIN OPERATION ON THE NEW LINES

On both the lines hourly service is given, to maintain which but one car is required on the St. Marys division. At the present time, two are required on the Sullivan line; but, when the line is completed to Sullivan, three will be employed. The fare on both divisions is approximately 2 cents per mile. On the Sullivan division, the five towns of any consequence are located approximately five miles from each other, and the distance between each town constitutes a section over which 10 cents is charged. This will give a fare of 50 cents to Sullivan. At the present time, the paralleling steam road is charging $1.55 for the round trip.







FRONT AND SIDE ELEVATIONS OF CAR

Freight traffic has already been developed to a considerable extent on both lines, a freight and express car making one round trip daily over each. At present, the freight is of a miscellaneous class, such as is required by the merchants in the small towns along the route.

NEW CARS FOR THE SULLIVAN DIVISION

Three new cars have been obtained and a fourth recently ordered for the Sullivan division, and these have an interior arrangement of compartments and motorman's cab somewhat out of the ordinary. The car is, in fact, of the same type as used on the interurban lines out of Milwaukee, Wis., and was described in detail in the STREET RAILWAY JOURNAL for Sept. 5, 1903. The body of the car might be said to be continuous to the bumpers, as there are no vestibules. Of the three compartments into which the interior is divided, the passenger compartment in the middle of the car is the largest. On one end is a smoking room, while on the other is a combination baggage and passenger compartment. The cabs, one in each end of the car, occupy the left corner of the compartment at the front of the car, and are separated from the compartment by sliding doors. When at the rear end, the cab is converted into an entrance or vestibule by sliding these doors back and lifting a trap door. The toilet room is located in one corner of the main compartment, and is provided with a Hart sanitary closet, the supply of water being obtained from a copper tank overhead in the motorman's cab nearest the toilet room. A Franklin hot water heater is placed in the baggage compartment. The car, although but 51 ft. 6 ins. over bumpers, seats sixty-four people. This comparatively large capacity is obtained by reason of the fact that no room is lost by

giving up space to vestibules of the customary type. The body of the car is mounted on Baldwin trucks, upon each of which is hung two GE-73 motors each of 75 hp. Sprague-General Electric type M control and Westinghouse automatic air brakes, fitted with graduated release connections, are employed.

ADDITIONS TO POWER HOUSES

The article to which previous reference has been made, described at considerable length the two power houses of the company in Terre Haute. One of these, the Water Street station, has recently been enlarged by the addition of a 1500-kw Curtis steam turbine, while the old station at Ninth and Cherry Streets has had its current output for railway work increased by the installation of a 500-kw synchronous motor-generator set operated by current from the a. c. bus-bars tieing the two stations together.

To install the new turbine in the Water Street station, it was necessary to enlarge the boiler room only, as the operating room was built originally of sufficient size to accommodate the additional machine. In the extension of the boiler room were set two B. & W. type horizontal water-tube boilers of 520 hp each, these being of the same type as the two originally installed. The boilers are guaranteed to carry an overload of 50 per cent for two hours. Under a test, however, one of the old boilers was fired at the rate of 1000 hp for one hour continuously.

In connection with the new turbine, auxiliary apparatus was installed of the same type as that used with the smaller turbine, which is of 500-kw capacity. On the main floor were installed a 10 in. x 18 in. x 18 in. dry vacuum Alberger condenser pump, and a 6000 sq. ft. Alberger condenser. The new pump for supplying cold water to the condenser was located in the basement, and to supply it an additional 16-in. main was laid from the cold well, located at the water's edge of the Wabash River near by.

The new turbine, although rated at 1500 kw, has an overload capacity far greater than this amount. The machine has a total of eighteen automatically-controlled valves supplying steam to the vanes. On several occasions when operating above the rated capacity, but eleven of these were opened.

The most noticeable feature of this station, is probably the size of the operating room as compared with the capacity of the machines installed in it. Although measuring but 49 ft. x 35 ft., it contains equipment which, in an emergency, is capable of generating more than 2500 kw for a considerable length of time.

FUNERAL TRAINS TO BE RUN ON THE AURORA, ELGIN & CHICAGO ELECTRIC RAILWAY

As soon as elevators are installed by means of which coffins can be raised to the platform, especially equipped trains for funerals will be run to the Roman Catholic Cemetery of Mount Carmel by the Aurora, Elgin & Chicago Electric Railway and the Metropolitan Elevated Railway. The trains to the cemetery will be run through from the Metropolitan station in Fifth Avenue, stopping at designated funeral stations.

The West Chester (Pa.) Street Railway Company has done away with excursion tickets on its various lines, and substituted straight 6-for-25c. tickets in their stead. This increases the single fare to Downingtown from 10c. to 12½c., and to Kennett Square and return from 50c. to 60c. The company claims that the advance is necessary, owing to the expense of operation.

THIRD ANNUAL CONVENTION OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION, I.

The third annual convention of the Iowa Street and Interurban Railway Association was held in the Kirkwood Hotel, Des Moines, Ia., Thursday and Friday, April 19 and 20. Practically all of the electric railway operating companies in the State were represented. The meeting was opened at 10 o'clock Thursday morning by H. H. Polk, president of the Inter-Urban Railway Company, of Des Moines, who welcomed the convention to the city, after which President George B. Hippee delivered the president's address. President Hippee referred to the origin of the association three years previous, and to the poor encouragement met by the secretary in the beginning. At the meeting a year previous in Dubuque, however, there had been an awakening of interest. In referring to legislation in Iowa during the past year he said that a new vestibule law had been proposed. He also mentioned the "long and short haul" bill. The "Sunday closing" bill, he said, was advocated by a class who believed all goodness was bound up in the churches. Summer Sunday amusement parks, he continued, were most potent factors in the promotion of temperance. Amusement and the desire for intoxicating liquor did not go together, and the police court records would bear this out. Since Sunday amusements had been in force Sunday was one of the smallest days in those courts. He thought legislation on Sunday amusements should be left to the people of each community, rather than to the State Legislature. One of the best acts of the Legislature was the anti-pass bill, and he expressed himself as being sorry that it did not include street railways as well as interurbans. At the conclusion of his address, President Hippee extended to the association, an invitation from the Des Moines City Railway Company, the Inter-Urban Railway Company and the Des Moines Edison Company to a smoker to be held in the Elks' Hall at 8 o'clock in the evening.

The report of the secretary was read, and showed that every operating company in the State, with the exception of four, were members of the association. The report also showed the finances of the association to be in good condition.

The first paper on the programme, "Transfers—Their Use and Abuse," by John F. Ohmer, of Dayton, Ohio, was then presented to the association. The following is an abstract of this paper:

TRANSFERS

Mr. Ohmer pointed out that so much has been said and written about transfers, their uses and abuses, that the subject has grown threadbare, but so little has been said along the lines of prescribing remedies to cure the evils that, in the writer's opinion, there is room for further discussion. The common medium of exchange given passengers whereby they are permitted to leave one car for another continuous journey is called a "transfer," but the application of this transfer to so many and varied uses suggests the propriety of giving it another name. Instead of the transfer subserving its purpose as a medium of exchange for a continuous ride upon the first connecting car, it seems to have developed into a commercial product subject to various uses. It is a stop-over privilege ticket subject to the use of holder or his transferee; it has developed into a commodity, bought and sold by newsboys; it is in some cases an exchange ticket for the convenience of clerks and employees in large stores living in different directions, and it is not unusual to find it an exchange ticket for cash wherever it can be substituted for cash by employees. It is used in all colors under the sun, and the

forms of printing are as varied in number as there are railroads in the country.

The transfer is a convenience to the public, and it was introduced for the purpose of permitting the passenger to continue his journey in another car than that upon which he pays his fare, but its successful introduction and popularity have brought about conditions under city ordinances which were not at all contemplated by railroad companies. Among these unjust and discriminating ordinances there are none which work so much hardship to the railroad companies as the giving of transfers in exchange for a transfer. A passenger pays 5 cents and transfers to another line, the second line pro rates with the first, each line getting 2½ cents. The passenger transfers the second time, and on the same pro rata basis each line will get 1¼ cents for the ride, and by continuing to transfer from one car to another in his merry-go-round about the city, the pro rata subdivision of payment for that ride becomes very small. In other words, the railroad company cannot issue indiscriminately transfers upon a transfer without sustaining direct loss, to say nothing of the indirect losses by reason of multiple opportunities for manipulation. Before the introduction of interurban service the traveling public was content to pay 25 cents or 50 cents to the transfer companies for a ride from the steam railroad station to the hotels in the city. Now the interurban cars invariably run to the best hotels in nearly all cities, and save to the passenger the 25 cents or 50 cents that he is satisfied to pay to the transfer companies connecting with the steam lines. This extraordinary benefit and economy derived from interurban service the public generally appreciates until some wiseacre conceives the idea that it would be a good thing for the interurban to issue transfers. The subject is agitated and an ordinance introduced, and lo and behold, the interurban railway company, in addition to its satisfactory and economical service, is compelled to issue and receive transfers to and from other lines. Why should a traction car, conveying passengers from one city to another, be compelled to exchange transfers with the city properties any more than should the steam lines be compelled to exchange transfers with the car lines running to the steam road stations? The ordinary alderman is too elastic and readily yields to any proposition which seems to burden the railroad companies.

Mr. Ohmer then spoke of some of the more common abuses of transfers. The transfer is abused by the employee, by the public, and by the company. It might be unnecessary to refer to the abuses chargeable to the employee, for since the introduction of the transfer system the employee has been the target to which all losses and complications, arising from the use of transfers, have been directed. The writer, from personal observation, inclines to the opinion that more losses are sustained by the railroad company from the abuses by the public than from those by the employee, and that ordinarily the company itself is responsible for the abuses by both the public and the employee. Many companies in the larger cities still cling to the old-time one-fare register, and the conductor is instructed to ring up 5-cent fares and transfers together, and in settlement he must have a total of 5-cent fares and transfers to correspond to the total number registered, and no matter how many transfers are substituted for cash fares, so long as he turns in the proper total, he complies with the rules of the company, and, thereby, his conscience is clear. Other companies in the larger cities, having a one-fare register only, undertake to eliminate the substitution of transfers for cash by issuing a manifesto that the transfers have no cash value to the conductor, and thereby do not register transfer collections. Just how the cash value of a transfer is removed, because the company decides it has no value and that it need not be registered, has never been explained, nor can it be explained.

The writer believes that so long as a transfer is good as a medium of exchange for transportation, just so long does the cash value remain, and manifestos and orders from the railroad office to the contrary, notwithstanding, do not remove its cash value, which remains until it is actually in the hands of the cashier of the company. Its cash value to the passenger ceases by its time limitation, but its cash value does not cease, so far as the conductor is concerned, until he has made his returns, either directly or indirectly, to the company for all collections made. The non-registration of transfers offers to the yielding conductor a better, or at least an equal opportunity to manipulate, as where transfers and cash are registered together; although he is told by the company that the cash value is removed from the transfer and that he must not register it, at the same time he is demanded to collect from every passenger either a 5-cent fare or a transfer for the ride. Every conductor fully appreciates that the little transfer has its 5-cent value just the same, and his rake-off is measured by the number of fares collected and not registered. The transfers not being registered make it easy to omit the registration of cash fares.

The introduction of the plurality-fare recording register has, in the writer's opinion, offered a satisfactory solution of this problem.

Mr. Ohmer laid emphasis on the fact that the railroad company is a creature of the public and is subject to its desires. As a rule, the public fails to appreciate legislation affecting the rights of any public utility service, and it fails likewise to respect the rules and regulations made by the utility company for the interests of the public, but it does not fail to take advantage of all opportunities offered, apparently to its advantage. One of the early and best innovations to the transfer was the time limit, which was introduced by the well-known transfer expert, J. H. Stedman, of Rochester, N. Y. He provides the means for fixing time limitations.

Statistics show the following with respect to the operation of the Chicago City Railway Company transfer system, as representing the growth and development of the use of transfers over a period of twenty years, 1884 to 1904.

	1884	1904
Number of distinct routes operated	19	182
Number of transfer points	2	94
Average number of transfer passengers carried daily	4000	207,728

From these figures one will realize the enormous increase in the transfer distribution, and it is safe to presume that the same average increases are shown elsewhere every year. With this enormous increased traffic it is an impossibility for the conductor to punch, by hand, the time limitations on each transfer issued. If he takes time to do this, he will do it at the expense of collecting some of the cash fares, and rather than lose fares he is licensed to punch transfers as best he can, and it naturally follows that there is no regularity about time limits, and the passenger is not slow to recognize this fact, and takes advantage of the opportunity to use the transfer as a stop-over privilege good for himself or transferee, being mindful always that a 5-cent value attaches to the transfer within the time limitation. For this reason a large number of passengers ask for transfers for no other purpose than to use them for stop-over privileges or to apply them in other advantageous channels. It is difficult to measure the losses from this well-known abuse by the public, but it is sufficient to say that the loss sustained is very great.

The writer then prescribed the following remedies: Let

the transfer be simple in form and distinctly printed. It should be easily read and understood. It should also be of such form that it can be rapidly, yet accurately, issued with the proper time limitations, and it should give means for transfering passengers, without confusion, from the car of one line to that of another within the prescribed limitations. It would be rather difficult to prescribe a form of universal transfer which might be used upon all roads and under all conditions, but that the majority of railroad companies could unite upon a system of transfer, the character of which might be generally uniform, there can be no question of doubt. The streets or transfer point connections are not necessary in the majority of cases. Transfers should be issued with time limitations and direction properly indicated. It matters not whether the passenger takes a white or green car, so long as he boards either one within the prescribed limitation and in the direction designated. Some of the largest cities have eliminated the indication of connections, and others have expressed their intention of doing so. A number of companies have more transfer points than can conveniently be printed and punched, separately, so they are printed in blocks, two, three and four points together, and the block punched, giving to the passenger the option to take any line included within the block. Why not eliminate the designation of street connections? The transfers used on the north and south lines of the New York City Railway Company are good on any of the crosstown lines. The transfers issued by the crosstown lines are good upon any of the transverse cars on north and south lines. The elimination of street connections lessens the burden of the conductor and gives the passenger his option of taking one of several lines moving in the same direction for which the transfer has been issued, but he has no more latitude than the exercise of his option to ask for a transfer upon any line he desires. Cut out the street limitations and save to the conductor time which is lost by ascertaining from his passengers the line upon which they desire to transfer. If the question of direction only is involved, it will simply be north or south, east or west, and no further questions need be asked.

Mr. Ohmer spoke of the Ohmergraph, and said the conductor with the hand punch must either sacrifice fares at the expense of properly punching the time limitations, or if he is instructed to collect his fares first and punch the transfers as best he can, then he takes advantage of the license and either punches many transfers together or punches them at his own convenience and irrespective of time limitations. From the time a transfer is issued and until the expiration of its time limitation it has a fixed value equivalent to the price charged for a fare, and the indiscriminate issue and giving away of transfers will be largely limited if a registration is made for each. Besides, if each transfer issued is registered, the conductor cannot and will not issue transfers indiscriminately for fear of detection. With the ordinary transfer pad and hand punch both hands of the conductor must be used, and any system that will relieve both the mental and manual work of the conductor should be a welcome innovation. A system, with which he was previously connected, attempt single operation, to issue, record and perforate the time limitations accurately and with despatch, and not to require more than one of his hands to do it, would be ideal. This is found, in the writer's opinion, in the Ohmergraph—a little machine worn on the side of the conductor. It will perforate the month, the day, the direction, the hour and the fractions, and it issues and records each transfer in less time than the conductor could place his hand in his pocket for a pad. Transfers put up in rolls of two hundred and three hundred each are enclosed within the machine. They are checked out to the conductor by the consecutive number and also by the register record. The operation requires one hand only of the conductor, and the transfer is properly punched, issued and recorded in one operation by the movement of a single lever. While it might be preferable to eliminate the perforation of the connecting line, at the same time the Ohmergraph will perforate anything printed upon the transfer, but it will require a movement of the perforator each time the connecting line is changed. With each transfer issued the bell rings, and the number of bell rings must indicate the number issued. The punches for the month and day are enclosed in the machine and are not accessible to the conductor. The punches controlling the hours, the minutes and the direction are available to the conductor and can be set in an instant to the required time, and the conductor needs only to move the hour punch once an hour and the minute punch once in fifteen minutes, and the direction punch is moved simultaneously with the issuing of a transfer.

Transfers are now employed upon all or nearly all city properties, and the number used will vary, according to the size of the city and the traffic. The increase in the use of transfers has been enormous, and carefully compiled statistics show that the number has grown beyond the normal increased traffic, while the average fare per passenger (cash and transfer passengers) has seriously decreased. It will be interesting to note some data taken from a recent comparative report of one of the largest city railways:

	1884	1904
Percentage of transfer passengers to cash passengers	4.6	50.7
Average fare per passenger (cash and transfer passengers)	$0.0478	$0.0313

This shows an average decrease fare per passenger of 32½ per cent, which, if applied to the gross traffic earnings of $2,000,000 per annum, figures a shrinkage of $650,000, and on gross traffic earnings of $8,000,000 shows a shrinkage of $2,600,000, while the average length of lines increased about 100 per cent, with chances for manipulation and abuses increasing accordingly. These figures are rather startling but their application is probably pertinent pro rata to all city companies. It, therefore, behooves the authorities in control to give time to this most important question for serious consideration.

Following the reading of the paper there was an animated discussion on the general subject of transfers. R. A. Leussler, of Council Bluffs, said that issuing transfers according to directions as advocated by Mr. Ohmer would result in many complications on the Omaha city lines. A person on an east bound car by the use of a transfer to a north-bound one could return to his point of starting. In Omaha, he said, transfers were not registered, but the conductor was compelled to deposit them in a locked box on the car after each half trip. Those for each half trip were placed in a small envelope bearing the badge number. Transfers were checked in the office, those of one line being examined one day and those of another line at another time. He added that on another system with which he was previously connected, attempt was made to check every transfer, and to mark the conductors short when the count showed it. About thirty-five boys were employed in counting the transfers, and they made frequent errors. He believed this practice leads to dishonesty on the part of the conductor, for when he was charged up with a shortage which did not exist, he would naturally pocket fares to make up for the amount charged.

P. P. Crafts, of Clinton, said that his line, the Iowa & Illi-

nois Railway Company, is not troul.ed with the transfer question, as it issued transfers only in the terminal cities, Clinton and Davenport. He thought, however, that transfers should be registered as a separate item. This reduced the actual cash value of the transfer, and the conductor could be checked at any time. On another road, with which he had been connected, the conductors were compelled to put transfers into a box on a pole at the end of the route. To insure the conductors doing this at the end of each trip, a special agent made collections at intervals. In respose to Mr. Craft's question as to whether or not the reduction in the pro rata cost of fares was due to abuse or increased use of transfers, Mr. Ohmer replied that he thought it due to increased use.

R. M. Howard, of Clinton, said he used a double register, which registered cash fares on one side and nothing but paper tickets on the other. There were three transfer points on his line, and he employed three different colors of transfers.

A. G. Maish, superintendent of the Des Moines city lines, said his company had found it necessary to register transfers. Checkers and secret service men were also employed. The most common mistake in punching the time of transfers was an error of one hour, and this the conductors usually claimed was due to a sudden lurch of the car. Instead of using a box on a pole, the transfers collected on each trip were placed in an envelope bearing the conductor's badge number, the number of the last transfer he had issued, and the conductor's transfer number. The number of the last transfer issued on each trip facilitated checking. All conductors were checked at frequent intervals. Mr. Maish stated that 12 per cent to 15 per cent more transfers were issued in Des Moines than were collected.

At the conclusion of the discussion of Mr. Ohmer's paper, the convention adjourned until 2 o'clock in the afternoon.

THURSDAY AFTERNOON SESSION

The afternoon session was opened by R. W. Conant, of Cambridge, Mass., who presented a paper on "Rail Bond, Field and Armature Testing." The following is an abstract of Mr. Conant's paper:

BOND AND MOTOR TESTING

Taking up the subject of bond testing, Mr. Conant remarked that up to a few years ago the problem of returning the current to the power station had been treated in the light of the telegraph and railroad signal experience of the day. In telegraphy the current was successfully returned by means of the earth. The railroad signal current was amply provided for by the rails, bonded with a small iron wire. As it soon became apparent that the larger volume of current necessary to street railway operation could not be successfully returned in this way, other means were tried, such as using a supplementary wire, return feeders, etc. Success was not met with along these lines, and the rail was again resorted to, so that finally the problem resolved itself into making at each rail-joint an electrical connection sufficiently large and perfect to carry the current, and of maintaining this condition throughout the life of the rail. The writer pointed out that what may be found to be a practical solution on some roads is a very imperfect solution on others; first, because of the difference in the volume of the current, and, second, because the mechanical and electrical difficulties on some roads are much more serious than they are on others. If the current is forced to overcome great resistance on its return to the power house, heavy losses of power will result; pipes may be corroded, car schedules slowed down, and motors will be overheated. A few badly bonded joints may easily introduce a large resistance into the return circuit, even though the majority of the bonds are perfect. On the other hand, a large number of poorly but not badly bonded joints will produce a like result.

Mr. Conant then spoke of joint resistance, and said the efficiency of a bonded rail joint is best stated as so many feet of the adjacent rail, as the equivalent in resistance, and the unit is usually 3 ft. of joint and rail. When speaking of the joint testing so many feet of rail, it should, therefore, be understood as meaning the test of a 3-ft. stretch with joint at the center. This 3-ft. stretch gives a uniform test length sufficient to include all the usual styles of bonding. If a joint is perfectly bonded up to the full capacity of the rail, the joint would then test equal to 3 ft. of rail. This figure represents a highly efficient joint, being, in fact, electrically equivalent to a continuous rail. As the joint becomes less efficient its resistance increases, and the test figure becomes higher. With perfectly installed 0000 double bonding on an 80-lb. rail, the usual test figure is found to be 4½ ft. From 3 ft. to 9 ft. may be considered good bonding. From 9 ft. to 18 ft. is to be considered poor bonding, and above 18 ft. is bad bonding. While these definitions of the terms good, poor and bad, are somewhat loose when dealing with any particular joint, they are accurate enough when applied to a large number of joints that have been tested on a stretch of track to ascertain whether or not there is great loss in the return circuit. Where the rails are in 30-ft. lengths and the joints have an average resistance of 6 ft. of rail, then the total resistance of one mile of rail so joined will be equivalent to one and one-tenth miles of continuous rail. In this manner, it is possible to figure out the equivalent increase in length of any rail tested. In investigating the efficiency of individual joints, it is, of course, of great value to know the exact test figure. This, coupled with the knowledge of what a joint so bonded should test, gives all that is required to enable one to bring the bonding up to the standard.

The writer gave a few standard figures showing what has been obtained in practice in good bonding work. The cast-welded joint properly installed will test 3 ft. of rail or better. Two 10-in 0000 plug bonds correctly installed in a 90-lb. rail will test 4½ ft. One 6-in. 0000 bond soldered to 75-lb. rails will also test equal to 4½ ft. of rail. These are the initial test figures before the joints have been subjected to service. Since on any road there are so many joints (252 joints per mile of single track laid with 30-ft. rails) subjected to the varying conditions of motion, moisture, freezing, thawing, etc., a test taken in the spring following the first winter will give results of great value. It has been thought by some that the fish plates alone would be sufficient to economically carry the current across the joint, and that when coupled with the bonding would add materially to the electrical efficiency of the joint. Practical test shows this not to be the case on account of the rust at the contact surfaces. The fish plate contact resistance alone is often equal to many hundred feet of rail, so that its effect in lowering the resistance of a bonded joint is inappreciable unless the bond happens to be open circuited.

Mr. Conant then considered the difficulties to be overcome in making perfect bonding, as disclosed by tests on the various styles installed under different conditions and length of service. Assuming that the bond has been selected of sufficient cross section, he stated the most important point is to install it so as to make good electrical contact with the rail. This is where most bonds fail, for if the slightest crevice is left between copper and iron, the moisture will rust the iron surface in contact with the copper and prove fatal to the bond. It is no exaggeration to say that there might as well be no bond at all as to have one installed so that a layer of rust intervenes between copper and iron at the surface of contact.

If it is a pin-driven bond in which the terminal is a copper sleeve expanded by a steel pin, then the pin must be of the right size as well as the terminal. If either the pin or the terminal is too small, the copper will not be forced outwards with sufficient force to properly fill the hole in the rail. If the pin is too large, the copper terminal is likely to be crowded out of its proper shape in various ways, and not expand uniformly into the hole. A common defect in installation is to neglect to drive the pin at all. This, of course, is fatal to the efficiency of the bond, and the bond may as well have been omitted altogether. In a compressed bond similar carelessness will have like results. In all protected forms that go between fish plate and web of rail, sufficient room must be given so that no amount of drawing up of fish-plate bolts will jam the bond, otherwise loosening and breaking will result. If there is much movement to the rail, the bond must be long and flexible, while for rails that are solidly embedded in pavement, a shorter bond will be sufficient.

The author cited a case in point, showing the necessity for suiting the style of bonding to the conditions of service. An interurban electric line owned by a steam road was equipped with some of the old steam rails. The worn ends had been cut off, leaving about a 28-ft., 70-lb., 6-in. T-rail, which was joined with one of the well-known forms of continuous joint. Two 10-in. flat strand 0000 protected plug bonds were carefully installed at each joint, by competent men. The track, which was laid in private right-of-way, was sand ballasted. For a portion of the way the sand reached to top of ties only, while on the rest of the road, it covered the ties and came nearly up to the top of the rail. The track had been down about a year when it was reported that all the bonds were working out through the joints in the shape of flat leaves of copper. This report was investigated and the line carefully tested, with the result that on the less liberally ballasted portion about one in every ten joints was found to be bad. Practically all the joints on the covered portion of the track were found to be good. About one quarter of the bad joints showed signs of the flattened copper projecting out through the space between rail ends and back of fish plates. Closer investigation was made to determine the cause of the trouble, attention being first directed to the bad joints that showed nothing unusual in their external appearance.

Upon taking off the fish plates at one of these joints the bond was found to be broken in several of its strands. Others of these joints were then inspected. In each one the bond was broken and always at the same place, namely, in the loop or crimp of the bond. In order that the proper remedy could be applied, it was necessary to find the cause of the bonds breaking. By taking off the fish plates on some of the joints that were all right, and carefully studying the difference between these and those on the bad joints, the clue to the solution was finally found. Here was the evidence: At each defective joint the fish plate and the rail at the bearing surfaces were both polished, while on the adjacent perfect joint, both fish plate and rail were uniformily coated with a layer of rust. It was, therefore, concluded that there had been slippage at the defective joints, caused by the daily longitudinal expansion and contraction of the rails. The very considerable amount of this motion, which caused the bond to be alternately stretched and pushed together, was due to the transmission of the longitudinal movement by the firmly rusted joints to about every tenth joint which slipped. The flexion in the copper strands took place either at the bottom or top loop, causing the bond strands to break, as will any piece of metal constantly bent backwards and forwards. Some of the fish-plate bolts at the defective joints were offset, and nearly sheared off in the direction of the length of the rail, thus further corroborating the conclusions. That the breaking of bonds was confined to the uncovered portion of the track was due to the fact that the covering of sand kept the temperature of the rails more uniform. In regard to the flattened-out copper leaves that projected from some of the joints, at first sight, it looked as if the bond had been rolled out by the car wheels. The clue to the explanation of this remarkable phenomenon was obtained by watching one of these particular joints as a car passed. Under these circumstances it was noted that this joint deflected more than the rest, showing that the foundation under it was not so firm nor so well able to resist the weight of the car. When the fish plates were removed, it was noted that this bond was not broken in the top loop, because the fish plate fitted so closely that it pinned the top strands at the loop, confining the expansion and contraction to the straight portion of the copper strands.

Based on the foregoing observations, the author offered the following explanation of the phenomenon: It is clear that the entire expansion and contraction of ten rail lengths, concentrated at one joint, would open and close the space between rail ends of that joint a considerable distance. Now, when all this movement of the bond was taken up, by bending at the top of its loop the strands eventually broke. When, however, the fish plate was drawn up by its bolts, so that it pinned the loop, the bond instead of bending here, arched itself up so that the foremost strands wedged themselves into the V-shaped space between the top edge of fish plate and head of rail. Of course, the first time the strands were pushed up into this space they were entirely too large to be forced outside of the joint through the narrow crevices back of fish plate, but as a car passed, its weight on the loose joint squeezed the strands of the bond that were wedged between fish plate and rail, and flattened them somewhat. At the next cycle of change of rail temperature, the expansion would push the now flattened strands a little farther up into the V-shaped space back of fish plate and the cars would squeeze the copper a little more, until finally it was flattened out as thin as paper and pushed out through the rail joint back of the fish plate, until it looked as if the joints were sprouting copper blades of grass.

The peculiar feature of the copper working out through the joint is not often met with, but the breaking of bonds is of rather common occurrence. The most common fault found in bonding is terminal trouble, due to rusting between the contact surface of the bond terminal and rail. Almost any road whose rail bonds have not been looked after for a year or more will have from ½ per cent to 1 per cent of its bonds defective, and usually about 90 per cent of this trouble is due to moisture rusting the rail at the inner surface of the bond hole. The figures, ½ per cent to 1 per cent, are to be taken as applying to roads using a plug bond under favorable conditions. Many roads are so poorly bonded that this percentage only of good bonds would be found. Then, of course, there are roads whose condition of bonding falls somewhere in between these two extremes.

The author next passed to the subject of motor testing, and after reviewing the history of railway motor designing and outlining some of the more common motor troubles, took up the matter of making armature tests. In his opinion, the only test that is really of much value for an armature is to put it in a motor frame and run it as near as possible under service conditions. Experience has shown that a high voltage test, while it locates some of the armature faults, does not locate all, and that many times an armature will come in burned out but a few hours after passing this test. The running test in motor frame shows up so many more of the armature defects than can be discovered by any of the simpler instru-

ment tests, that it hardly pays to make these latter at all. This should be taken as applying to the average medium-size road. There are, of course, exceptional cases where this statement is not true.

He then discussed field testing, and said the prime defect in all field trouble is caused by some of the turns of the coil short circuiting upon themselves. There are two principal causes bringing about this short-circuiting. First, baking by heat, and second, moisture. The limited space beneath the trucks which is allowed for a motor, as well as the motor's excessive first cost, usually prevents a company from obtaining a motor of sufficient size to do the work, without overheating. A large motor of ample design effectively radiates the heat, as is seen in the case of stationary shop motors. In the case of a series railway motor, since all the current passes through armature and fields in series, the heat is generated in all parts of the winding in proportion to the square of the current and amount of the resistance. As the fields heat up, their resistance increases, which in turn causes heat to be generated at a more rapid rate even with the same amount of current flow, so that this heating action is cumulative to a surprising degree. This overheating is not by any means confined to exceptionally heavy service, but takes place under ordinary operating conditions. Dry cotton, which is the basis of all the usual wire insulation, has but a limited life when subjected to this long continued baking. The highest temperature reached on each run in service impresses itself on the cotton, scorching it, as will a hot flatiron on cotton cloth. Each succeeding run scorches it a little more, until finally it is reduced to a brownish powder, which crumbles and allows the bare wire turns on a spool to short-circuit. This weakens the entire field and the motor, therefore, takes more current to do the work, now piling up heat still more rapidly in both field and armature windings.

If the defective field spool can by test be located and replaced much of the damage will be prevented. It is worthy of note that on account of the cumulative action before referred to, it takes but a slight difference in ventilating conditions between spools in the same motor, to make one of them, usually one of the top spools, short-circuit long before any damage has been done to the rest. This is contrary to the usual idea that all the spools are bad if one is bad. Where systematic testing has been adopted, this statement is abundantly born out by the results in practice, and much saving thereby effected. Tests of the resistance, which have been somewhat relied upon to locate bad fields, will seldom disclose the defect, because the change in resistance of a field coil due to a short-circuit is very slight, and is swallowed up by larger changes in resistance, due to poor contacts, temperature variation, etc. It is very important to have some method of testing the fields that does not involve skilled observation or calculation, that will plainly indicate whether or not a spool is faulty and without disconnecting the motor or car wiring, and while the fields are still in the motor under service conditions. Even under the best conditions the ordinary heating that fields get bakes the insulation and renders it brittle, so that if a spool is removed for test or for any other reason and put back into another motor, the shaking up that it gets greatly shortens its life. But if the bad spool only is replaced, leaving the others undisturbed in their places in the motor, although they may be partially baked but not actually short-circuited, it is surprising how long they will last and continue to give good service.

An advantage of being able to test the fields while in the motor obtains from the fact that owing to the springing apart of the turns of stiff field wire when the field clamping plates are loosened, some classes of defect apparently disappear. Occasionally it is advantageous to test the motors hot, just as they come in from service, for the reason that certain rare but troublesome defects are thus located, while if the motor is allowed to cool off, the defect apparently disappears, but immediately recurs again as the motor warms up in service. This is due to the expansion of the copper by heat causing more pressure between the poorly insulated field turns which short-circuits the coil. The difficulties arising from moisture entering the fields are often very troublesome, mainly for the reason that a field damaged by moisture shows no evidence of any deterioration on the outside. Even when stripped down to the cotton-covered wire it looks white and new, but a test will disclose a bad short-circuit somewhere in the coil. It is usually the bottom spools which get the moisture and they are not subjected to so much heat as the top spools, consequently the cotton is not discolored on the outside. When, however, a layer or two of wire is unwound there is seen throughout a part of the coil a greenish discoloration. This is due to electrolysis of the copper, and careful examination will disclose an electrically pitted place eaten through the cotton into the copper wire. This frequently occurs at one of the inside corners of the field spool, between two wires that short-circuit and cut out two or more layers of the coil. Moisture troubles are quite common with some types of motor, notably those which allow the condensation to settle near the bottom field spools.

Mr. Crafts wanted to know if a preliminary and rough test of the bonds could not be made by running out on the line with a single car and taking ampere and voltage readings at intervals of one mile, using the same amount of current for each test. He suggested that for a line having two 0000 trolley wires and 70-lb. rails, 200 amps. be used. Mr. Conant thought this a very good way to make a preliminary test.

In response to a question as to the life of bonds, Mr. Conant said that plug bonds, if put in properly, were good for five years, and probably longer. He had tested soldered bonds after two years and found them all right.

H. B. Noyes, of Omaha, said he did not see why a better class of workmen were not employed to install soldered rail bonds. He thought this work as important as the soldering of armature terminals, and believed the same class of workmen should be employed.

At the conclusion of the discussion on rail bonds, the convention held a joint meeting with the Iowa Electrical Association, which was assembled in another room of the hotel, and listened to an address by Hon. M. J. Wade, of Iowa City, Ia., on the "Political Status of Rate Regulation."

On convening in regular session again, that portion of Mr. Conant's paper on the testing of armatures and fields was taken up.

F. W. Hield thought a simple test to determine the condition of a motor was to use a thermometer and observe the rise of temperature.

Mr. Noyes suggested as a test for defective fields, that two 500-volt voltmeters be placed across the terminals of two motors of a car, and the motors be run in series. Equal readings on the two voltmeters indicated that the fields of the motors were all right. If there was a difference of 5 or 10 per cent between the readings, a field in one of the motors was evidently defective. Usually with a 5 per cent difference the motors would operate very well, but above this he thought it best to repair the motor. He made short tests on fields by letting those supposed to be defective accumulate until he has about fifty. He then connected them all in series with a good field, and then put 60 amps. through them. By means of a voltmeter and a double-throw switch, he compared the volt-

age drop across each field with the drop across the good field. Mr. Noyes stated that he was using asbestos-covered wire to wind his fields.

L. D. Mathes, of Dubuque, said that at one time he was having trouble with armatures sparking at the commutator. The trouble was supposed to be due to defective armatures. Tests, however, showed that 66 per cent of the fields had been baked out. On replacing these fields with new ones, the trouble was eliminated.

"Discipline of Car Service Employees" was the subject of the next paper, which was presented by J. G. Huntoon, of Davenport. This paper was as follows:

DISCIPLINE OF CAR SERVICE EMPLOYEES

Discipline means to the disciplinarian not only the meting out of punishment to the guilty, but training of the novitiate in the rules and regulations by which a body of men is kept in a state of efficiency and order. This is accomplished by a careful selection of men, of good moral character, backed up by the best of references. The superintendent of employment should abstain as far as possible from appointing to the operating department men whose chief recommendation is from some politician or office holder, who is endeavoring to pay his political debts by recommending to the consideration of the company one of his allies, and a vote getter, who, in his opinion, would be a good man for the company. The writer does not believe that applications of this character should be entirely ignored, as good men are occasionally picked up in this way, and the question of policy applies, but other references than those first presented should be insisted upon.

Applicants for a position should be closely questioned as to their past, their fitness for the position, their habits, etc. At least four letters of reference should be furnished by applicant from good, reputable men, former employees, if possible. A company often gets letters from the butcher, the baker, the groceryman, and the clothing dealer, recommending men for employment. Letters of this character should be looked into closely, as often there will be found a motive back of them. The applicant brings a letter from the dealer to the superintendent of employment. The superintendent should scan the letter closely, and try to find out by close questioning, whether the applicant is really the man he is looking for. Often he is not, as the real reason for giving the letter and lauding the applicant's virtues is sometimes a small account that the merchant hopes will be paid should the applicant secure a position on the strength of the recommendation. Some men, and they are numerous in every city, have the recommending habit. They gladly recommend any one, regardless of character or fitness for the position sought. It is difficult to say what the motive for giving letters of this kind may be, but the writer suspects that the chronic recommender takes pleasure in impressing on the applicant his own importance, that he has a powerful pull and acts as a sort of guardian angel to the management.

Applicants for employment should be at least twenty-one years of age, of good health and not addicted to the use of intoxicating liquors to excess. In selecting trainmen, we prefer the married men, as being more steady and less liable to leave on short notice. We do not, however, bar the single man, but of the two applicants, conditions being the same, we would select the married man. The successful applicant for employment is required to fill out an application, giving his name in full, date of birth, name of wife, residence, name of father and mother if living, their residence, names and addresses of those dependent on him for support, the length of time and where he has attended school, previous occupation, cause of leaving last situation, whether any previous street railway experience, in what capacity employed, when and where, and cause of leaving. History of the past five years, giving each year in regular order down to date, closing with the following, "I certify that foregoing statements are true, and hereby apply for a situation in the service of the ———— Company, and if accepted, agree to maintain strict integrity of character, to abstain from the use of intoxicating liquor and tobacco while on duty, to refrain from the use of intoxicating liquors to excess while employed by the ———— Company, to familiarize myself with the general and special rules and regulations of the company, to faithfully observe the same, and to keep advised of such amendments to said rules and regulations as may hereafter be made, and to perform all my duties to the best of my ability." This application should be filled out in the presence of, and witnessed by, the head of the department in which the applicant is to be employed. The applicant is then passed on to the surgeon of the road, who examines him as to his physical qualifications. The examination should be thorough, not only as to the eyesight and hearing, but defects and deformities of the body and limbs should also be noted.

Defective sight and hearing should be cause for rejection, as also hernia, and faulty heart action. Weight and height should also be considered, a conductor should weigh not less than one hundred and forty-five, and a motorman should weigh at least one hundred and sixty pounds. Their height should be not less than 5 ft. 6 ins.

The new man should be given a thorough course of instruction in the duties for which he has been selected. Particular attention should be paid to the instruction of the student, by placing him in charge of old and experienced men, who will give him the necessary instructions and prepare him in a proper manner for the examination, which inevitably follows after the student is reported to the assistant superintendent as proficient. This examination covers all the salient points in connection with the position for which he has been selected. After passing a satisfactory examination he is marked up on the extra list, and is then qualified to fill the different runs to which he is assigned, and is amenable to the merit system of discipline, which was adopted Jan. 1, 1903, by the company with which I am connected.

This system was adopted on account of the unsatisfactory ways of the old method of discipline, which was by reprimand, layoff, and discharge. This had been in vogue for years and was inherited by me from my predecessor. Often under this method a layoff meant to the innocent family of the delinquent hardship and actual suffering. In the fall of 1902 our people became interested in the merit system of discipline, as used at the time in Kansas City. Through the kindness of Mr. Satterlee, the general manager of the Metropolitan Street Railway Company, we were put in possession of the details of the system, and after a thorough discussion with the officers of our company, we decided to put the plan in operation on Jan. 1 following. Previous to that date, however, the following circular letter was sent out to all men in the train service of our company:

Commencing Jan. 1, 1903, suspension of trainmen from duty with loss of time will be discontinued, and hereafter discipline for infraction of rules, neglect of duty, and bad conduct shall be by reprimand, demerit marks, or discharge.

On that day every trainman will start with a clear record, except that when subsequent records show that past offenses are being repeated, the person concerned will be discharged or double the number of demerit marks will be entered against him. It will be understood that disloyalty, intoxication, immorality, making false reports or statements or concealing facts surrounding matters under investigation, will be considered a dischargeable offense.

A complete record of all trainmen will be kept, and all discipline imposed will be shown thereon, and credit given for excellent conduct, deeds of heroism, loyalty, etc., and these records will be given full consideration in connection with the charges entered against any trainman. This record will be a private one, and no employee will be shown any record therein except his own. Each employee will be afforded an opportunity for appealing against any decision regarding the number of demerit marks imposed, but such an appeal must be made to the general superintendent within ten days of receipt thereof. When 100 demerit marks are entered against the name of any employee, his services will be dispensed with.

The objects to be attained by this new system are: First, to avoid loss of wages to persons employed, and consequent suffering to those dependent upon their earnings; second, to stimulate and encourage all persons employed in the company's service in the faithful and intelligent performance of their respective duties. This system is introduced with the belief that it will be directly beneficial, and that it will meet with the approval and cooperation of all concerned.

With this letter was sent out sheets specifying the charges under which marks would be given. In brief, the system consists of a debit and credit account with each trainman, using the car index alphabetically arranged. When the demerits exceed the merits marks by 100, the party receiving them is subject to dismissal.

Every man started out with a clear record, but within a short time we noticed that a number of our men were getting demerit marks quite regularly; this continued until some had almost reached the limit, when again a change was noticed, and that was this, the men who had previously been erratic in their conduct were noticed to be endeavoring to please, and were making every effort to win back what they had lost. We have in mind a conductor on one of our lines who was constantly being reported for various infractions of our rules, and had about reached the limit, when, to our surprise, he faced about, and by careful work in looking after the interests of the company, won back all he had lost and to-day is considered one of our best men. Numerous instances could be cited where a man has started out wrong, but has been brought up with a sudden turn to realizing that if he continued along the same lines, he would eventually work himself out of a position.

Any act performed by our trainmen, reported to the office, that meets with our approval, whether reported by an inspector or a disinterested party, is noticed and trainmen reminded of the occurrence by a certificate of merit. We have found that by the judicious use of merit marks, the trainmen are stimulated to greater exertion in pleasing the traveling public and guarding the interests of those who interest themselves in the trainmen's welfare. The man who is first on the scene in the case of a blockade, broken down car, or wire down, who exerts himself and endeavors to clean it up should certainly be commended. The trainmen appreciate the fact that the company recognize their worth, and mentally resolve that the company in the future will again be called upon to recognize their efficiency in other ways.

Mr. Satterlee, in an interesting paper read before the American Street Railway Association, in 1902, entitled "Discipline of Employees by the Merit System," said: "There are many trivial acts, small in themselves, committed by trainmen in handling passengers, that as a whole tend to produce a feeling on the part of the traveling public, either favorable or unfavorable to the company, which once formed is hard to offset. Small acts of courtesy towards passengers by trainmen are felt by the management in ways unknown to the men who perform these acts, and are as far reaching for the good of the company as small acts of discourtesy are damaging.

"To teach employees to be guarded in their talk, their acts and their deportment on duty toward those with whom they come in contact, is a problem more nearly solved in the merit system than in any other way. The value of courteous, accommodating and careful trainmen to any street railway system is of such importance, and so eagerly sought for, that any method of discipline which will accomplish that end will be of such great worth as to make the management of street railway property a pleasure instead of a care and worry that breaks down the health of all but the robust men."

The demerit sheet for conductors consists of a list containing fifty-five demerit and eleven merit charges. For motormen fifty-seven demerit charges are recorded, and the same number of merit marks as on the conductors' list. The different charges are as follows:

CONDUCTORS

Immediate Discharge

1. Disloyalty to company.
2. False statements.
3. Intoxication.
4. Dishonesty.
5. Gross ungentlemanly conduct.

Demerits

6. Failing to report accidents.
7. Giving bells too quickly, before passengers are safely on or off.
8. Smoking on duty.
9. Errors on trip sheet.
10. Shortage.
11. Overage.
12. Missing fares.
13. Failing to ring fares.
14. Failing to properly flag railroad crossing when required.
15. Incomplete and poor accident report.
16. Inattention to passengers.
17. Trouble with passengers when conductor is to blame.
18. Missing out.
19. Dirty car.
20. Untidy condition of dress.
21. Recommending unworthy men for employment.
22. Back headlight burning, except in case of fog.
23. Reading on duty.
24. Sitting down in car on duty, when running.
25. Unnecessary conversation with motorman.
26. Letting boys change trolley.
27. Entering saloons when on duty, without good excuse.
28. Drinking on or before going on duty.
29. Unnecessary conversation with passengers.
30. Accidents, when avoidable in opinion of superintendent.
31. Failure to call street and announce transfer points.
32. Profanity on duty.
33. Disobedience of orders, if flagrant, discharge.
34. Error in punching transfers.
35. Deliberate punching of transfers to permit passengers to lay over.
36. Gambling.
37. Running away from passengers at transfer points.
38. Bad judgment on special occasions.
39. Bad judgment or carelessness in regulating heat of car.
40. Criticising management of road in presence of passengers or others.
41. Failing to turn in unused transfers.
42. Talking about accidents to other than proper officers of the company.
43. Register not turned at end of line.
44. Riding on front platform.
45. Careless and indifferent operation of car.
46. Impolite remarks to passengers.
47. Garnishee.
48. Failing to report register when out of order.
49. Not going ahead and trying to locate trouble when power is off.
50. Acts detrimental to good service in opinion of superintendent.
51. Failing to report delays.
52. Incompetency.
53. Bunching fares.
54. Carrying people free.
55. Taking transfers when time limit has expired.

Conductors' Merits

1. Warning persons in act of jumping on or off moving car, to wait for car to stop.

2. Securing names and addresses of witnesses who saw accident other than those on accident report.
3. Politeness and attention to passengers noticed by company officers.
4. Adjustment of shades and windows to please passengers.
5. Assistance rendered in case of accident, such as to bring commendation from passengers.
6. Informing company of matters in the interest of good service.
7. Complete and perfect accident reports.
8. Good working in handling layout or blockade.
9. Special meritorious act calling for recognition from company.
10. Turning in passes or badges ordered up by company.
11. Twelve consecutive months' perfect service.

MOTORMEN

Immediate Discharge

1. Disloyalty to company.
2. False statements.
3. Intoxication.
4. Dishonesty.
5. Gross ungentlemanly conduct.

Demerits

6. Failing to report accidents.
7. Missing out.
8. Smoking on duty.
9. Failing to make safety stop at crossings.
10. Incomplete and poor accident reports.
11. Untidy condition of dress.
12. Recommending unworthy men for employment.
13. Neglecting to pick up passengers.
14. Running over current breakers and overhead crossings without throwing off current.
15. Allowing unauthorized person to run car.
16. Fast running.
17. Front headlight not burning when required.
18. Entering saloon when on duty without good excuse.
19. Drinking on or before going on duty.
20. Gambling.
21. Disobedience of orders, if flagrant, discharge.
22. Profanity on duty.
23. Accidents, when avoidable in opinion of superintendent.
24. Unnecessary conversation with passengers.
25. Unnecessary conversation with conductor.
26. Failing to report trouble with car.
27. Not answering signals promptly.
28. Feeding current too fast.
29. Running away from passengers at transfer points.
30. Not ringing bell at street intersections.
31. Not ringing bell when passing car.
32. Passing standing car without first stopping.
33. Running ahead of schedule time.
34. Stopping without proper signals, except to avoid a collision.
35. Running too close to wagon upon track, before getting car under control.
36. Following car in front too close.
37. Bad judgment on special occasions.
38. Leaving car without taking reverse lever.
39. Flattening wheels.
40. Injury to car equipment that could be avoided by proper care and judgment.
41. Not obeying conductor's signal.
42. Running railroad crossings without proper conductor's signal.
43. Trouble with passengers when motorman is to blame.
44. Garnishee.
45. Talking to others than proper officers of the company about accidents.
46. Careless and indifferent operating of car.
47. Criticising management of road in presence of passengers or others.
48. Failing to report delays.
49. Not having proper tools.
50. Plugging car except to avoid accidents.
51. Running without sand in sand-box.
52. Acts detrimental to good service in opinion of superintendent.
53. Incompetency.
54. Running with front gate open.
55. Running over obstructions on track.
56. Failure to stop at top of hills before descending.
57. Tampering with brake mechanism or other machinery that has been properly adjusted by regular inspectors.

Motormen Merits

1. Warning persons in act of jumping on or off moving car to wait for car to stop.
2. Securing name and addresses of witnesses who saw accident other than those named on accident report.
3. Politeness and attention to passengers noticed by company officers.
4. Assistance rendered in case of accident, such as to bring commendation from passengers.
5. Informing company of matters in the interest of good service.
6. Complete and perfect accident reports.
7. Good stop in avoiding accident.
8. Good judgment and work in handling layout or blockade.
9. Special meritorious act calling for recognition from company.
10. Careful handling of car.
11. Twelve consecutive months' perfect service.

Operating under this system of discipline for a trifle over three years, we are of the opinion that it is far superior to the old method, and has a tendency to bring the management and trainmen closer together, and inspire them to greater diligence in the performance of their respective duties. The system, however, is incomplete, as some other and more substantial reward should be given to those who, in one year, have to their credit one hundred merit marks—a substantial reward that will not only encourage the man who receives it, but stimulate others to a higher standard.

The discussion which followed the reading of the paper was largely concerned with the "merit system" of disciplining employees. In reply to the question as to whether or not service notices were issued when men were given demerits, Mr. Huntoon said his company did not issue such notices. They did so in the beginning, but abandoned the practice when it became necessary to send out thirty or forty notices a day. In exceptional cases, however, the name of the man receiving demerits was posted.

Mr. Mathes said his road gave substantial rewards to the men for meritorious acts. In one case three vicious characters attacked a conductor. The motorman, who came to the rescue with a switch iron and beat off the ruffians, as well as the conductor, was awarded $25. It was a common practice to give the men $5 or $10, and as high as $50 had been given out to a man at one time. He thought this practice did much to bring the men and the management closer together.

Frank McDonald, of Waterloo, thought that consideration should be taken of the length of service in discharging a man who had acquired the required amount of demerits. A man who accumulated one hundred demerits after a service of ten years did not deserve discharge as much as one who acquired the same number of demerits in one year. He had found that the more experienced men received the most credits.

Before adjournment a nominating committee was appointed, consisting of R. A. Leussler, of Council Bluffs; H. H. Polk, of Des Moines, and Frank McDonald, of Waterloo.

The Cincinnati, Georgetown & Portsmouth Railway has received a special mail car, which will be used exclusively in the mail service between Cincinnati, Georgetown, Russellville and intermediate points. It is fifty feet long, and practically a duplicate of mail cars used on steam roads. The road handles all the mail along its line, as well as to a number of towns off from the line which are accessible only by stage lines, as there is no steam road throught its territory.

SOME PRACTICAL EXPERIENCES WITH STEAM TURBINES*

By C. E. STANTON,
Chief Engineer, Union Electric Company, Dubuque, Ia.

I am expected to talk on the "practical operation" of steam turbines, and some of the few things which we have learned will be described in this paper.

STEP-BEARING PUMPS, BAFFLERS, STRAINERS, ETC.

All step-bearing water passes first through a "Jewel" water filter, thence through the pumps to the strainer which is contained in the "baffler casting"—thence through the baffler direct to the step bearing. By its passage through the baffler the pressure of the water is reduced, so that (in our case) the actual step-bearing pressure is from 180 lbs. to 200 lbs. per sq. in. All shock or pulsation of the step-bearing pumps is also eliminated by the baffler. As the step pumps and the service pump, which supplies the water used in the step-bearing pumps, are packed with a fibrous packing, we soon found we must keep a record of the safe life of this packing—as if left in until it began to lose its elasticity and get soft, small particles and strings of packing would find their way into the strainers, and would soon plug them, thereby cutting off the water supply to the step. We find that on the step pumps, which pump against a pressure of 400 lbs. per sq. in., the safe life of the packing is sixty days. On the service pump, against 50-lbs. pressure, the safe life of the packing is four months to five months, depending on the condition of the river—whether muddy or not. We find that if dirt or pieces of packing do get into the step-bearing pipe system, it is uncertain when they will find their way into the strainers—it may be hours, days or weeks. This uncertainty is far from pleasant, because if there is enough loose packing in the system it can at any time plug the strainers, thus cutting off the water supply to the step bearing. With us, all strainers are taken out and cleaned every twenty-four hours.

The hydraulic accumulator, which is connected into and forms a part of the step-bearing piping system, and which acts as a reserve in case of the temporary stoppage of the step-bearing pumps, is tested every twenty-four hours. To test the accumulator, the throttle on the step-bearing pump is closed slightly, as we run the step pumps just fast enough to keep the accumulator up. This slight closing of the pump throttle allows the accumulator to drop slowly. We lower it four or five feet every day. As there are always one or more turbines in operation, and as we carry just pressure enough on our step-bearing pumps (400 lbs.) to keep the accumulator raised, if it was not for the test each day, it would always be up and would finally rust fast and would not come down, even if all pressure was removed from the pipe system which holds it up—thus defeating the object for which the accumulator is used. We know by experience that the accumulator will stick, if not tested often. The ram or piston of the accumulator is 9 ins. in diameter, and the bored part of the cylinder, which acts as a guide to steady the accumulator when raised, is about 36 ins. in length. As this bored part is a close working fit on the ram and the water is always in contact with it, the nicest kind of a rust joint will finally form between the ram and the bored hole around it.

One other precaution, which is usually taken in connection with accumulators for this work, is some kind of signal, usually a steam whistle, which will blow if the accumulator starts to come down. Something of this kind is necessary, as without it, if the step pumps should slow down, and there are many reasons why they should do so, the step pressure might get so low as to be dangerous and injure the step.

STEP BEARINGS

As the step bearing, with its very thin film of water, under pressure has to support the weight of all the revolving parts of the turbine, wheels, shaft, field, etc., it is a very important part, and cannot be examined too closely while being assembled. Under the bottom half of the step bearing is the adjusting screw; this screw is vertical and in exact alignment with the turbine-shaft center. The end of this screw, on which the step bearing and all the revolving parts of the turbine are carried, must be exactly square with the axis of the screw—a burr or dirt here means trouble, as it will throw the step out of its true alignment. This is also true in regard to the top of the upper step plate and the bottom of the turbine shaft, which rests in a socket or recess in the top of this plate. In the bottom of the turbine shaft are drilled two guides or dowel-pin holes. A key way is also cut across the bottom of the shaft, the guide pins and key are made fast in the top of the upper step-bearing plate, and are an easy fit in the shaft—if all surfaces are clean and all burrs, scratches, etc., removed.

If through any cause the step plate should bind, either from dirt, abrasions, or a bad fit, and it should be forced up in place, the chances are that it would not be square with the shaft. The turbine would then have a tendency to vibrate, and might not run right until this fault was corrected. The bottom step-bearing plate should be an easy fit in the casting which holds it and the adjusting screws in place; it should drop of its own weight into its socket or recess and should not bind or have to be forced to its set. Both step plates should be of exactly the same diameter and should line perfectly. The recess in the plates, from which the step-bearing water is forced out between the faces of these plates, should also be of exactly the same diameter and depth. The edges of the recess should also line perfectly, as if they were not in line a fin might form around one side of the recess, which would cause an unequaled flow of water from the step and have a tendency to cause vibration.

If for any reason it is desired to grind the step bearing in place, it can be done very easily, and without any trouble whatever by gradually closing the stop valve between the step-bearing main pressure pipe and the step bearing. By listening at the step bearing and watching the step-bearing gage while very slowly closing the stop valve, any degree of pressure can be had between the two bearing faces of the step. It should be borne in mind that the greater the speed of the turbine while grinding the step, the faster the faces will grind, and the more damage would be done if the stop valve was closed enough to let the steps together hard.

STEADY BEARING

Directly above the step bearing is the steady or guide bearing. This is a bronze shell, flanged on one end, lined with babbit metal, and bored about .006 in. larger than the shaft. It is held in place by stud bolts through its flange; these studs are screwed into the bottom of the turbine base. The outside of this sleeve is tapered and fits in a corresponding tapered hole in the base of the turbine. Before this bearing sleeve is put in place, it should be thoroughly cleaned and examined for any rough spots. If it should not seat perfectly all around when in place, it will work loose; screwing up on the nuts will not hold it. We have had two or three loose steady bearings, and in each case the trouble was found to be due to dirt, bruises or metal chips, which would not allow the bearing to seat properly.

Before leaving the subject of bearings, I want to say that the first turbine started in our plant, and which has done all of its share of the work since (about one year), has the

* Paper presented at meeting of the Iowa Electrical Association, Des Moines, April 19-20.

original step bearing and guide sleeve still in place, and apparently as good as ever.

TURBINE PILOT AND MAIN NOZZLE VALVES, ETC.

There are eight main nozzle valves, each with its individual pilot valve, which is electrically controlled. The pilot valves control the action of the main-nozzle valves. On any load within the rated capacity of the turbine, running condensing, five valves are all that will open, leaving three valves which might not open for days at a time. If these valves are left alone they will corrode and stick, and if a heavy overload should come on might not open at all—or if they did open they might stick open. In this case, if a short circuit should open the breakers, the turbines would run away, causing the safeties to act and shutting off the steam supply to the turbines. This would cause considerable more delay in getting current back on the line again. If the main valves are packed too tight, or if the pilot valves leak, the main valves may stick. To obviate these troubles all valves are opened and closed several times each day when starting turbines. As the pilot valves are electrically operated, and as they govern the action of the main-nozzle valves, all that is necessary is to make or break the electrical contact for each valve, which, if kept in proper condition, will open and close promptly.

The close regulation of the turbines was a surprise to some of us who had spent many years in charge of belted and direct-connected engines and generators. It was the original intention to use separate turbines and bus-bars for the commercial lights, but this has not been found necessary. Everything we have—railway, power and lighting—is on one set of bus-bars. We have no trouble with the regulation of lights or turbines.

A suitable packing for the main nozzle valves was at first hard to find. We first used a kind of string metallic packing which has proved successful on lower steam pressures, but found it would melt here, as 190 lbs. of steam and 150 degs. of superheat were too much for it. We then tried another kind of metallic packing, guaranteed to stand any degree of superheat. This seemed to be made up of small metal chips and graphite, and was supposed to form a well lubricated metallic ring which would last for months. In use, however, the chips of metal would get under the pilot and main valves holding them open. All valves had finally to be taken out and cleaned. In cleaning the stuffing boxes all that was found of the packing was a lot of loose metal chips. We now use the best asbestos ring packing we can get, and pack the valves more often than we expected to with the metallic packing.

MIDDLE AND TOP BEARINGS

The middle bearing is made in halves of cast iron, babbited and bored out about .01 in. larger that the shaft. Extra large oil grooves are cut in both middle and top bearings—they run in a bath of oil, and with a circulation of oil through the bearings more than would be possible with any other type of bearing with which I am familiar. The top bearing is a cast-iron shell flanged on one end, babbited and bored about .01 in. larger than the shaft; it is clamped in place by bolts through the flange, if it is a solid bearing. We have used both solid and spring bearings for the top and middle bearings. At first all bearings were solid; at present both top and middle bearings are of the spring type. On two turbines the springs have been renewed several times; on one once or twice; on the fourth, or rather the first one supplied with spring bearings, the first bearings put in are still in use—it is about six months since these bearings were first put in.

LUBRICATION

Gravity oil feed is used on all turbines, and the bearings are so constructed that there can always be a strong circulation of oil through them.

One trouble we had can be best explained by first giving the layout of our gravity oiling system. From the turbines the oil flows by gravity to the oil-cooling and separating tank, then through the oil filter to the suction tank, from which the oil pumps take the oil and pump it into the gravity-oil-feed tank, which is perhaps 25 ft. above the turbines. From this tank the oil flows to the turbines, then to the cooling tank, and over its same route through the filter, etc. We have a valve so placed that when closed it cuts the oil off from the gravity-oil tank and puts the full force of the oil pumps on the oil-feed line. This valve proved to be our salvation several times before we learned where our trouble was. With three or four turbines on, the oil would suddenly stop running on the turbines. The only thing left to do was to partially close the valve on the delivery pipe to the gravity-oil-supply tank, putting the oil pump directly on the oil-pipe system, when, of course, the oil had to come if the pumps were in order. It was finally decided that air must trap in the gravity-oil tank, and getting into the oil-feeder-pipe line interfere with the flow of oil. This would cause an intermittent flow at certain times, of which we had no means of knowing until we found our supply of oil shut off. That this was right has since been proved by the remedy, which was to vent the top of the tank. We used a ½-in. pipe 4 ft. or 5 ft. long, with the top bent over in the form of a goose neck.

One point in regard to the step-bearing pumps which was overlooked by me, and should have been mentioned in its proper place, is concerning the water valves. After nine months' service it was noticed that the pumps were running much faster than at first, to do the same amount of work. An examination showed that the water valves and seats were cut quite badly, and nearly all the way around with shallow grooves, mostly, although some spots looked, as far as their shape was concerned, more like corrosion than anything else. We made a tool to true up the seats in place and faced the valves off in a lathe; with a slight grinding with emery dust we had them in good condition again. It was thought that as these valves should open and close positively with each stroke of the pump, they should not cut so quickly, or as badly as they did. Close examination showed that a close hard scale had formed on all valves and seats, and this seemed to hold the valves slightly away from their seats. This wire drawing of the water (if it can be so called) was thought to be the principal cause of the cut valves. We now clean them free from this scale each week.

In conclusion, I will say that this paper is based on the everyday practical experience of the writer, as encountered in the erection and operation of Curtis four-stage, 500-kw turbines. To cover the subject fully would require more time and space than has been devoted to this article, the purpose of which is to point out some of the things which we have learned in everyday practice.

The steam turbine has upset many of the hard and fast principles of the Corliss engine builder, and is undoubtedly here to stay. The economies and efficiencies of the steam turbine are so pronounced that this type of prime mover is being universally adopted in modern plants for the generation of electrical energy.

The Dayton & Western Traction Company has taken off the "Interstate Limited," the through fast car operated between Dayton and Indianapolis, owing to inability to make satisfactory arrangements for the continuance of the service with the Indianapolis & Eastern. The Indianapolis & Eastern is operating its own limited cars as far east as Greenfield, and through service is now possible.

ENTERTAINMENT OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION

Several features of entertainment were provided for the members of the Iowa Street and Interurban Railway Association during the convention held in Des Moines, April 19 and 20. On registering, each member of the association, as well as the supply men, was presented with a book of souvenir tickets, good over the lines of the Des Moines City Railway, and a mileage book, good for 250 miles of travel over the system of the Inter-Urban Railway Company. During the session a special car left Kirkwood Hotel every hour, to carry visitors to the power house of the Des Moines Edison Company and the shops of the Railway Company.

Thursday evening members of both the railway association and electrical association were entertained by the Des Moines Edison Company and the railway companies at the Elks Hall. Wrestling and boxing contests, moving pictures, and vaudeville made up the programme.

After the adjournment of the convention, the members and the supply men present were given an 80-mile ride over the lines of the Inter-Urban Railway Company. The new private car "Iowa" and one of the new 50-ft passenger coaches of the company were utilized. Supper was served en route on the "Iowa." During the trip an informal meeting of the supply men was held, and resolutions were passed expressing appreciation to President Hippee and the association for the treatment accorded the supply men on the occasion.

CORRESPONDENCE

NEW YORK CENTRAL AND NEW HAVEN LOCOMOTIVES

New York, April 23, 1906.

Editors Street Railway Journal:

Commenting, in your issue of Oct. 21, 1905, upon the proposed New Haven locomotives at the New York Central's terminal, I stated that as they were designed to operate at a maximum of about 250 volts a. c. per motor at full normal speed, when in the d. c. zone they would of necessity be coupled in series in units of two because of the higher potential, with the result that when operating at switching speeds up to about 12 m. p. h. they would require at least twice as much current for like train weights as the Central's locomotives, because the latter's motors were designed for 600 volts.

I hardly need to refer in detail to the comments these statements aroused, but an attempt was made to belittle them by distributing this excess demand over a long run, and ignoring local yard movements, despite the fact that this excess falls entirely upon a single sub-station.

Again, at the last meeting of the Railroad Club, I called attention to a comparison of the Central and New Haven locomotives, and especially to the great weight of the latter in proportion to its capacity under like conditions, stating that the former has about 70-tons weight on the drivers, its motors, measured on the hour rating and without special ventilation, aggregate 2200-hp capacity, and it is guaranteed to handle trains of from 400 tons to 550 tons, according to the schedule, while the New Haven a. c. locomotive is variously reported to have from 72 tons to 95 tons on the drivers, to have an hour rating without ventilation of only 1000 hp, and is intended to handle trains of 200 tons to 250 tons. Ventilation is, of course, equally possible to both, hence comparisons should be made under like conditions.

I have waited, with reasonable patience, for the official curves of performance of the New Haven machines, and those given in the detailed description in your issue of April 14 not only confirm my criticism, but are pregnant with interest. According to that description, the normal full-load potential of the a. c. machines is 235 volts per motor, and in the matter of control it appears that the independent operation of the motors in parallel has been abandoned, probably because of the potential and current requirments, and the acknowledged "necessary and unavoidable" excess of weight in proportion to capacity,—the tractive effort attained, even considering the pulsating torque when operating a. c., requiring only a low co-efficient of friction. The motors, instead of being independent, are at all times coupled in units of two armatures with their compensating coils in series, the exciting fields of both machines being external to this combination, and provision is made for coupling the latter in series and parallel relations, also for shunting them with a resistance when in series on d. c.

When operating on a. c. the fields in each group are always in parallel, "to work the iron rather gently," as is so naively stated in your editorial, and which tells a whole story in itself. The parallel arrangement of the fields is also used when operating d. c. under heavy load to keep down the heating.

According to the latest reports, the weights of the two locomotives are about 100 tons for the Central, of which 70 tons are on the drivers, and 85 tons for the New Haven, all on the drivers. Of the Central's weight, 30 tons is on the guiding trucks, and has nothing to do with the weight of the electrical apparatus. True comparison of weights which can be strictly assigned to the motor equipments in the two types is difficult, but for equal capacity without ventilation it is very much less in the case of the Central.

With 15 per cent traction co-efficient, which is all that can be counted on for continuous work, the Central's locomotive should be able to exert a tractive effort of 21,000 lbs., and the New Haven locomotive 25,500 lbs., if it were not for some unbalancing of wheel pressures, and much more when starting with sand on a dry track. In both machines, however, on account of being uncoupled, when the armatures are in series the drawbar pull, with any given co-efficient of friction, will be reduced, because of the reduction of the pressure on the leading wheels, with consequent tendency to slip them.

But assuming use of sand, interesting comparisons of performance with special reference to the operating conditions necessarily governing terminal yard movements are indicated in the following typical examples:—

(a) With 1000 amps. from line—d. c. operation—slow speed, with armatures in series and all resistance cut out:—

Machine	Fields	Tractive Effort	Speed
Central	Series	29,200 lbs.	6 miles
New Haven	"	11,800 "	22 "
"	Ser. Par	9,200 "	27 "

With the same d. c. line current, then, which is well within the capacity of the Central's locomotive, it exerts at its slowest economic speed a tractive effort from two and a half to more than three times that of the New Haven. If thrown into series-parallel combination, the Central's locomotive would with 1000 amps. from line, develop a tractive effort of 12,600 lbs. at 21 m. p. h., but with very much less heat rate than the New Haven.

(b) With 20,000-lbs. tractive effort, which is practically about the limit of the New Haven machine—d. c. operation—armatures in series and all resistance cut out:—

Machine	Fields	Current from Line	Current in Fields	Speed	Time to Rise 75° C.
Central	Series	725	725	7 miles	90 minutes
New Haven	"	1,540	1,550	14 "	8 "
"	Ser. Par.	1,740	870	19 "	14 "

To secure 20,000 lbs. tractive effort on a. c. operation with the New Haven machine is, save momentarily, out of the question, because it would require nearly 2100 amps. in the armatures, and even at 2000 amps. the temperature rises 75 degs. C. in the extraordinarily short time of 4 minutes, and it cannot be kept down.

(c) With 18,000 lbs. tractive effort, since 20,000 lbs., which is only two-thirds that possible to the Central's locomotive at slow speed, is impracticable for New Haven a. c. operation, and with armatures in series we have the following comparisons:—

Machine	Supply	Fields	Current from Line	Current in Fields	Speed	Time to Rise 75° C.
Central	d. c.	Series	665	665	8 miles	105 minutes
New Haven	"	"	1,420	1,420	19 "	11 "
"	"	Ser.Par.	1,620	810	21 "	18 "
"	a. c.	Parallel	C, in arm, 1,900	950	Variable	8 "

Of course, these high-tractive efforts are for starting, and the locomotives would acquire higher speeds while the motors are in series on d. c. operation. It is, therefore, quite evident that the New Haven locomotive, despite an excess of fully 20 per cent on the drivers, does not approach the Central's in tractive possibilities, and will, in yard movements in the d. c. zone, require at least double the line current for equal tractive effort. In any case, when operating at slow speeds the controlling resistances must, on the New Haven locomotive, be left in circuit.

Comparison of the heating of the machines when required to be run at slow speed on like duty without ventilation shows an enormous disparity between the two locomotives, and it is safe to say that with equal ventilation a single Central locomotive can, on d. c. operation, be made to perform an all-round service almost equal to that of two New Haven locomotives on a. c. operation. Verily, these latter machines, to quote one of my critics, "cannot turn a square corner, climb a tree, or please" me overmuch, under the circumstances. Moreover, it seems clear that, leaving aside comparison between motors each built solely for d. c. or a. c. operation, which cannot but be to the ultimate disadvantage of the latter, the attempt to make the same machine acquit itself with equal satisfaction on either circuit cannot but meet with disappointment.

Frank J. Sprague

THE STREET RAILWAY SITUATION IN SAN FRANCISCO

Dire as is the calamity that has overtaken the city of San Francisco, it is gratifying to record that from later advices it appears many of the first reports of absolute ruin and destruction were exaggerated and unwarranted. This is particularly true in reference to the street railway situation, and the authentic reports at hand at this writing have inspired, on the part of those interested, a much more hopeful view of the condition and affairs of the United Railroads of San Francisco than the rather dismal outlook of the first few days following the catastrophe made possible. It is now believed, considering the comparatively small physical loss suffered by the company, and taking into account the undoubted recuperative powers of the city, that the sharp decline in the market value of the securities allied with United Railroad interests was not justified, and that the renewed confidence in the future of the city and the company will soon be reflected in a counter upward movement of these securities.

In an official statement, issued April 24, Patrick Calhoun, president of the United Railroads of San Francisco, states that Messrs. Ford, Bacon & Davis, of New York, have received from their partner, George H. Davis, who was in San Francisco in charge of the engineering department of the United Railroads, telegrams, dated San Francisco, Sunday, April 22, in which the actual loss sustained by the company is described. Mr. Davis wires that the Bryant Street electric power station is in full operation; the North Beach power station is but slightly damaged, and that the two cable power houses, operating the Hays and McAllister Street lines, were not burned. As regards the loss of rolling stock, only seven out of a total equipment of 455 electric cars, and seventy-five out of a total equipment of 423 cable cars, were burned. The small loss of cars is explained by the fact that the heaviest earthquake shock occured shortly after 5 o'clock in the morning, when most of the rolling stock was in the various car houses, which were situated in outlying suburbs. A portion of the shops and some few stores on hand were burned or damaged. The total general loss to all physical property of the railroads company is estimated by Mr. Davis at $2,000,000. A large portion of this property, eveything, in fact, except damage to track and overhead structure, is covered by insurance against loss by fire.

Mr. Davis also states that operation on the Filmore and Sixteenth Street line was resumed on Saturday night, three days after the disaster. This line extends from North Beach south along Filmore Street, across Market Street to Sixteenth Street, and thence east along Sixteenth Street to Kentucky Street, at a point near the Union Iron Works. Kentucky Street parallels San Francisco Bay, and is the nearest through street to the bay. The approximate length of the Filmore and Sixteenth Street line is 5 miles, and forms a belt beyond and around the portion of the city which has been burned. Mr. Davis further reports that Market Street, from Fifth Street to the Ferry, would be under trolley operation by April 24, and that the mayor of San Francisco has authorized the temporary operation of all car lines by means of electric trolleys. The directors of the United Railways Investment Company of San Francisco feel very much reassured by Mr. Davis' telegram. It is an interesting fact that the census of 1900, when San Francisco had a population of 342,000 people, showed a total population living within the now well-established burned area of 135,000 people. The growth of the city since 1900 has been estimated at 100,000 people, residing principally in that district of the city lying outside of the burned area.

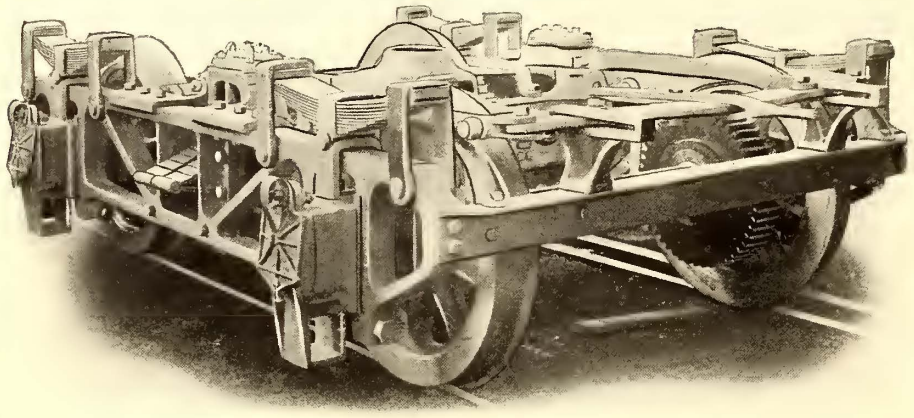
In preparation for the rebuilding of the city, Ford, Bacon & Davis, of New York, have already commenced drawing up plans for the extension of certain of the company's lines. It is expected that in the rebuilding of the city the filled-in ground, which was the part of the city most affected by the earthquake, will not be used as the site for the business district, but the business and commercial sections will doubtless be moved to the south of the section which they formerly occupied. This will so encroach upon the residential section that many dwellings will be constructed at a greater distance from the old center of the city. The extensions to the street railway system will be planned to meet these new conditions.

In view of the uncertainty of the situation in San Francisco, the directors of the Investment Company have decided to pay the dividend of 4¾ per cent on the preferred stock, recently declared and payable May 1, in scrip instead of cash. This will make it possible to employ all the cash available in restoring the property to its full earning capacity.

The many friends of the officers and staff of the United Railroads of San Francisco will be glad to know that, so far as has been learned, the entire personnel of the company and of the engineering staff of Ford, Bacon & Davis on the ground has been accounted for, and no one was seriously injured.

MOTOR TRUCKS FOR THE NEW YORK CENTRAL ELECTRIC SERVICE

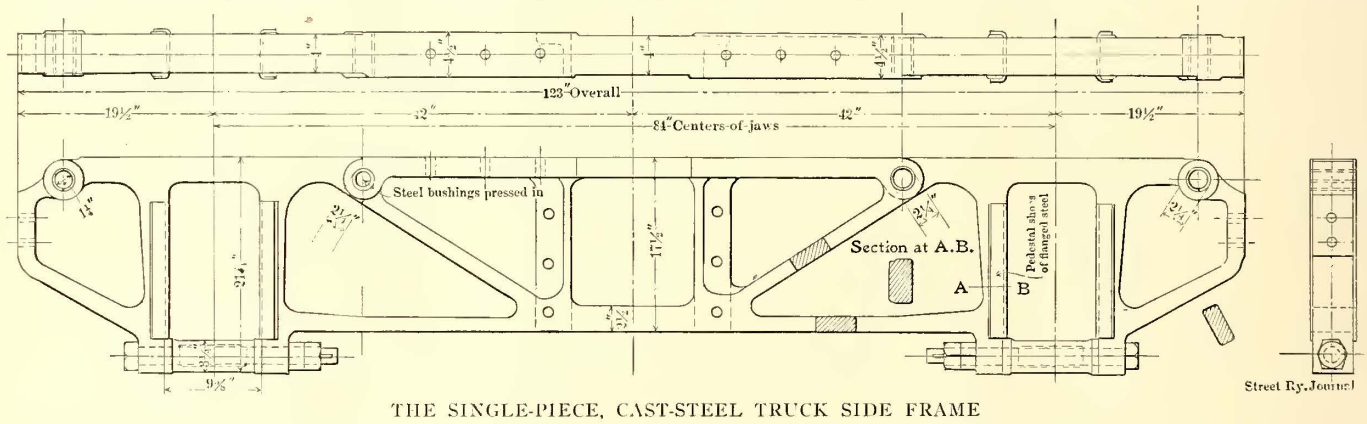
The accompanying engravings illustrate the truck which has been adopted for the electric suburban cars of the New York Central Railroad, and which constitutes a radical departure from any type of motor truck heretofore used in this country. The requirements that were imposed upon the builders included operation with high-speed schedules and heavy loadings, and with either electric-traction or steam-locomotive haulage. The cars for this service were described in detail in the Nov. 4, 1905, issue of this journal, and are cars of the most rigid construction of steel throughout, having an estimated total weight, light, of 102,600 lbs. each; of this, the car body is to weigh 53,000 lbs. The maximum total weight, loaded, is expected to be nearly 56 tons, of which over 32 tons rest upon the motor trucks. Each motor car will be equipped with two 200-hp motors, which weigh together 12,400 lbs., and which will be mounted on the same truck. This truck has a 7-ft. wheel base and 36-in. steel-tired wheels of standard dimensions, which are to be mounted upon axles, 7 ins. in diameter at the middle, with 5½-in. x 10-in. journals, and with wheel fits enlarged to 7⅞ ins.



SIDE VIEW OF NEW YORK CENTRAL TRUCK

The principal point of departure from prevalent construction is in the use of a solid cast-steel side frame, without any equalizer. In this feature of its design the truck conforms closely to the principles of steam locomotive frame construction, as well as in the method of suspending the frame by spring hangers with half elliptic springs over the journal boxes, which are identical with those used in locomotive frames. In fact, the design of the truck is representative throughout of the entire adaptability of steam locomotive constructive methods to motor trucks for heavy electric service. The framework of the truck consists essentially of four steel castings, consisting of two single-piece cast-steel side frames and two cast-steel transoms with corner brackets cast integral for the most rigid attachment to the side frames. The side frame structures are of a trussed construction, with 2-in. top members and 1½-in. diagonal and lower members, the lateral thickness of the casting being 4 ins. throughout, except at the pedestal and transom fits, where it is 4½ ins. The diagonal members are specially designed to facilitate the transfer of the load from the transoms to the axles. The transom castings are of channel section, 11½ ins. high, with ⅝-in. web and flanges, the upper flange having a width of 3½ ins. and the lower flange 2¾ in. Near either end, the top flange is raised and widened to provide a bracket for the support of the swing links and the brake hangers and then extends, with a total width of 15½ ins., to form a lip or flange which hooks over the upper face of the side frame, thus supplying a rigid connection independent of bolts. The transoms are fastened to the side frames with inner faces 12 ins. apart, the lipped flange to the upper member of the side frame, and the end flange of the transom to a vertical member, each by three 1-in. bolts with drive fits. The ends of the side frames are tied together by 4 x 6 x ½-in. angles, bolted across their end faces to clear the wheel flanges. Both side frame and transom castings have been given excess metal in all members over that required for strength. This metal has been carefully distributed and disposed with liberal fillets to provide against shrinkage strains or other weakness in the castings.

The journal boxes play in pedestal openings in the side frames in a way exactly similar to that of locomotive frame construction. The lower ends of the pedestal jaws are strengthened by the usual type of locomotive pedestal binder. The binder consists of a 1¾-in. bolt and a cast-iron sleeve separator or spacer inserted between the lower ends of the pedestal jaws, the bolt being inserted through the latter and serving to maintain them 9⅝ ins. apart. The binder bolt is fitted rigidly with two nuts, which are locked by a flat key driven through a slot in the end of the bolt. The inner faces of the pedestal jaws are lined with steel shoes, ¼-in. thick, which are flanged over 1½ ins. upon either edge to a close fit over the frame. The latter have raised surfaces milled to driving fits with the shoes, so that when driven on they cannot work loose. Symington malleable-iron journal boxes are used with M. C. B. standard wedge. The brasses are modified from the M. C. B. standard by being brought down ⅜ in. further around the axle, to better withstand the thrust of the motors. The spring hanger construction consists of half elliptic springs supported on the journal boxes by means of

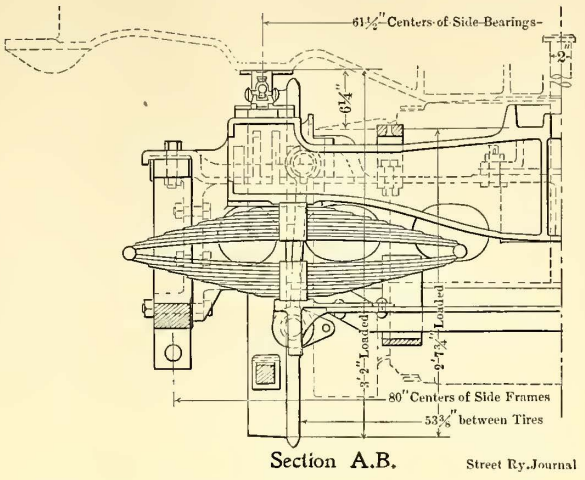


THE SINGLE-PIECE, CAST-STEEL TRUCK SIDE FRAME

U-shaped pedestals of 1 x 4-in. steel bar, straddling the side frame. Flexibility at the point of support is provided by a 1-in. rocker pin lying in the milled slots upon the top of the U-shaped pedestal and lower face of the spring band. The truck frame is suspended from the ends of the elliptic spring by forged loops of 5/8 x 3-in. iron, which are pinned to the upper member of the side frame by 1¾-in. pins keyed into place. The holes in the side frame for these pins are in all cases bushed with 2¼-in. steel bushings, which may thus be renewed when worn. The springs are ten-leaf half-elliptic, 5 ins. in width and 30 ins. in length between bearing sockets.

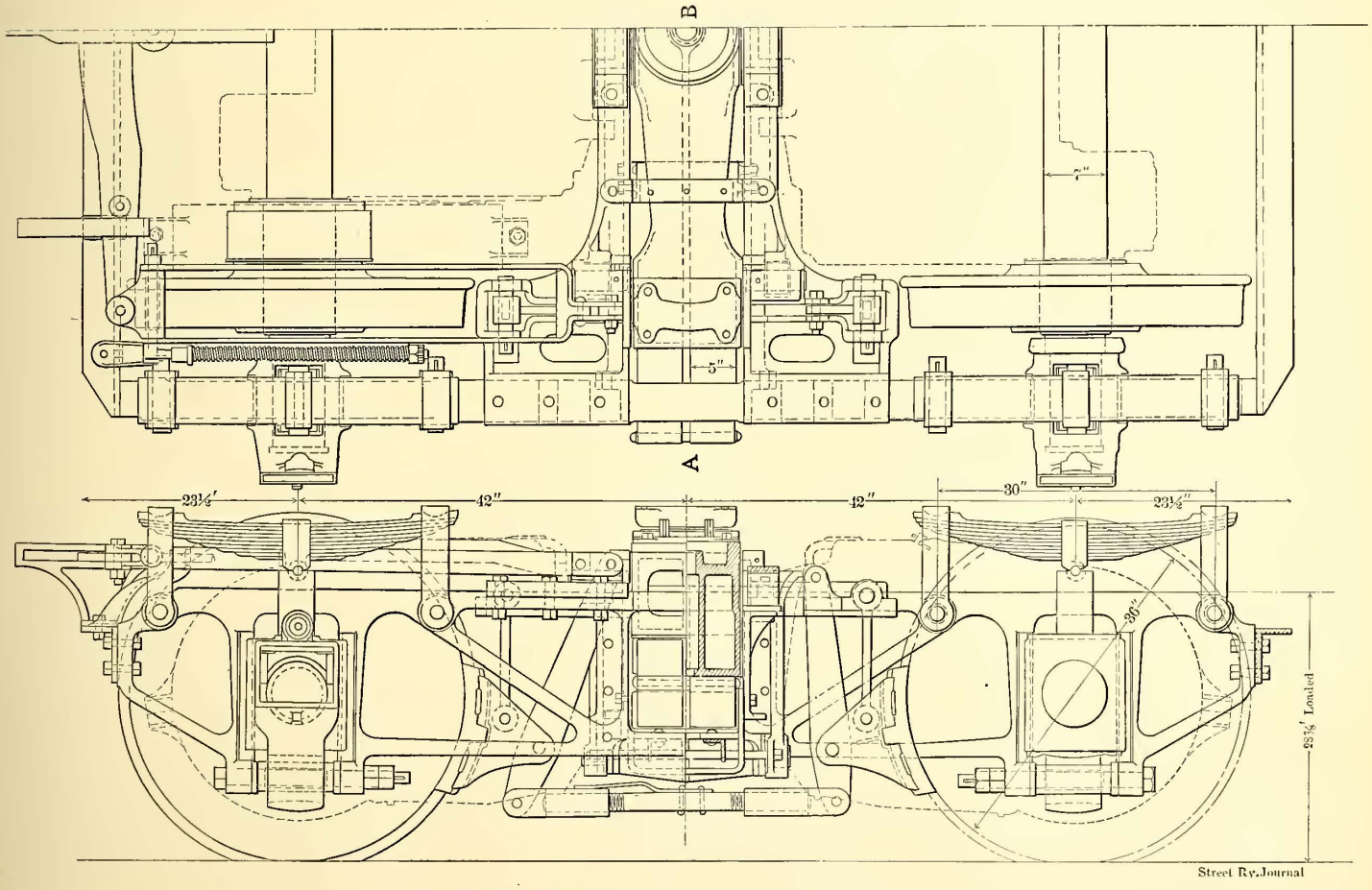
Lateral flexibility is provided for the truck bolster and car by the use of a swing link-supported spring plank of a usual construction, upon which the bolster is spring-supported. The spring plank consists of two steel castings, properly spaced by two 2½ x 2½ x ⅜-in. angles riveted between them, to which castings the swing links are pivoted, and upon which the elliptical springs carrying the ends of the bolster rest. The swing links, which are of eye-bar steel forgings 1 in. x 1½ ins. in section with 2¾-in. pivot openings at either end, carry pin projections from the plank casting at the lower end and at the upper ends are pivoted to the upper members of the transoms, close to the bolster side. The construction of the transom at this pivot is of interest, as the upper flange is raised and the upper end of the link is inserted into the opening below, and is pinned through from the sides. The pivot pins are then pinned in place in the transom castings. The lower ends of the swing links have projecting lugs, and 1-in. tie bolts are used to hold them upon the pivot pins on the spring-plank end casting, as keying or other means of locking was prevented by the brake-hanger rigging. The bolster springs at either end are double elliptics, 5 ins. wide by 34 ins. long; each is a 9-leaf spring, and is located by means of the binder bands, which rest in recesses in the spring-plank castings and ends of the bolsters.

The truck bolster is of novel construction in that it is a single piece of steel casting, with the center plate cast integral



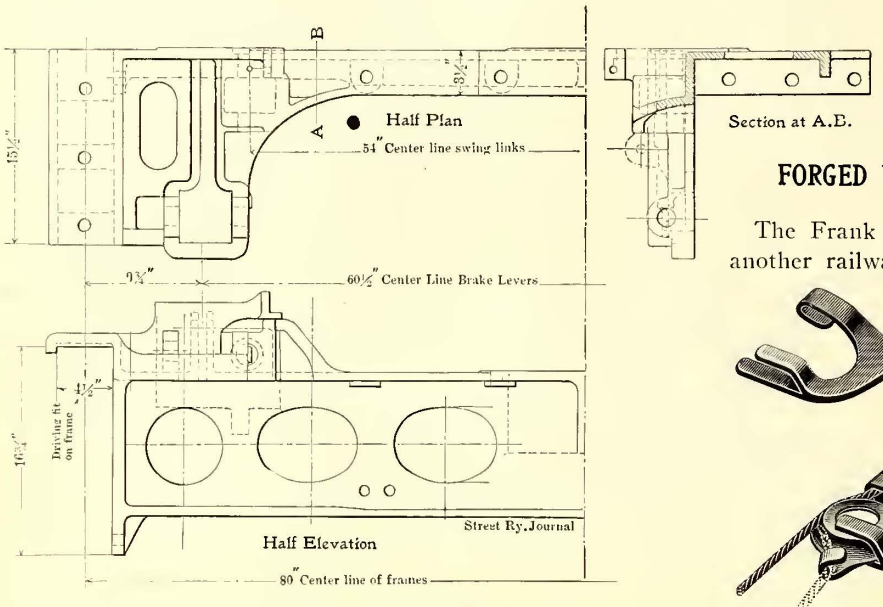
SECTION THROUGH BOLSTER AND SPRING PLANK

and enlarged sections at either end, to fit closely within the guiding faces of the transoms and thus prevent canting and racking the bolster. It is of I section, with box-girder construction at center and ends, 68½ ins. long, with top and bottom ¾ in. in thickness, and with a ⅝-in. vertical web extending longitudinally through the center from end to end. The bolster is 11½ ins. in height at the middle, narrowing to 6-in. vertical height toward the ends, although at the extreme end it is raised 3 ins. to accommodate the side bearing casting, which is bolted to the upper face; it is 12 ins. in width at the



SIDE ELEVATION AND HALF PLAN OF TRUCK

middle and across the side bearing faces between the transoms. The side bearings to be used are of the Norwood ball-bearing type, the contact surfaces of which are 3½ ins. above the center bearing pocket. These bearings are spaced 61½ ins., center to center, or 30¾ ins. from side bearing to center of king bolt. No chafing plates are used upon the bolster-wearing faces, as it was preferable to allow the first wear to come directly upon the strengthened wearing surface of the



TRUCK TRANSOM

castings, to which chafing plates can be attached at any future time if noticeable wear occurs.

The brake rigging is simple and compact, to give the maximum clearances for motors and equipment. The brake-shoe heads are supported individually from the corner brackets attached to the transoms by eye-bar links, 1x 2 ins. in section, with pin bearings at either end, thus effecting a rigid support. The brake levers are pivoted to the brake heads so as to transfer the braking force in a direct line to the center of the wheel. Attachment to the brake system of the car is made through a radial sector bar, 1 x 5½ ins. in section, which is supported by two guide castings upon one end of the truck frame. The ends of this sector are attached to the nearest brake levers by loop bar connections which straddle the wheels. The system is held normally in released position by a spring, which is attached to either end of the rector bar and is compressed by the application of the brakes. The adjustment of the system is accomplished by a turn-buckle which connects the lower end of the brake levers. The turn-buckle stud is square in section at the middle, and is fitted with a retainer spring which engages with the flat faces of the square-end lugs, thus providing an effective locking mechanism.

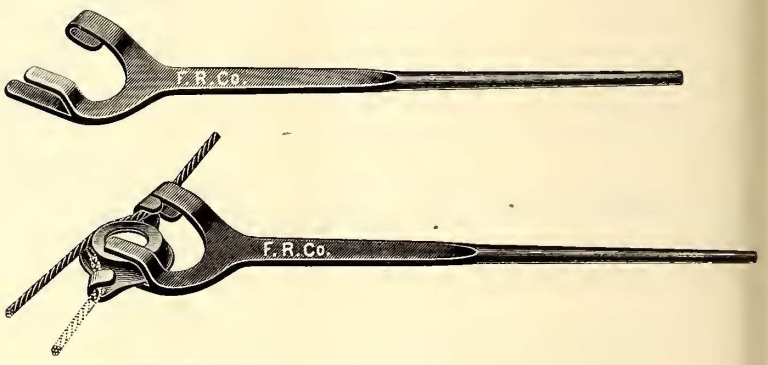
The truck is designed for the nose suspension system of mounting the motors, for which there are case-hardened wearing plates upon the upper flanges of the transoms to carry the motor lug. These wearing plates are held in place by the loop bars passing over the motor lugs, the bolts of which fasten both the loop and the hardened plate. The motor and gear-case clearances are indicated in outline in the accompanying drawings. A feature of the motor-gear equipment is that each axle gear is cut from a ring of forged steel instead of the usual cast-steel ring. This results in a homogeneous structure throughout the ring, and will thus obviate the tendency to uneven wear, which has been experienced with solid cast-steel gears. These gear rings are mounted upon enlarged and extended wheel hubs, and are shrunk in place by heating.

Another novel feature of the truck construction is to be noted in the third-rail shoe beam supports, which consist of stirrups cast upon the lower front sides of the journal boxes. These stirrups are designed to take 4 x 6-in. beams, and are so located as to give ample clearances at the rear of the beam to prevent possible danger of short circuiting.

This truck was designed by the American Locomotive Company to meet the requirements of the specifications of the New York Central & Hudson River Railroad.

FORGED WRENCH FOR CAP AND CONE HANGERS

The Frank Ridlon Company, of Boston, has just placed another railway specialty on the market in the form of a



HANGER WRENCH AND ITS APPLICATION

forged wrench designed for cap and cone hanger. It is claimed that by using this wrench, a hanger can be installed in about a minute. The accompanying cuts demonstrate the efficient action of this tool. The hanger is laid in the jaws of the wrench, the wire passing under the hook of the wrench and also over the right hand hook of the hanger, then passing around the back of the hanger, as shown by the solid lines in the lower cut; the handle of the wrench is then pulled to the left, which allows the span wire to be readily placed under the left-hand hook of the hanger, which completes the operation, as shown by the dotted lines in lower cut.

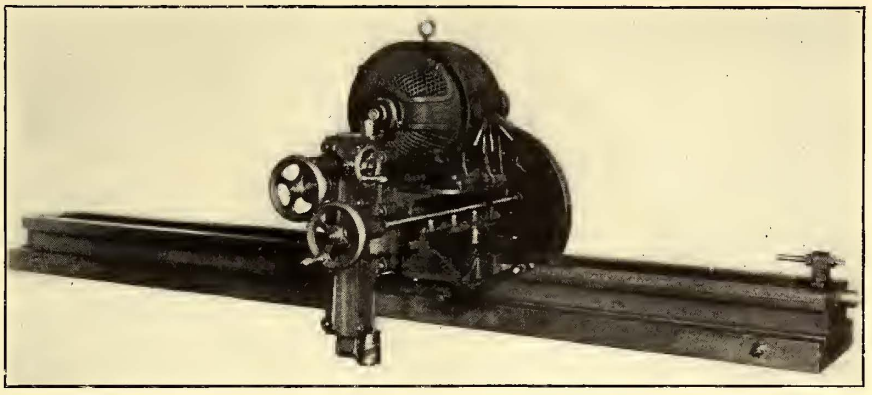
RESULTS OF A TRACKLESS TROLLEY TRIAL IN GERMANY

The conclusion of a series of experiments with a trackless trolley system at Eberswalde, Germany, has released for publication some instructive data. It was found that the average consumption of power, including transmission losses, was 660 watts per omnibus-kilometer. The weight of the vehicle was 3400 kg (7496 lbs.); power consumption per ton (2204 lbs.), 153 watts; and maximum speed per hour, 14 km.

The costs of the installation, owing to unusual conditions, were exceptionally high. The estimated cost of an automobile trolley line of 3.1 miles in length under ordinary circumstances is as follows: Electric line, $9,650; two cars, $6,948; car depot, $2,702; total, $19,300. The estimated annual cost of operating the above-mentioned line on the basis of 30,000 car-km annually, the cost of current furnished by the central station being 4.82½ cents per kw, is $1,737. Counting upon receipts of $3,088, or $617.60 per km, the net profit will be $1,351, or 7 per cent of the capital invested. The fare charged was 2.38 cents per person. The road at Eberswalde was in operation for a little over five months, when, owing to the unusual costs of construction and of operating and keeping the line in repair, it was withdrawn by the company.

PORTABLE MILLING MACHINE

The special portable milling machine shown in the accompanying cut is the outgrowth of a temporary rig that H. B. Underwood & Company, of Philadelphia, were forced to make to do work on a large machine in a stated time and in place. From that the idea was elaborated on from time to time until this machine has become one of the company's special tools. It is designed for straight line work, 8 ft. long, with a number of surfaces in line, but on different planes. As it is motor driven, it can be taken to the job. It can do work of a character that no machine tool could, for the work can be done after all parts are assembled. The carriage has a travel of 8 ft., with automatic feed; the cross slide has a travel of 12 ins.; the vertical spindle a travel up and down of 10 ins., the spindle has a taper hole to receive taper shank mills. The cross slide on this machine has hand feed. The bed is mounted on a sub-base, allowing accurate adjustment by set screws setting up against taper space pieces, securely holding the two beds as solid as though in one piece. This sub-base has long shots and projections for securing to the work by clamps or bolts.



PORTABLE MILLING MACHINE IN ACTION

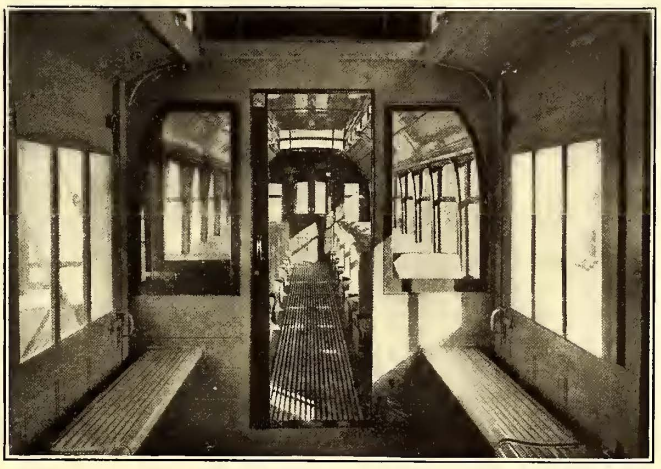
THE TERRITORY AND EQUIPMENT OF THE WALLKILL TRANSIT COMPANY

The lines of the Wallkill Transit Company are about 13 miles in length, including the tracks in the city of Middletown. They were formerly the property of the Middletown-Goshen Electric Railway Company, and were purchased last year by Messrs. E. R. & W. H. Sponsler for a company which was subsequently organized under the present name. The entire system has been reconstructed with new overhead work, ties and electric bonds, and the old power house and car houses have been replaced with new buildings located between Middletown and Goshen. The power house contains three 250-hp engines, one 350-hp engine, and one 250-hp engine, which drive 350-kw and 225-kw generators. The switchboard is of the latest six-panel blue Vermont marble type. The new car house and machine shop, which are nearly finished, are modern in every respect, and equipped in the most approved style.

COMBINATION CAR FOR THE WALLKILL TRANSIT COMPANY

The lines extend through Midway Park, owned and operated by the railway company, which contains fifty acres, and is considered to be one of the finest amusement resorts of the kind in this part of the State. It is half way between Middletown and Goshen, and is beautifully located on the Wallkill River, which affords boating, bathing and fishing. The summer theaters, pavilions, boat and bath houses are commodious and handsome structures, and during the season the park attracts thousands of visitors from all points on the lines and vicinity.

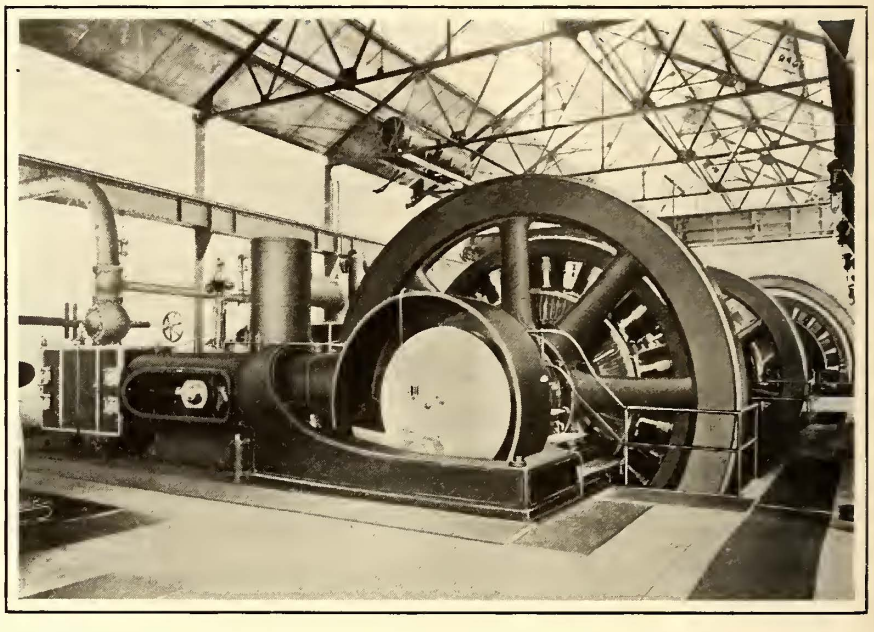
Middletown is 60 miles from New York City, and 20 miles from the Hudson River. It is on the line of the Erie, the New York, Ontario & Western and the New York, Susquehanna & Western railroads. It is situated in the highlands of the Shawangunk Mountains, and has a population of about 16,000. Within its limits is located the New York State Hospital for the Insane, one of the largest institutions of the kind in the country. There are a number of manufacturing industries, the most noted of which is the Borden plant for condensing milk. The Wallkill Traction Company transports daily two tons of milk, and frequently more, from Goshen and intermediate points. The shops of the New York, Ontario & Western Railroad are also located here. The city is the commercial and shipping center of a considerable agricultural and manufacturing district, and in the neighborhood are many popular summer resorts and the summer homes of a large number of New York people. Goshen, which is connected by the lines, has a population of about 3000, and is noted for the number of magnificent residences and summer homes of wealthy New York families. It is also famed for the race horses which are bred in the neighbor-



INTERIOR OF COMBINATION CAR

hood; many hundreds of the finest track horses of the country are annually wintered there.

Within the last few weeks, the Wallkill Transit Company has put in service four handsome semi-convertible cars of the Brill grooveless-post type, built by the John Stephenson Company, two of which are for straight passenger service and two are combination passenger and baggage. With the exception of a slight difference in the length, the cars are of the same dimensions, namely: Length of the straight passenger, 30 ft. 8 ins. over the body, and 40 ft. 1 in. over the vestibules; length of the combination cars over the body, 31 ft. 8 ins., and over the vestibules, 41 ft. 1 in.; length of the baggage compartment, 9 ft. 2 ins.; width of the cars over the sills, including the panels, 7 ft. 11½ ins., and over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 1¾ ins.; distance between the center of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 7 ft. 10½ ins.; from the track to the under side of the sills, 2 ft. 8¼ ins., and from the under side of the sills over the trolley board, 8 ft. 10½ ins.; height from the track to platform step, 16½ ins.; size of side sills, 4 ins. x 7¾ ins. The center sills are 3¼ ins. x 4¼ ins.; size of side sills, 1¾ ins. x 6 ins., and end sills, 5¼ ins. x 6⅞ ins. The sill plates, which are on the inside of side sills, are 12 ins. x ⅜ in. The seats are 36 ins. long and the width of the aisle is 22 ins. The thickness of the corner posts is 3¾ ins., and the side posts, 3¼ ins. The cars are finished in the interior with cherry, and have spring cane upholstered seats, with pushover backs, manufactured by the J. G. Brill Company. The baggage compartment of the combination car has folding seats for the use of smokers. As will be seen in the illustration of the car interior, folding seats are arranged to fill the space in the front of the sliding side doors, these seats being folded against the partition when not in use. Trucks of the 27-G type are used for both styles of cars, and have a wheel base of 4 ft. 6 ins., and wheel diameter of 33 ins. Four 40-hp motors are used for each of these cars.



HORIZONTAL CROSS-COMPOUND ENGINES IN HARRISBURG POWER STATION

NEW TRACTION FACILITIES FOR HARRISBURG, PA.

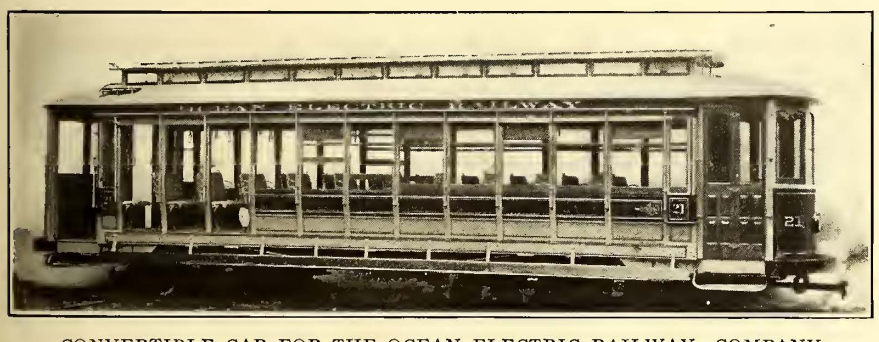
Excavations for the new power station of the Central Pennsylvania Traction Company, of Harrisburg, Pa., were begun early in December, 1905, and the construction of the building proper is now well on the way. The new plant adjoins the old No. 1 Station on South Cameron Street, Harrisburg, and when completed will replace three separate plants which are now in service. The building, 175 ft. x 102 ft., and one story in height, is of steel construction imbedded in concrete. The steam and electrical equipment for the plant will consist of three Reynolds horizontal cross-compound, condensing, Corliss engines, heavy duty type, built by the Allis-Chalmers Company. Each engine will be direct connected to a 650-kw, 600-volt d. c. generator mounted on the main shaft, the generators also being furnished by the Allis-Chalmers Company, and built at the "Bullock" works, Cincinnati. These units will have a capacity of 50 per cent overload for short periods, giving a maximum capacity for the entire plant of approximately 4500 hp. The main switchboard, which will consist of twelve panels, will be connected by a direct-feeder line to each of the twelve different sections into which the Traction Company's lines are divided. The engine room will be 50 ft. wide, extending the full length of the building, 170 ft., and directly facing Cameron Street. An electric traveling crane, with a lifting capacity of 30 tons, will serve the engine room for installing heavy apparatus. The boiler room, which will occupy the rear portion of the building, and contains for the present five 350-hp horizontal water-tube boilers, furnished by the E. Keeler Company, of Williamsport, Pa., will be equipped with all the necessary modern appliances for handling coal and ashes, including an overhead bin for coal, with 600-tons capacity. There will also be an overhead ash bin of ample capacity, the ashes being taken from the ash pits below the boilers, in a basement 11 ft. below the boiler-room floor, and deposited in the bins by means of a vertical chain bucket elevator. A continuous belt conveyor, extending the full length of the coal bin, is used for conveying coal to a bucket elevator. The boiler plant will be equipped with the usual feed-water heaters and economizers, which will occupy one-half of the floor space of the building only, ample room being provided for the installation of additional boilers and engines, as the growth of the system warrants, so that the plant will have an ultimate capacity of 9000 hp, or 10,000 hp. The stack, 10 ft. inside diameter and 210 ft. high above foundations, will be built of reinforced concrete, resting on the solid rock, 20 feet below the ground level. A railroad siding, connecting with both the Pennsylvania and Reading railroads, will run between the boiler room and the stack.

An interesting engineering feature of the new plant will be the water-supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a 5-ft. tunnel in the solid rock, 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron & Steel Company to the river. From the river bank a 36-ft. cast-iron pipe will extend to a point in the river where the best quality of water is to be obtained. This water-supply tunnel will be built and used jointly by the Traction Company and the Central Iron & Steel Company. All the work is being carried out from plans prepared by and under the direction of Mason D. Pratt, consulting engineer, of Harrisburg, and W. C. Gotshall and C. O. Mailloux, of New York City, acting as advisory electrical engineers. This plant, the cost of which will approximate $250,000, is expected to be ready for operation early in May.

STEEL BOTTOM, GROOVELESS-POST CONVERTIBLE CARS FOR ROCKAWAY, N. Y.

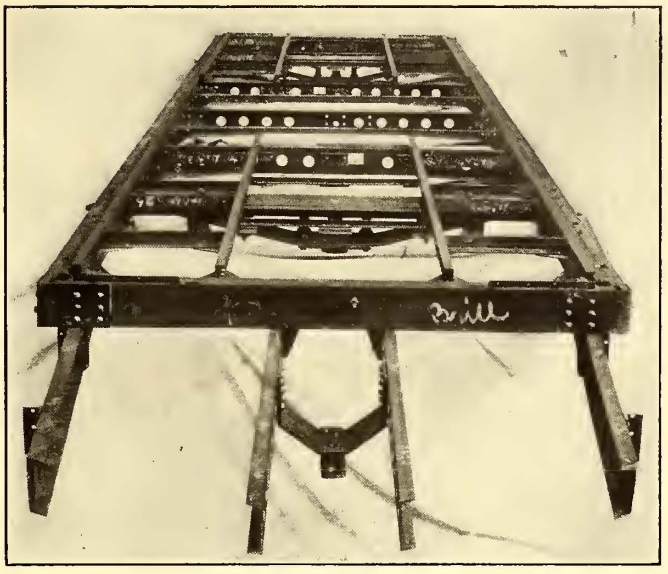
One of the most attractive summer resorts on the ocean side of Long Island is Far Rockaway and vicinity. It is but eighteen miles from New York City, and frequent train service from Long Island City makes it a convenient place for business men of New York to have their summer homes. It is in the southeastern corner of the borough of Queens; therefore within the limits of Greater New York. Fort Rockaway is about five miles from the ocean, and is separated from the beach by the shallow waters of Far Rockaway Bay. The chief means of transportation to the beach is the Ocean Electric Railway, which, although it has but five and a half miles of track, is one of the busiest lines for its length in the country. The rolling stock of the road has been entirely furnished by the J. G. Brill Company, and consists of two single-truck semi-convertible cars; three single-truck convertibles; two double-truck convertibles and a considerable number of fifteen-bench open cars. The types of trucks used are No. 21-E single truck and No. 27-F short-base equalized double trucks. The same builders have just shipped four more double-truck convertibles, mounted on 27-F trucks, which are practically the same as those which have been used for the last two years, and which have not been heretofore described. They measure 30 ft. 8 ins. over the bodies and 40 ft. 1 in. over the vestibules; width over the sills, 7 ft. 5½ ins., and over the posts at the belt, 8 ft. 1 in.; sweep of the posts 3½ ins.; distance between the centers of the posts, 2 ft. 6½ ins.

An unusually interesting feature of these cars is the fact that they are the first of the type to be built with all steel-bottom framing. The illustration of the bottom framing gives a fairly accurate idea of the design. The side sills are each composed of two channels, with the flanges meeting, with castings between, which not only serve as spacers but also as sockets for the post tenons. The latter are of the usual size used for timber sills. Strap bolts at the bases of the posts are bolted through the posts and extend down through both flanges of the inner panel. A fireproof plastic cement laid on corrugated galvanized iron No. 22 fills in the spaces between the different members, with the exception of those over the wheels which, for extra clearance, are covered with steel plates. The corrugated iron is riveted to the flanges of these members. The platforms are covered with sheet steel, on which the flooring is laid, and the side steps or running boards are lined underneath, both the treads and the toe guards, with sheet steel. Pressed steel platform steps complete the fireproof under bottom. The reason for this non-combustible construction is that the cars are operated with current obtained both from third rail and overhead trolley wire. The arc sometimes emitted from the overhead trolley is not where it can catch upon the car, but as the low-carried body is so close to the third rail, any arcing which might cause a flame to reach under the car is rendered harmless.



CONVERTIBLE CAR FOR THE OCEAN ELECTRIC RAILWAY COMPANY

Another novel feature in connection with this car lies in the continuous cross-seats which are used when summer weather becomes settled. These are arranged by substituting wooden slat backs, which extend across the car for the spring rattan backs of the double seats. The spring rattan cushions are allowed to remain and the aisle space is filled with a rattan cushion which is clamped into place. By this arrangement larger seating capacity is afforded during the warm weather, which at this resort results in a large number of passengers being carried. As soon as the weather becomes variable in the autumn, the cane backs for the double seats are replaced, so that the panels and sashes may be drawn down whenever desired, instead of relying upon the curtains, which do well enought for protection against slight summer showers, and which are arranged to be drawn entirely to the floor.



STEEL BOTTOM OF CONVERTIBLE CAR

The interiors are finished in cherry with ceilings of decorated birch. The furnishings, such as seats, automatic vestibule door controllers, channel radial draw-bars, pressed steel steps, angle-iron bumpers, brake handles, gongs, signal bells, round corner seat-end panels, and other devices, are of the builder's manufacture. A car and truck without motors weighs 31,560 lbs., which is unusually light for a car with all steel-bottom framing, considering that the plastic flooring weighs about 2000 lbs.

NORFOLK ELECTRIC MERGER

The merger of all the electric traction, light and gas properties in Norfolk, Portsmouth, Berkerley and Suffolk, with the exception of the Bay Shore Terminal and Norfolk & Atlantic Terminal properties, into the $14,000,000 holding corporation known as the Norfolk & Portsmouth Traction Company, has been finally completed, and the merger becomes effective from June 1. These officers were elected at a meeting held April 22: R. Lancaster Williams, president; Caldwell Hardy, first vice-president; G. M. Serpell, second vice-president; W. J. Kehl, secretary and treasurer, and F. C. Hathaway, general manager. The full directorate has not been named. It will be completed at a future meeting. The Trust Company of America, of Philadelphia, was named as trustee in the $3,500,000 5 per cent thirty-year bond issue, which is to be made at once, for immediate improvements.

CARS FOR DOUGLAS, ARIZONA

Several combination open and closed cars of the Los Angeles type are being built by the St. Louis Car Company for the Douglas Street Railway Company, of Douglas, Ariz. These cars are exact duplicates of 90 cars built by the St. Louis Car Company for the Los Angeles Railway. They measure 39 ft. over all, and have a closed compartment in the center and open compartments at each end, containing six cross seats. Entrance to the central compartment is made through center doors from the open ends. The posts of the open sections are enclosed to the height of the arm rail by a wire screen with a comparatively small mesh. The ends of the car are enclosed by vestibules having all the sash stationary, with the exception of the center sash, which is arranged to slide to one side. Double steps, placed at each corner of the car, are constructed with wooden hangers and Stanwood treads. The interior finish of the closed compartment is of mahogany, while the open ends are finished in mahogany and ash. The exterior of the car is painted a medium quaker green. The cars are mounted on the Los Angeles type of truck for city service.

NEW EQUIPMENT FOR SPRINGFIELD, MO.

There has just been placed in commission on the lines of the Springfield (Mo.) Traction Company a number of the Brill grooveless post semi-convertible cars, built by the American Car Company, of St. Louis. The cars used in Springfield are necessarily narrow because of the street conditions, 7 ft. 5 ins. over the posts being all that was allowed for these cars; therefore, the reason for ordering this type of semi-convertible car will be readily understood by those who are acquainted with the fact that it provides the maximum interior width and permits a transverse seating arrangement, which would be impracticable in a type having window pockets in

SEMI-CONVERTIBLE CAR FOR THE SPRINGFIELD TRACTION

the side walls. The length of the seats of these cars is 33 ins., leaving the aisle 19 ins. wide. Of course, the other excellent features of the car had an important bearing on the adoption of the type—the suitability to summer as well as winter service and the easily operated and durable window system.

The new cars are of the builder's standard dimensions for a length 20 ft. 8 ins. over the end panels and 30 ft. 1 in. over the vestibules, to which attention has already been called of narrower width than usual. The interiors are finished in cherry with simple ornamentation, and the ceilings are of three-ply maple veneer neatly decorated. Brill seats are used, which are upholstered in spring rattan and have corner grab handles. The trucks are of the 21-E type with a wheel base of 8 ft., wheel diameters of 33 ins., and an axle diameter of 4 ins. Two 30-hp motors are used per car, and the total weight, including motors and full equipment, is 20,700 lbs. The weight of the car and the truck without the motors is 15,300 lbs.

ELEVATED ELECTRIC RAILWAY FOR MILAN EXPOSITION

The Milan Exposition, which will open April 21, will serve, among other things, to afford interesting trials for an elevated electric railway which, though primarily built to connect two parts of the fair, will be used for some extended experiments in this sort of traction, which is the first in Italy, and among the few similar enterprises on the Continent. The Milan fair is in two sections, one in the Castle Park, not more than a half mile from the center of the city; and the other on the Piazza d'Armi, the drill ground of the garrison, and distant one mile from the Park. Accordingly, the line has been built on a timber trestle alternated with stone piers and steel beams at street crossings. It is only 4500 ft. in length, but has a complete equipment of power plant and single-phase rolling stock, and it is the work of the Unione Elettrotecnica Italiana, now controlled by the Westinghouse Company.

The station is provided with a single-phase alternator of 2000 volts, 15 cycles, and 410 r. p. m. There is also another alternator for reserve, and a storage battery outfit. Although the effective operating voltage on the wire line is to be about 2000 volts, the insulation and other details of this part of the work have been constructed with a view to carrying a potential of as much as 10,000 volts. At the close of the fair, the line will be made the subject of a series of experiments in single-phase traction with the tension gradually augmented from 2000 volts to 10,000 volts. The insulators were made by the Richard-Ginori Company, of Milan.

The rolling stock of the line will be made up of four trains of four cars each, with two cars to be held in reserve at the stations. The cars will be 33 ft. long, and will weigh 14 tons each, giving a total weight for the train of only 56 tons. As the extreme carrying capacity will be 300 passengers per car, over a thousand people will be transported at each movement of a train. The head and rear cars of each train will carry two motors, and will be fitted with closed vestibules for the motorman and driving mechanism. The two center cars of each train will carry one motor each. Thus, each train will carry six 120-volt single-phase Finzi motors, with a capacity of about 30 hp. Each of the end cars will also carry a transformer, which will lower the voltage of the trolley-wire for the motors. The trains will be completely fitted with Böker air brakes.

A concession has recently been granted to J. A. MacNaught, by the State government of Puebla, Mex., to organize a company, and build an electric railroad from a connection with the Mexican Railroad, through the city of Puebla, with rights to throw out spurs to the various cotton factories along the route, to the city of Atlixco, which is an industrial place of between 16,000 and 20,000 inhabitants. This property will be known as the Puebla & Southwestern Electric Railway. The man to whom the concessions have been granted is the traffic representative of the National lines at Puebla. The connections with the Mexican Railroad will only be for the purpose of receiving and forwarding any cars of through freight that may be turned over from that road, to be delivered to any of the factories or stations along the line of this electric road, and to facilitate shipments of freight in car loads from any of the stations or factories to outside points in the Republic. While the distance between Puebla and Atlixco is only about 37 kms, the whole line, including spurs and short branches, sidings, etc., will be about 60 kms. long.

FINANCIAL INTELLIGENCE

Wall Street, April 28, 1906.

The Money Market

Despite the heavy shipments of money to the Pacific Coast as a result of the great disaster at San Francisco, the local money market has not undergone any decided change during the past week. Rates for time accommodations are somewhat higher than those ruling at the close of last week, but this has been caused by a desire on the part of the banks to keep their reserves intact in order that they may be prepared to meet any further demands from this source. During the past week the New York City banks have shipped to San Francisco and other Pacific Coast points upwards of $20,000,000, and it is expected that further heavy transfers of funds to those points will be necessary. On the other hand, substantial amounts of gold continue to be engaged in the European markets for import to this side, and which partly, if not wholly, offsets the shipments of money above referred to. Since April 12, the payments by the Sub-Treasury on account of gold exports under the plan recently adopted by the Secretary of the Treasury amounts to about $19,500,000. Rates of exchange are still at the gold import point, and once the Russian loan is out of the way, it is expected that the movement of the yellow metal in this direction will assume much larger proportions. The opinion prevails in banking circles, however, that the money market will continue firm for the present, and that it will be influenced largely by the continued outward movement of funds from this center. The European markets have ruled comparatively easy throughout the week, although money and discounts at the principal centers have not changed materially. The bank statement published on last Saturday made a very satisfactory exhibit. Loans increased $8,153,800 as a result of the activity in the securities market. The increase in cash was considerably larger than expected, amounting to $17,994,900. The reserve required was $6,400,675 larger than in the previous week, which, deducted from the increase in cash, resulted in an increase in the surplus reserve of $11,594,225. The surplus now stands at $16,336,725, and compares with $11,448,050 in the corresponding week of 1905; $34,203,700 in 1904; $10,985,475 in 1903; $9,461,050 in 1902; $16,759,775 in 1901, and $14,894,350 in 1900.

Money on call has been in abundant supply at rates ranging from 6½ to 4 per cent. Time money was extremely quiet, the liquidation in stocks during the week having provided stock houses with ample funds. Offerings, however, were only moderate, with 6 per cent the general asking rate. Commercial paper was quiet, merchants relying upon their banks for accommodation.

The Stock Market

The speculative situation has been very much unsettled, and at times demoralized, during the week, as a direct result of the great disaster which overtook San Francisco, and resulted in an enormous destruction of property and considerable loss of life. It is doubtful if the full extent of this disaster is yet fully appreciated, or if its full influence upon the speculative market has yet been witnessed. The chief point which the speculative interest has considered is the relation of the disaster to the money market. It has been necessary to transfer large amounts of money from this center to the stricken city during the week, and doubtless the amount will be greatly enlarged before the end of the month. The Treasury Department has also taken prompt action and will afford the banks of San Francisco all possible relief. The question of insurance loss is one that has figured prominently in connection with the stock market. Conservative estimates place the total loss at about $150,000,000, of which the home companies would be called upon to pay about three-fifths. All other influences have been overshadowed by the great calamity, and it was the direct cause of a heavy volume of liquidation in stocks and a substantial decline in prices. It is usual, in the event of a disaster of such magnitude, for traders to get out of their stocks as promptly as possible, and this competitive selling was a demoralizing influence. In addition to this selling there was heavy liquidation from other sources, and some of the pools were forced to lighten their loads. The Steel stocks have received good support throughout, and this was justified by the very flattering statement of the corporation for the first quarter of the year. The extra dividend on Amalgamated Copper was a sustaining influence in that stock, and much interest now centers on the action which the Consolidated Gas directors will take in relation to the dividend on that stock. Taking the market as a whole, it would appear that the most pressing liquidation has been witnessed, and that while an irregular and feverish price movement may be expected, the market should soon work to a point where some improvement will be in order.

The local traction stocks have been weak, especially Brooklyn Rapid Transit, which declined sharply on necessity selling, rather than to any unfavorable developments in connection with the property. The position of the company is very satisfactory, and the earnings for the fiscal year promise to make a new record. There was very little trading in the Metropolitan issues, and there are no new developments in connection with these shares.

Philadelphia

Dealings in the traction shares were considerably larger during the past week, but they were accompanied by a general decline in values, due in part to the liquidation in the general securities market. A prominent feature of the early dealings was the selling of United Railways Investment of San Francisco preferred on the reports of damage of the company's property resulting from the San Francisco disaster. Opening at 77⅝, the price ran off to 62½, but later there was a recovery to 69⅝. About 1800 shares of the stock changed hands. Philadelphia Company's shares suffered in sympathy, especially the stamped receipts, which broke from 54½ to 50½, but later recovered to 52¾. Upwards of 6500 shares changed hands. Of the free common stock, about 3500 shares changed hands at from 49¾ to 47. Near the close, however, there was some good buying which lifted the price to 50½, a net gain for the week of ½ point. The unstamped receipts sold at from 46 to 43 and back to the opening figure, and small amounts of the preferred stock brought prices ranging from 49½ to 48⅝, the final transaction taking place at 49. Philadelphia Rapid Transit declined from 28¼ to 27 on the exchange of about 7000 shares, and Philadelphia Traction sold from 99¾ to 99. Other transactions included Fairmount Park Transportation at 18; American Railways at 53¾ to 52; Railways General at 6½ to 7; Consolidated Traction of New Jersey at 80¼ to 80; Fort Wayne & Wabash Valley at 28; United Companies of New Jersey at 263. Union Traction was active, upwards of 1500 shares changing hands at from 63⅛ to 62⅝ and back to 63.

Chicago

The Chicago traction stocks were extremely dull, but prices generally displayed a decided tendency to advance. Chicago City Railway stock was again entirely neglected, but in both North and West Chicago stocks sharp recoveries were made. North Chicago, after selling at 35, broke 3 points, but subsequently rallied to 34, which price compares with 31, the closing figure of last week. West Chicago advanced 2 points to 28, and sales of the Consolidated 5 per cent bonds were reported at 65⅛. Metropolitan common rose a full point to 27½, while the preferred sold at 67 and 68 for small amounts. South Side Elevated eased off a point, 168 shares selling at 93 and 92. Chicago Union common brought 5⅞ for 200 shares.

Other Traction Securities

The pronounced weakness in United Railway incomes was a conspicuous feature of the Baltimore market. The free bonds, after an early rise to 74, broke to 72⅜ on extremely light selling, while the pooled incomes ran off to 71¼. United Railway 4s were quiet but steady, about $40,000 changing hands at 92½ and 92¼. The pledged stock sold at 17¼ and 17½ for about 400 shares. On the other hand, Baltimore City Passenger 5s advanced ½ to 106½ on the purchase of $5,000, while Norfolk Railway & Light 5s moved up ⅜, about $33,000 selling at 102½ and 102⅜. Other sales included Augusta Street Railway 5s t 104; Macon Railway & Light 5s at 100¼, and 125 Norfolk Railway & Light stock at 19. In the Boston market, the Boston

Elevated shares displayed considerable strength, transactions taking place at 158½, but toward the close it eased off and closed at 157½, a net gain for the week of 1½ points. Boston & Worcester common was ¾ lower, several hundred shares changing hands at 28 and 28½, but the preferred held steady with sales at 89. Massachusetts Electric preferred moved up ¾ to 67 on the exchange of a small amount of stock. The common, after selling at 20 dropped to 19, and closed at 19¼. Boston & Suburban sold at 21½. West End common brought prices ranging from 100 to 99½, upwards of 400 shares changing hands, while the preferred sold at 116 and 114¾. In the New York Curb market trading was very light, and prices generally reflected the movements of values in the general securities market. Interborough-Metropolitan common was dealt in to the extent of about 6000 shares at prices ranging from 53⅞ to 51¼ and closing at about the lowest, while several thousand shares of the preferred changed hands at from 90 to 86¼. The 4½ per cent bonds were comparatively firm, about $250,000 being transferred at from 91 to 89½. New Orleans Railway common sold at 3⅜ for 200 shares.

The general apathy struck Cleveland, and several traction issues experienced a downward movement. In several instances it was undoubtedly due to forced selling on the part of holders who required immediate cash. Toledo Railways & Light stock suffered a break, doubtless due to this cause. For some months it has been selling at around 35, and last week there was a straight line of breaking prices, the latest sale being at 29½. There has been a current rumor that the company would pass its dividend next time, but there appears to be no other foundation for this report, as the company is making good gains. Western Ohio receipts came into the trading for the first time in some weeks, and had a downward movement from 19½ to 15½. This is also attributed to forced selling, as there is no other apparent reason for such a decline. Cleveland Electric was inactive, a few small lots selling at 79½. Western Ohio bonds suffered a decline to 83¾. Northern Ohio Traction & Light also has the dumps, and dropped off from 31½ to 30¾. Lake Shore Electric was firm at 16½. Aurora, Elgin & Chicago was stronger at 34. There has been considerable trading in the underwriting of the Washington, Baltimore & Annapolis Railway with an advance from 105 to 106. The Baltimore terminal concessions just secured by the company seem to make its success assured. Toledo & Western stock has been enjoying a strong upward movement in Cleveland and Toledo, advancing from 15½ to 19½ on reports of greatly improved earnings.

Cincinnati, Newport & Covington continues the leading feature at Cincinnati. About 1100 shares sold during the week with an advance from 59¼ to 64½. This stock has been making rather sharp moves for several weeks, and is now at a high mark, in spite of the statements of President Ernst that there are no negotiations on for the sale of the property and there are no present indications of a dividend on the common; hence it would seem that this activity is purely speculative. Cincinnati Street Railway was stationary at 146. Cincinnati, Dayton & Toledo lost a point to 27.

Security Quotations

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

	April 18	April 25
American Railways	54	52
Boston Elevated	158	157
Brooklyn Rapid Transit	87½	81⅛
Chicago City	150	150
Chicago Union Traction (common)	6	5⅝
Chicago Union Traction (preferred)	21½	21½
Cleveland Electric	81	81
Consolidated Traction of New Jersey	80	79½
Detroit United	97	95½
Interborough Rapid Transit receipts	—	225
Interborough-Metropolitan Co. (common), W. I.	53¼	51¼
Interborough-Metropolitan Co. (preferred), W. I.	89	86¼
Interborough-Metropolitan Co. 4½s, W. I.	90¼	89
International Traction (common)	37½	37½
International Traction (preferred), 4s	72	73
Manhattan Railway	155½	154
Massachusetts Elec. Cos. (common)	19¼	18½
Massachusetts Elec. Cos. (preferred)	67	66
Metropolitan Elevated, Chicago (common)	26	26
Metropolitan Elevated, Chicago (preferred)	67	67
Metropolitan Street	116⅝	113½
Metropolitan Securities	73¾	71⅝
New Orleans Railways (common)	32⅞	33
New Orleans Railways (preferred)	80	80
New Orleans Railways, 4½s	88½	89
North American	100⅝	98
North Jersey Street Railway	27	27
Philadelphia Company (common)	49¾	50½
Philadelphia Rapid Transit	28¼	27
Philadelphia Traction	99	99
Public Service Corporation 5 per cent notes	94	94
Public Service Corporation certificates	72½	72½
South Side Elevated (Chicago)	93	92
Third Avenue	133½	125
Twin City, Minneapolis (common)	119	115
Union Traction (Philadelphia)	63	63
West End (common)	99½	99
West End (preferred)	115½	115

W. I., when issued.

Metals

A better demand for pig iron is reported at all of the principal centers, but makers are not disposed to press sales. Foundry iron is in much better demand, especially for the high grades. The United States Steel Corporation, the Lackawanna Steel Company and the Pennsylvania Steel Company announce that they will accept orders for steel rails for 1907 at the present price of $28 a ton. Recently one of the large Southern makers of steel rails advanced the price from $28 to $29 a ton. Copper metal continues strong at unchanged prices. They are as follows: Lake, 18½ and 18¾c.; electrolyte, 18¼ and 18½c.; castings, 18 and 18¼c.

CLEVELAND ELECTRIC ASKED TO MAKE PROPOSITION

At the meeting of the Cleveland Council this week, a resolution was adopted calling upon the Cleveland Electric Railway Company to submit at once a proposition for a new franchise which it would be willing to accept and which may be used as a basis for negotiations. It was pointed out that the company had made no reply to the recent proposals of the Cleveland Chamber of Commerce, and that the recent decision of the Supreme Court, which was favorable to the company, had placed matters in a position where a settlement may be delayed indefinitely. It is interesting to note that the thirteen Councilmen who have heretofore backed Mayor Johnson in his 3-cent fare ramifications, voted against the resolution looking to a settlement of the question. General Manager Stanley of the company agreed to call a meeting of his directors at once to consider what proposition could be made.

WASHINGTON, BALTIMORE & ANNAPOLIS COMPANY SECURES BALTIMORE TERMINAL

The Sherwin-Bishop syndicate, of Cleveland, which is building the Washington, Baltimore & Annapolis Railway, between Washington and Baltimore, has secured a most important concession in a franchise for its Baltimore terminal, a grant for which it has been working for several months. The terminal company is a subsidiary company, to be known as the Baltimore Terminal Company. By means of private right of way and elevated structures the new road will be able to operate to within about 1 mile of the heart of the business district of the city on its own tracks. The franchise gives the company the right to construct tracks on several streets leading to the proposed terminal at Fayette and Liberty Streets and McLane Place. The company is to have a trackage arrangement with the United Railways Company, and is to pay to the city a portion of its gross receipts within the city limits and a tax of 1 per cent on all freight handled within the city. The Roberts & Abbott Company, of Cleveland, engineers for the road, is now asking for proposals on the steam and electrical equipment, and bids will be received for both the single-phase alternating-current system and the direct-current system. The road is likely to have an interesting complication of systems if it uses the tracks of the Washington Railway & Electric Company in entering Washington, because the lines there use either the double trolley or the conduit system.

EFFECT OF LOW FARES IN OHIO

The statements made by traction operators in Ohio that the passage of a 2 cents a mile law in that State has not materially affected their business, is borne out by the complaints being made by the steam road managers that the lower rate is a failure as a revenue getter. While the measure has been in effect only about thirty days, the steam railroad men do not hesitate to make this sweeping statement. The majority of steam roads have given the thing a thorough test without any curtailment of service or other changes that might cut down operating expenses, but they say now that further tests are useless. Perhaps there has not been a single question in railroad economy which has had closer scrutiny than this one, not only among the steam road men, but among traction men as well. Careful figures prepared by passenger departments of various steam roads indicate that the lower rates have been responsible for an increase of only about one-tenth of 1 per cent in traffic, and it is figured that this is not likely to continue because much of this gain doubtless came from people who rode for the novelty of riding for the lower fare, and in the future they will not ride any more than they formerly did, because the new fares will become fixed in their minds and they will not figure that they are getting a reduction. Many of the station sales on the steam roads show a decrease, this being due to the fact that under the new law the passenger gets the same rate on the train as by buying a ticket. But it is stated that even the earnings of some of the trains on the larger steam roads are showing losses in receipts, and in some cases the receipts from passengers alone do not pay for running the train, when figured into that cost is the proportion of the general expenses supposed to be allotted to each train. In some instances the decrease in earnings has been offset somewhat by the increase from excess baggage, these rates having been increased. On the whole, however, the results are far from satisfactory, and on many roads the change will undoubtedly result in the removal of some of the trains.

The traction operators feared that on the through long-distance traffic they would lose by the change. It has been found that this is true in a few instances, especially on one-way rates. In a great many cases the one-way rates are now practically the same as those of the steam roads; this being particularly true where the traction lines have roundabout routes with greater mileage than the steam roads. But on the round-trip business the tractions are holding their own, because they are making a reduction for round trips while the steam roads are not. The removal of excess fares on limited trains by the traction people has also been a point in their favor. On the whole, the Ohio tractions are faring a great deal better than they had reason to believe they would.

McKINLEY SYNDICATE SEEKS TO ENTER ST. LOUIS

An ordinance providing for terminals for the McKinley system in St. Louis was introduced in the City Council April 20. The company now operates lines from Granite City to Hillsboro, Springfield, Decatur and Clinton, Ill., and is constructing lines connecting with Bloomington, Peoria and Champaign, and expects eventually to reach Chicago. The local company is known as the St. Louis Electric Terminal Railway Company. The following are directors: Charles Zilly, B. E. Bramble, J. W. Ferris and George M. Mattie, of Champaign; George L. Edwards, J. Herndon Smith and C. H. Moore, of St. Louis. The company expects to cross the river from Venice, transporting its express and passenger cars on water craft especially designed for the purpose. It has acquired ground for extensive terminals in North Street, including a large tract at Hall and Salisbury Streets, purchased at a cost of $500,000. On this tract are to be erected storage and terminal yards, express warehouses and possibly a passenger station. The company expects to have two or more passenger stations in the downtown business section if the ordinance is passed.

The ordinance authorizes the construction of a single track on Salisbury Street, beginning at the right of the Burlington system, to Ninth Street. A double track, beginning there, will run south on Ninth to Branch Street, southwest on Branch to Twelfth Street and south on Twelfth to Lucas Avenue. From this point a single track will run east on Morgan Street to Eleventh, either over the tracks of the Easton Avenue line of the United Railways Company or a new track to be constructed. From Eleventh and Morgan the track will run over Eleventh south to Washington Avenue. If arrangements can be made, the cars will use the track of the Bellefontaine line of the United Railways Company, or it may construct a new track. From Washington Avenue to Walnut Street, a single track will be constructed over Eleventh, east on Walnut to Eighth, and south on Eighth to Clark Avenue, east on Clark to the wharf, north on the wharf under the elevated tracks of the Terminal Railway to Lucas Avenue, and west on Lucas to a terminus at Broadway. A branch will run from Branch and Eleventh Streets south on Eleventh to Palm and west on Palm to Twelfth. Another branch will run west on Linden Street from Twelfth to Thirteenth, and south on Thirteenth to Gay. From Thirteenth the track will run east on Gay to Twelfth Street. Both branches will be single track.

Two years are given the company in which to operate the lines in St. Louis in connection with the interurban lines of Illinois. The fare in St. Louis will be 5 cents. Cars are to run at intervals of not less than 30 minutes between the hours of 6 a. m. and midnight, and from midnight until 6 a. m. at intervals of 1 hour. In consideration for the franchise the company agrees to pay the city $5,000 annually and to post a $25,000 bond to insure the faithful carrying out of its provisions. Work on the lines in St. Louis is to be commenced within six months after the passage of the ordinance and be completed within eighteen months after starting. The board of public improvements will have general supervision over the construction. The cars will carry baggage, passengers, mail matter and express.

THE BRIDGE PROBLEM IN NEW YORK

Six-car trains, to run direct to Manhattan from Brooklyn during the rush hours in the morning and direct to Brooklyn from Manhattan during the rush hours at night, on the Brooklyn Bridge, is a problem which Bridge Commissioner Stevenson has instructed Consulting Engineer H. B. Seaman to work out in connection with a plan for relief of the Brooklyn Bridge. Mr. Stevenson has made public some of the plans that he has under way for the improvement of bridge conditions generally. Now that the tedious work of the Manhattan Bridge is out of the way, and matters are moving satisfactorily on that structure, the attention of the Commissioner and engineers of the department will be directed toward a solution of the transportation problems. One improvement already under way is a tunnel from the Brooklyn Bridge subway station to connect directly with the stairs to the elevated road on the Brooklyn Bridge. This tunnel will lead under the four westerly trolley loops, so the crowds from the subway will not interfere with the crowds waiting for trolleys and will not be exposed to the dangers of crossing the trolley tracks.

IN MEXICO

Important announcements come from Mexico of new roads proposed and extensions to existing lines that are in contemplation. From Chilpancingo comes the news that R. H. Springer, of Chicago, is at the head of a party of engineers who are making a survey for a proposed electric railway that is to be built from Chilpancingo to some point on the Balsas River. Mr. Springer says that a syndicate of Chicago capitalists are back of the project, and that all preliminary arrangements have been made for the construction of the road. The line will traverse a rough country which is now cut off from the outside world through lack of transportation facilities, and will penetrate a rich mining district where a number of large mines are operated. It will be operated for both freight and passenger service. The syndicate which Mr. Springer represents recently obtained options to purchase large tracts of land situated adjacent to the route of the proposed road, and it is their intention to colonize this land with Americans.

At Guadalajara preparations have been made for pushing the construction of the Guadalajara-Lake Chapala Electric Railway, the contract for which is held by Juan W. Shepard & Company. Part of the material for the proposed line is on hand, and forces of laborers are being employed so that the grading can be carried on rapidly. J. N. Zermeno, of Mexico City, is vice-president and general manager of the company.

At Puebla, plans are being made for the formal inauguration of the new electric railway that is being built between Puebla and Mexico City, a distance of 69 miles. The Mexican Light & Power Company, the Canadian concern which operates the Necaxa plant, will furnish power for the road.

At Manzanillo, the representative of an American syndicate has been investigating the situation, with the view of building an electric railway.

THE NEWARK-NEW YORK HIGH-SPEED LINE ARRANGEMENTS

Negotiations which for some time have been under way between Public Service, the Pennsylvania Railroad Company and the McAdoo tunnel interests were consummated Tuesday, April 24, at the offices of the Public Service Corporation, in Newark, by the signing of the various agreements between the respective interests. By these agreements the Public Service Corporation has transferred to a real estate company owned by the Pennsylvania Railroad Company its large terminal site adjoining Proctor's Theater, Newark. The Pennsylvania Railroad and the McAdoo tunnel interests jointly agree to co-operate in the construction and operation of a high-speed electric line that will give rapid, direct and frequent service from Newark and Hudson County to the several projected terminals in Manhattan at rates of fare consistent with rapid transit development. The Public Service Corporation agrees to operate its surface systems both in Essex and Hudson Counties so as to facilitate the transfer of passengers as conveniently as possible to the stations of the high-speed line. In view of the co-operation thus provided for, it is deemed unnecessary to construct the tunnel and high-speed line contemplated by Public Service or the proposed additional surface lines in Hudson County laid out by the tunnel interests. The Pennsylvania Railroad will construct a large transfer station at Harrison, where all of its trains will stop, and which will be the point where the motive power will be changed from steam to electricity. The line should be finished and in operation not later than 1908, says President McCarter, of the Public Service Corporation. He also says that the distance from the terminal in Newark to the terminals at Church and Cortlandt Streets, New York, should be covered easily in 15 minutes, and 25 minutes should suffice for the journey to the uptown terminal. The various interests represented unite in the belief that the transportation facilities afforded by this high-speed line, working in co-operation with the surface systems, will produce an enormous increase in population throughout the territory served.

NEW OHIO LAWS

The General Assembly of Ohio, which adjourned two weeks ago, passed a number of measures affecting the interests of electric railway companies. Several of these measures have been signed by the Governor, and the others will become effective in a few days by lapse of time.

The most important of these measures was the Pollock bill, authorizing Councils of municipalities the right to grant to interurban railroads using electricity or other power than steam the right to secure terminal facilities within the municipality. The law provides that franchises may be granted to interurban companies having 10 or more miles of track outside the municipality upon such terms and conditions as it may prescribe for the purpose of securing terminal facilities only. Council may grant the privilege to an interurban company to build upon streets where there are no tracks where the consents of a majority of foot frontage have been secured, and the Council may also permit the interurban company to use the tracks of a city company by the agreement of the companies. No company shall be permitted to condemn more than one-eighth the trackage of a company within a municipality. Such interurban company shall not be required to submit to competitive bidding, and the grant shall be for not more than twenty-five years. The bill provides that no franchise shall be used for the purpose of operating a municipal street car system, it being the intent of the bill simply to provide terminal facilities for interurban roads.

The Lersch bill provides that Council, by resolution, may require a street car company to sprinkle its tracks or right of way within a city, and upon failure to do it after order, the city may do the work itself and the county auditor may collect the bill the same as a tax. Under the old law, the company could not be required to sprinkle the tracks, but it could be required to pay into the city treasury 1 cent per lineal foot as its part of the cost of sprinkling.

The Hatfield bill provides that the County Commissioners may cause to be removed from any stream within the county any drift, timber, piling or other obstruction placed or allowed to remain in the river by any railroad or electric railway company which in any manner obstructs the free flow of the water or which endangers any bridge or turnpike. The county may order such obstruction removed and impose a fine of 50 per cent of the cost of removal. This law may be the means of causing considerable trouble to traction lines taking water supply from streams, or roads having bridges crossing such streams. This is especially true of companies having intake courses or cribs constructed in a manner likely to obstruct free flow of water or cause accumulation of drift.

The Reynolds bill provides that front vestibules of cars shall be closed and that they shall be heated to a temperature of 60 degs. during five winter months. No penalty is provided for a violation of this law.

The Spangler bill relates to the cleaning out and keeping in repair of public ditches, and in townships where such ditches have been located it is the duty of lot owners, land owners, corporate roads, railroads, township and county to keep clean the portion of the ditch allotted to them. This law probably will not affect electric roads, unless the word "railroad" used in the law should be construed to embrace both steam and electric roads.

The Spicer law amends former laws relating to street railway companies and grade crossings. The only change in the old law is the addition of the provision that the municipality shall have the right of action against the street railway company for its portion of the cost of a grade crossing, and such cost shall be a lien upon any of the property of the company within the county.

The Wertz railway rate commission law provides for the appointment of a commission to fix and adjust freight rates, the provisions of the law covering electric roads, express companies and other common carriers, in addition to steam roads. All the powers now exercised by the Railroad Commissioners are vested in the new commission.

THE BROOKLYN COMPANY'S TUNNEL PLANS

The plan of the Brooklyn Rapid Transit Company to eliminate the Bridge crush by the construction of a subway and tunnel loop running through the lower end of Manhattan and the shopping district of Brooklyn has been officially announced. It contemplates a four-track tunnel landing in Manhattan at Fourteenth Street. Four tracks continue along Fourteenth Street to University Place, where two, forming an inner loop, turn south and recross the river at Maiden Lane. The two tracks of the outer loop continue to Ninth Avenue, thence south and east by Greenwich, Washington, Liberty and William Streets to the mouth of another tunnel at Old Slip. On the Brooklyn side the two loops connect with all the principal travel routes.

NEW HOME FOR STREET RAILWAY JOURNAL

A contract has been placed with Frank B. Gilbreth, New York, for the erection of a building on Thirty-Ninth Street, between Seventh and Eighth Avenues, for The McGraw Publishing Company, publishers of the Street Railway Journal, the "Engineering Record," "Electrical World," and other periodicals. The plot is 126.4 ft. long and 98.9 ft. deep. It is planned to make this structure ten stories high, with the basement and lower floors devoted to printing machinery, the top floor to an engraving establishment and the remaining floors to offices.

It is proposed to construct this building entirely of reinforced concrete. It will be the most important concrete structure in New York City, and will have much influence in determining the future of such work, but until the specialists who are preparing the plans and the building department of the city, which must approve them, have reached a conclusion, no definite plans can be made. The building is designed by Prof. William H. Burr and Messrs. Radcliffe & Kelley. W. S. Timmis, consulting engineer, will be in charge of the mechanical equipment of the printing offices.

The new home of the Street Railway Journal will be about half-way between the New York Central Railroad and Pennsylvania Railroad termini in New York City, and is in close proximity to the new United Engineering Building and Engineers' Club, which are now being erected between Fifth and Sixth Avenues and extend from Thirty-Ninth to Fortieth Street. The United Engineering Building will be occupied by the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and other engineering and scientific bodies, and upon its completion will undoubtedly constitute the center of engineering interest in New York City.

CHICAGO TRACTION MATTERS

At the conference of the Chicago traction interests, held in New York, the Union Traction Company made a proposition to put the underlying companies, the North and West Chicago Companies, exactly where they were when the Union Traction Company took them. It denied the claim of $3,350,000 which the underlying companies contended was due them.

Mayor Dunne, Walter F. L. Fisher and W. W. Gurley made an appeal to Secretary Taft for an extension of time for the lowering of the tunnels in the Chicago River. Concerning the meeting with Secretary Taft, Mr. Gurley said: "Mr. Fisher had a theory that we could handle the traffic without electrifying our cable lines. His notion was that we could electrify the downtown lines and change motors north and west of the river. The Mayor had the same idea. Unfortunately, I could not agree with them.

Samuel Adams has been appointed by Mayor Dunne special traction counsel. Mr. Adams will be an assistant to Walter L. Fisher. Mr. Adams is an instructor in the Northwestern University Law School.

The answer filed by the Chicago Union Traction Company to suits brought by the North Chicago Street Railroad Company and the West Chicago Street Railroad Company, by which these companies ask that their leases to the Chicago Union Traction Company be declared void, avers that the company is able to carry out the terms of the lease. The answer in part reads:

"It is denied that the amended leases are too onerous for the Union Traction Company to bear and abide by, and we respectfully show that in the absence of any existing or imminent default in respect to any of the covenants and provisions of said leases, it is not competent or seemly for the lessor or its receivers, for their own gain and advantage, to suggest that the leases be terminated."

Clarence A. Knight, in the interests of the Yerkes estate, has renewed his application for the right to examine the books of the North and West Chicago companies so he could make proper answer to the suit of these companies, which seek to have the court declare that the Consolidated line is equitably the property of the complainants.

BROOKLYN RAPID TRANSIT EMPLOYEES' ASSOCIATION DOINGS

The entertainment committee of the Brooklyn Rapid Transit Employees' Association arranged a free entertainment for employees, their families and friends, which was given at the clubhouse of the association at East New York, on Thursday evening, April 19. The entertainment consisted of a band concert by the Employees' Benefit Association band and a series of illustrated songs and moving pictures. Included in the entertainment was the distribution of prizes to the following employees for selling the highest number of subscriptions to "The Third Rail," the new magazine published under the auspices of the association: James Seely, motorman, Halsey Street depot, first prize, $50; Joseph Perger, motorman, Ridgewood depot, second prize, $20; Jos. A. Willey, conductor, Ridgewood depot, third prize, $15; Joseph Ebert, inspector, East New York depot, fourth prize, $10; Geo. Greene, conductor, Bergen Street depot, fifth prize, $5.

In connection with association matters, the visit of Miss Clara Pickens Noble, representing the American Institute of Social Service, to the various clubrooms of the association recently, is of interest. Miss Noble took some twenty-four interior and exterior views of the structures, which will be exhibited at the exposition in Milan this summer. Lantern slides were made of these views by the association, and they were shown at the entertainment last Thursday.

The spring Luna Park festival of the association will commence on Monday, May 14, and, as customary in former seasons, purchasers of festival tickets will have the advantage of getting $1 worth of attractions at Luna Park for 50 cents. As Luna Park has been completely renovated this spring, the association expects much larger returns from the festival than heretofore.

The annual election for a vice-president and three trustees will take place on Saturday, May 5. The candidates for these offices have not yet been fully nominated.

"THE FASTEST INTERURBAN ROAD"—CHANGES IN LONG DISTANCE SERVICE

At present there is a great deal of rivalry between several of the interurban roads in Ohio over which has the fastest regular schedule for its limited trains. Nearly a year ago the Western Ohio and Dayton & Troy roads put on a parlor car limited schedule between Dayton and Lima of 80 miles in 2 hours 30 minutes, and the company has since been advertising the "fastest trolley service in the world." A few weeks ago Manager Darrow, of the Toledo & Indiana Railway, put on a parlor car limited making the 57 miles from Toledo to Byran in 1 hour 45 minutes, and his advertisements read "The Fastest Electric Service in the World." Then came the Ft. Wayne, Van Wert & Lima Traction Company with a limited service between Lima and Ft. Wayne, 64 miles, in 2 hours, and it now claims to be the record breaker for high speed. An interesting feature of the controversy is that if the passenger agents of the various roads had taken the trouble to figure out the speed of their schedules in miles per hour they would have discovered that all three are practically the same—32 m.p.h.

Some interesting innovations will take place soon in the development of long-distance high-speed service on Ohio and Indiana roads. At a meeting, held in Dayton between representatives of the Dayton & Troy, Western Ohio and Toledo urban and interurban companies, plans were worked out for starting the through Dayton to Toledo service on May 1. Parlor cars will be operated, and there will be no excess fare on interline trips, but on rides between local points an excess will be charged. The cars will make the 162 miles between cities in 5 hours 30 minutes, an average of 30 m. p. h. On April 15 the Indiana Union Traction Company and the Ft. Wayne & Wabash Valley Traction Company instituted their limited service between Ft. Wayne and Indianapolis, 137 miles, in 4 hours 30 minutes, a trifle better than 30 m. p. h. These new services will closely connect, and will make it possible to travel from Toledo to Indianapolis, 281 miles, in 9 hours 30 minutes. Rates between these and intermediate points have been announced. The indications are that Indiana roads will withdraw the excess fare on limited runs on all except local rides, as is being done in Ohio.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 24, 1906

817,820. Railroad Rail Joint; George A. Weber, Stamford, Conn. App. filed Nov. 27, 1900. Comprises side bars at each side of the rail, a rail chair having a base and upright at right angles thereto, and bolts extending through the upright, the side bars and the web of the rail.

817,821. Rail Joint; George A. Weber, New York, N. Y. App. filed March 31, 1905. Rail chairs provided with bases underneath the rails and inwardly and upwardly bent portions adapted to bear upon the upper surface of the bases of the rails and against the outer portions of side bars which embrace the rail.

817,822. Rail Joint; George A. Weber, New York, N. Y. App. filed March 31, 1905. A rail chair having a base and upright and an inwardly extending rib or nose upon the upright projecting beyond the plane thereof and adapted to bear upon the base flanges of the rails, sleeves between the upright of the chair and the side bars which embrace the rail and bolts for securing the parts together.

817,823. Rail Joint; George A. Weber, New York, N. Y. App. filed March 31, 1905. Relates to a joint such as that shown in patent 817,821, above, with the addition of a spiking-rib bent out of the plane of the base.

817,824. Rail Joint; George A. Weber, New York, N. Y. App. filed June 24, 1905. The rail chair has a base underneath the rail, and an inwardly and upwardly bent portion forming a bolt-plate and means for securing the side plates to the rail and upright.

817,825. Step Joint; George A. Weber, New York, N. Y. App. filed Sept. 14, 1905. Relates to means for adjusting the height of one rail end with respect to the other.

817,846. Trolley Head and Current Collector; John E. Greenwood, Utica, N. Y. App. filed Oct. 31, 1904. Two trolley wheels supported on a spring yoke swivelled on the trolley pole.

817,858. Automatically Tripping Trolley Pole; Thomas H. Mars, Chicago, Ill. App. filed July 12, 1905. The trolley pole

has an extensible link connection with a spring which normally holds the wheel against the wire, but the spring is tripped out of operative relation by any sudden upward movement of the trolley pole. The extensible link serves to reposition the parts in normal relation when the pole is drawn downward.

817,960. Signal for Switches; Barnard G. Matz and Michael Wozniewski, Chicago, Ill. App. filed July 17, 1905. The switch point has mechanical connections with a rocker arm which moves a lever over segments to illuminate different lamps.

817,940. Inclined Railway; William H. Strickler, Chicago, Ill. App. filed Oct. 25, 1905. Details of a cable and means for engaging the same.

818,116. Renewable Cap for Permanent Way Rails; Herbert W. Perry, Trichinopoly, India. App. filed June 6, 1905. A removable tread having depending flanges for engaging the head of the rail.

818,133. Combined System of Electric Signaling and Switch Setting for Railroads; Bruno O. Wagner, El Paso, Tex. App. filed Oct. 28, 1904. A signal system having electromagnetically-operated switch points and various operating and signal circuits, including means for heating the rails in winter.

818,169. Electrical Circuit and Device; Robert J. Hewett, Westfield, N. J. App. filed June 2, 1905. A overlap block system operated by the successive short-circuiting of the rails by the train axles. The invention is designed to effect an economy in the circuit consumption of the signal circuits.

818,170. Electric Device and Circuit; Robert J. Hewett, Westfield, N. J. App. filed June 2, 1905. Modification of the above.

818,189. Theatrical Device; Harry M. Pettit, New York, N. Y. App. filed Feb. 27, 1905. An automobile having wings and means for spreading the wings and vibrating the same.

818,203. Railway Signal Controlling Circuit; Herbert B. Taylor, Newark, N. J. App. filed Oct. 1, 1900. Comprises track sections electrically continuous from end to end of the section and electrically separate from adjacent sections and the circuits of the respective sections being identical in arrangement.

818,279. Car Step; Nancy A. E. McLendon, Sanford, Col. App. filed May 31, 1905. Folding steps and means for folding and unfolding them.

818,311. Boltless Rail Splice; Charles L. Sullivan and Willett J. Dickinson, Chicago, Ill. App. filed Jan. 27, 1906. A rail joint comprising a spring clamp extending beneath th rail and having upwardly inturned ends engaging perforations in the side bars.

818,349. Control System; Frank E. Case, Schenectady, N. Y. App. filed Oct. 10, 1904. Obviates the necessity of careful insulation which is now required for a pilot wire of a train which actuates the circuit braking magnets. Provides that the circuit-breaking wire shall be operable to throw the circuit breakers only when the motor circuits are energized, but not when the motor circuits are de-energized.

818,384. Car Wheel Flange Lubricator; Andrew C. Love, Sacramento, Cal. App. filed Aug. 23, 1905. In stead of lubricating the track rails, the wheel flanges are lubricated.

PERSONAL MENTION

MR. JOHN CLAFLIN has resigned as a member of the New York Rapid Transit Commission.

MR. HENRY EVERETT, of the Everett-Moore syndicate, of Cleveland, has returned from a two months' trip through Europe.

MR. HARRY W. GARFIELD, superintendent of the Marlboro & Westboro Street Railway since its opening six years ago, on his retirement from the road April 1, was presented with Masonic and Odd Fellows emblems by his associates.

MR. HENRY F. MILLER, of the General Electric Company, of Schenectady, has been appointed to the newly created position of superintendent of shops of the Hartford Street Railway Company, of Hartford, Conn.

MR. HENRY A. NETTLETON, cashier of the Hartford, Manchester & Rockville Tramway Company, of Hartford, Conn., has been appointed superintendent of the company, to succeed Mr. J. L. Adams, whose appointment to a position in Ohio is noted elsewhere in this issue. Mr. Nettleton has been with the company since 1896.

MR. GEORGE H. CLIFFORD, secretary of the Northern Texas Traction Company, has been appointed general superintendent of the operating department of the company and will look after all details of the operation of cars, etc., on the Interurban, the Dallas and Fort Worth lines. Mr. Clifford has been with the company five years.

MR. MICHAEL KELLEY, superintendent of the People's Railway Company, of Dayton, died last week. The deceased had been suffering from organic trouble for some time, but it is believed that his death was brought on by worry over the recent tragic death of General Manager Joseph L. Breen, of the company, whose duties fell largely upon Mr. Kelley.

MR. F. W. HAMLIN, formerly trainmaster of the Appleyard lines, has been appointed trainmaster of the Columbus, Delaware & Marion Railway, with headquarters at Delaware. The trainmaster's work has heretofore been looked after by Traffic Manager A. L. Neereamer, but because of his numerous other duties it was found necessary to create this office for the company.

MR. HARRY T. REITER, manager of the Fremont Street Railway Company, of Fremont, Ohio, has resigned to become manager of the Fort Worth & Arlington Heights Interurban Railway Company, of Ft. Worth, Tex., operating the electric light and waterworks plants and the street railway system in conjunction. Mr. A. V. Baumann, of Fremont, is president of the company, and Fremont people control the property.

ANNOUNCEMENT was made in Milwaukee on April 14 of the engagement of Miss Mary Grace Beggs, only daughter of Mr. John I. Beggs, president of the Milwaukee Electric Railway & Light Company, and Mr. Richard McCulloch, of St. Louis, Mo. The wedding will take place some time next fall, and the couple will leave immediately after for a tour of Europe. Mr. McCulloch, who is assistant general manager of the United Railways Company, of St. Louis, is the son of Capt. Robert McCulloch, the vice-president and general manager of the company.

MR. EDWIN B. MEISSNER has been appointed chief clerk to President John I. Beggs, of the Milwaukee Electric Railway & Light Company, succeeding Mr. R. O. Jasperson, who retires from the company to return to the newspaper business. Mr. Meissner has been with the company eight years, entering the service as a messenger when fifteen years of age. Mr. Meissner is a graduate of the Second District School and attended the West Division High School and a commercial college. He also studied electrical engineering after he had entered the service of the company.

MR. GEORGE E. TRACY has recently been appointed master mechanic of the St. Louis & Suburban Railway Company, of St. Louis. Mr. Tracy graduated from Rutgers College in 1894, with degree of E. E., and was connected with the North Jersey Street Railway Company, at its Plank Road repair shops, for a period of seven years. Later he was superintendent of the Camden, Gloucester & Woodberry Railroad Company, Gloucester, N. J., for four years. Previous to Mr. Tracy's connection with the St. Louis & Suburban Railway Company he was at work in the testing department of the Interborough Rapid Transit Company, of New York.

MR. J. L. ADAMS, manager of the Hartford, Manchester & Rockville Traction Company, of South Manchester, Conn., has been appointed general manager of the Indiana, Columbus & Eastern Railway Company, with headquarters at Columbus. This is the company formed by the Schoepf syndicate to take over all the lines between Dayton and Zanesville, heretofore known as the Tucker-Anthony lines and the Appleyard lines. The properties include the Columbus, Newark & Zanesville; the Columbus, Buckeye Lake & Newark; the Columbus, London & Springfield; the Columbus, Grove City & Southwestern; the Dayton, Springfield & Urbana; the Urbana, Bellefontaine & Western, and the Springfield & Western, in all about 250 miles of road.

MR. GARDNER F. WELLS, general manager for the Terre Haute Traction & Light Company, of Terre Haute, Ind., has been promoted to the Boston office of Stone & Webster, owners of the local property, and Mr. C. T. Mordock, who has been superintendent of the lighting and power department of the Terre Haute company, has been appointed to succeed Mr. Wells. The change will be effective May 1. Mr. Mordock's successor has not been appointed. Mr. Wells assumed charge of the local system in Terre Haute about three years ago, and many improvements have been carried out under his management. Mr. Mordock came to Terre Haute in December, 1901, as superintendent of the lighting and power department. He is a Pennsylvanian by birth, but has lived most of his life in and about Chicago. He was graduated from Cornell University in 1897 with the degree of electrical engineer. Before coming to Terre Haute, Mr. Mordock was with Stone & Webster, of Boston, for a year. Previous to that he was with the American Telephone & Telegraph Company, of Chicago, for three years.