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

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## Improving the Forge Shop

In common with the repair shop, the forge shop offers a fertile field for the introduction of labor-saving methods. Thus, the ventilation question deserves study in its bearing upon increased output of employees, for in many cases the atmosphere of the smithy is vitiated by smoke and dust—a condition sometimes extending to adjoining shops.

Frequently the air for the forges is supplied by one employee at the bellows instead of being furnished by a power-driven fan. A case in point is that of a Western road in which the forge and machine shops occupied different ends of the same room. The air was very bad, and the company finally realized the expense of running the bellows by muscular power. In-

stead of belting a fan to a convenient line shaft which was already installed within 10 ft. of the forge nearest the machine shop, the company attached an old locomotive steam-driven air compressor to the opposite wall, with all its wastefulness of power, and at last accounts was attempting to operate the blacksmith department air supply by this means. Half-way measures of this character often show economical results in comparison with the original conditions obtaining; but in many cases a much higher efficiency of operation and a greater saving in running expenses can be secured by following questions of this kind to their logical conclusions. It is often as easy to obtain economical operating conditions in an old shop as in a new one, if a little forethought is observed.

## Changing Car Colors

There is a constant changing of the standard car colors of both steam and electric roads. This is partly attributable to changes in management, but is due fully as much to changes in the ideas of the same manager from year to year. It is not uncommon to find a large city system having three or four different colors, and this difference in colors is not due to any old-fashioned ideas of the management as to having a different car color for each route, but is caused by the different ideas entertained by the management as to the proper car color at the time various lots of new cars were ordered. It has been our observation that, no matter what color the management of a road adopts, there is likely to come up a question after a few years operation as to whether that color is the best, and whatever the color, the difficulties in securing one which will not fade, which is easy to match and easy to maintain, are so great that the management is likely to conclude that almost any color than the one with which it has had the most experience would be better. In other words, it is a case of "whatever you do you will wish you had done the other thing." One company abandons red because it is hard to maintain; another is just adopting red, and so on. Even the standard Pullman car colors are not entirely the same from year to year. This is evidently not a case where we can learn much from the steam roads, because we find our steam road brethren are fully as fickle in the matter of colors as electric railway men. Not quite as great a variety of colors are used on steam railway passenger coaches as on street railways, but there are enough to confuse any one who is trying to select the best color in the light of steam railroad experience. In view of the great variety of colors used by railway companies during many years operating experience, it would appear that, as far as durability and ease of maintenance are concerned, there is no great difference between the five or six most common car colors, and that it is mainly a question of getting good colors in the first place and not neglecting cars so that they can become weather beaten. No color will look well if a car is neglected, and almost any of the good standard colors will look well if the car painting is well maintained.



### Buffet Cars on Interurbans

At first thought, the proposition of operating a buffet car on an interurban line might seem questionable, as most interurbans cater so largely to local business. A further investigation shows, however, that there is a certain field for the interurban buffet or dining car, just as there will certainly be in time for the interurban sleeping car. The buffet car of the Aurora, Elgin & Chicago Railway, described in our last issue, might appear at first to be one of these questionable investments, but when the conditions are all understood it settles down to a more businesslike proposition. In the first place, as long as the company is catering to special parties, there will always be an opportunity to make good use of a car of this kind, for it makes an excellent car for special parties and is not by any means purely a buffet car. As a special car was needed to take care of the special party business, it was nothing more than good business judgment to make the car so that it could serve the purpose of a diner, especially when the character of the suburban territory through which this line runs is considered. This is the only railroad having a station near the extensive golf grounds at Wheaton, near Chicago, and there is a fairly steady demand during the summer for the highest class of service in the way of cars for special parties, as well as a parlor and buffet car service, and it is not unlikely that something in the way of regular combination parlor and buffet car service may be arranged for later if traffic conditions warrant it.

There is another field for the interurban buffet or dining car to which we have referred before. This is in the interurban limited service which is being carried on between some of the more important towns. These limited cars are patronized by those who are willing to pay an extra price for speed and freedom from the annoyance of local stops, and it is this class of passengers, including traveling men and others, that would gladly pay for buffet lunch service on these cars during meal time hours, as it would mean either the avoidance of considerable discomfort due to irregular meals, or the saving of considerable time. For such service, while a regular dining car would hardly be the thing, a car of the class now being built for limited interurban service, with arrangements for tables between seats and for serving light lunches, is well adapted, and such a car does not involve much idle investment, as the kitchen can be very small and takes up but little room. It is only where runs are more than an hour in length that such a service could probably be made to pay, but between large towns, with runs of over an hour, there is certainly a demand for it.

For example, suppose a traveling man in Indianapolis wishes about noon to take a limited car for some point two hours distant. If he can get a lunch on board he will by all means take that car rather than wait until another car and lose half the afternoon for the sake of getting lunch before he starts. No one realizes this better than the traveling man.

It may be a little aside from the subject of buffet cars, but it would do every interurban manager good to occasionally start out as would a commercial traveler and attempt to "make" a number of the principal towns, either in his own or some other territory. He would no doubt be set to thinking of several things that would not otherwise occur to him, not being in the habit of looking at things from the traveler's standpoint, and he would therefore be in a better position to plan for the accommodation of those who create the gross receipts. It is usually best to make such trips away from one's own territory, because the home ground is so familiar that it is impossible to

go over it in the same critical state of mind as would the average traveling man.

### Amateur Criticism in St. Paul

One of the most prominent traits in human nature seems to be the tendency to perpetually kick against the pricks. Since the telephone came into universal use in active urban affairs, the mental athleticism of rancous-voiced fault-finders has been stimulated beyond precedent, and scarcely a day passes in any city telephone exchange without a liberal harvest of indiscriminate complaints from the public at large. Most of these objections to the service are lodged with the operating company, however, and to the street railway is left the privilege of being run by non-technical editors and letter-writers to the daily newspaper—if the regular management would but consent.

The latest illustration of this constant chip-on-the-shoulder attitude comes from St. Paul. One of the prominent daily papers of that city has "handed a hot wan," as Mr. Dooley would put it, to the Twin City Rapid Transit Company in regard to the Union Depot Loop, the editorial roasting oven having been run overtime on forced draft to deliver the high temperature criticisms in season for the breakfast editions. It seems that the company, backed by the opinions of numerous abutting citizens along the route, has about come to the conclusion that the Union Depot Loop is scarcely worth its operating expenses in the transportation scheme of the city, and on the strength of the exceedingly small traffic handled on this portion of its lines is considering the desirability of cutting out that particular service altogether. The possibility of such an occurrence has aroused the daily paper in question to such a feverish state of mind that it is worth while to bring out a few points in connection with the situation.

At the present time the traffic on the Union Depot Loop in St. Paul is handled by two small cars on an interval scheduled at seven or eight minutes through most of the morning and afternoon. The Union Depot is located at the foot of Sibley Street, in the heart of the wholesale district, and is within three short blocks of close interval car lines giving free transfers to every line in the city. Two of the most important lines pass within two blocks of the railway station, and practically every electric car in St. Paul that enters the business district passes within, at the most, five blocks of the Union Depot. Innumerable passengers leave their cars at points so near the station that they do not consider it worth while to transfer, either to the loop cars or to the other adjacent lines. The nearest point to the depot on the loop line itself is a block from the door. The traffic on the line indicates that little if any need of the loop service exists. In comparison with other cities the people of St. Paul are well served in the matter of access to the railway station, and in no city of consequence is it expected that every car will pass out of its logical route to handle the relatively small business of long-distance travelers—at least by persons informed upon transportation matters. One does not walk much, if any, further in St. Paul between the steam railway train shed and a car line transferring to every route in the city than in leaving the Boston South station or the Denver Union Depot, to cite two examples of cities having adequate car service. Certainly the majority of the traveling public must be cared for before the cars on every line can be diverted for the benefit of a small minority.

In this connection lies a point often missed by these amateur masters of transportation who are always on the hunt for trouble: The interests of the public and the street railway com-



panies are identical in ninety-nine cases out of one hundred. Track locations are difficult enough to secure in these days, so that when one is given up or the service cut out, it may be pretty generally assumed that the line is of no value to either the public or the operating company. It is only fair to say that the interval between cars on the Union Depot line in St. Paul has not always maintained the highest standards of regularity, and that if any service whatever is to be given it should be as close to scheduled intervals as congested city streets will permit. This, however, in no way justifies the editorial tirade against the Twin City Company, as an examination of the present adequate facilities by a professional electric railway man will disclose. From the earliest days of the commuter on steam roads down to the present time, practically every other man in the street considers himself perfectly capable of running a railroad under all circumstances, failing to realize that the experience of years is a vital factor in successful service. Criticism is well enough if it is presented to the proper authorities, but it would be fitting if unprofessional students of street railway matters would refrain a little oftener from rushing into print until they have first discussed operating questions with the men who grapple with them in their daily work and who are making a life study of the business.

### The Supply Men at the St. Louis Convention

As already announced in these columns, a preliminary organization, known as the Manufacturers' Committee, has been effected among the manufacturers and dealers in street railway supplies to co-operate with the executive committee of the American Street Railway Association in caring for the exhibits and the entertainment of attendants at future conventions of the association. Several suggestions have been made in past years for the organization of a body of this kind, but the time was not ripe for it, as the traditions of the association had always been that the local street railway company, in the city in which the convention was being held, would provide all of the local arrangements necessary for the entertainment of those in attendance.

This hospitable policy originated at a time when the association consisted simply of the presidents of a very few street railway companies and when the total number in attendance at any convention did not number over fifty. The custom has been continued up to the present time with most praiseworthy generosity and regardless of expense, but all members of the association have recognized for some time that with the increasing attendance this burden could no longer be placed upon the local railway company. In fact, many have expressed themselves to this effect at recent meetings of the association. It is not only a question of expense, although this item runs into many thousands of dollars, but of expediency as well. Under the plan pursued so far, the manager of the local company and his assistants, all of whom are busy men, are obliged to assume for several months prior to the meeting, the details of providing entertainment and caring for other features of the annual convention, a burden which it is not fair to impose upon them.

For a long time the representative manufacturers have felt that they would be glad to assist in both the necessary expenditure and the preliminary work attendant upon the carrying out of a successful convention programme, but there has been a natural disinclination both on the part of the local street railway company to seem to shirk any of this work and on that of the members of the association to receive co-operation in this

way from any one outside of the association. This year, however, seems for every reason a most opportune one for initiating a new plan. The executive committee has wisely agreed that in view of the meeting at St. Louis there is no necessity for any exhibits, and opinion is now unanimous among the street railway companies that in view of the size of the gatherings a change of procedure is advisable. To undertake this work is, in brief, the field of the present Manufacturers' Committee. The plan has had the indorsement of the officers and of many of the leading members of the association, and we have no doubt that it will receive the co-operation as well of all of the manufacturers and the supply dealers, as well as the approval, at St. Louis, of all of the members of the street railway association.

As at present constituted, and with practically no personal solicitation, the new association has over seventy subscribed members and other pledges which will make the number over one hundred. If its purposes were better known—and we hope that they will be fully recognized before the St. Louis convention—it should have at least 300 members, as the expense connected with membership is trifling. At St. Louis the new association will provide an attractive programme in the way of entertainment, and will also supply all of the badges used by both delegates and supply men. Its future work will depend upon the wishes of the association as expressed at the annual meeting, but the committee is prepared to act for the American Street Railway Association in any way in which the latter will consider its services useful.

Although the step is an innovation in the street railway field, it is in no sense an experiment. A similar body has been co-operating for a number of years with the Master Car Builders' and the Master Mechanics' Associations of the steam railroad companies, and has been found a most useful body; in fact, one which is now regarded as indispensable to the success of the meetings of those two societies. The steam railroad manufacturers' association is fifteen years old, and at the last convention at Saratoga of the Master Mechanics' and the Master Car Builders' Associations was represented by 327 members, each of which had present anywhere from one to thirty-two men. The annual dues to this association are \$35. The badges at Saratoga were supplied by this association and were confined to official delegates and to members of the manufacturers' association or their representatives, and it is needless to say that all supply men in attendance at the convention were members of the association.

We realize that a number of street railway manufacturers have taken no action as yet in regard to the Manufacturers' Committee, partly because of their desire to await further information at St. Louis and partly because the work of the committee has been identified largely with exhibits, and as there are to be no exhibits at St. Louis it has been thought that there was no special reason for joining the association. This, however, we believe to be an erroneous theory. The policy of the American Street Railway Association as regards its future plans must depend largely upon the co-operation which it can depend upon receiving from the manufacturers' association, and hence upon the unanimity with which this association is supported by the supply men. The latter, for many years past, have been the recipients of hospitality from the American Street Railway Association, and it is time for them to demonstrate to the street railway managers that they are ready to co-operate with the association in any policy which the latter desires to pursue.

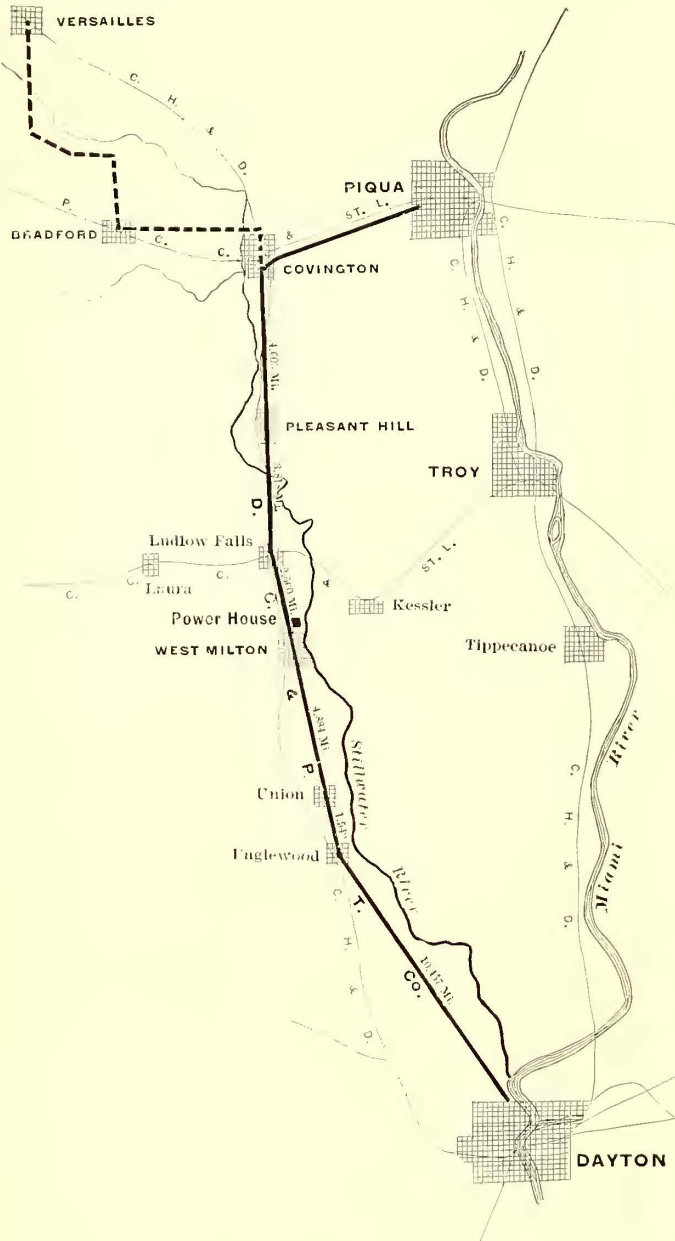


**THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY**

An excellent example of the successful development of an electric railway passing through a farming district containing several small towns is furnished by the Dayton, Covington & Piqua Traction Company, of Dayton, Ohio. With reference to territory and construction, the road is situated like dozens of other interurban roads in the Central West. To be more accurate, it is in one respect worse off than the majority of such roads, since its terminal points are connected by another electric railway traversing a shorter route. Despite this apparent handicap, the Dayton, Covington & Piqua has a territory which is distinctly its own and it is serving and develop-

ing of the 6-mile extension, and the name of the property was changed accordingly. The valley is lined with small farms given up largely to market gardening, and the produce is sold in Dayton and Cincinnati. Before the building of the electric railway the people were obliged to depend upon a branch line of the Cincinnati, Hamilton & Dayton (steam) Railroad, which ran but two trains a day. The steam road takes a circuitous route into Dayton, and although the electric line makes no pretense at being a high-speed road, its cars give better time into the city from nearly all points than do the steam trains. The inhabitants of the towns along the line are as follows:

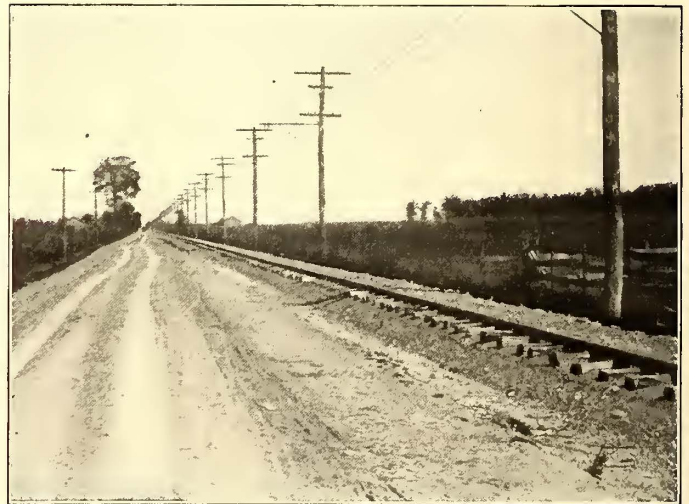
Dayton .....	115,000
Englewood .....	400
Union .....	300
West Milton .....	1,000
Ludlow Falls .....	300
Covington .....	1,800
Piqua .....	16,000



MAP OF DAYTON, COVINGTON & PIQUA TRACTION COMPANY'S SYSTEM AND CONNECTING LINES



AN EXAMPLE OF MASONRY CONSTRUCTION



TANGENT, SHOWING LINE WORK ON THE DAYTON, COVINGTON & PIQUA TRACTION LINE

ing it by methods unique in many respects and making the property a satisfactory investment for those who own it.

The road is 34 miles long, extending from Dayton to Piqua by way of Covington. Between Dayton and Covington it traverses the valley of the Stillwater River, one of the most picturesque and fertile valleys in the State. Originally the line was projected to afford better transportation facilities for this valley alone, and the project was known as the Dayton & Stillwater Valley Traction Company, but the demand for better connection between Covington and Piqua prompted the build-

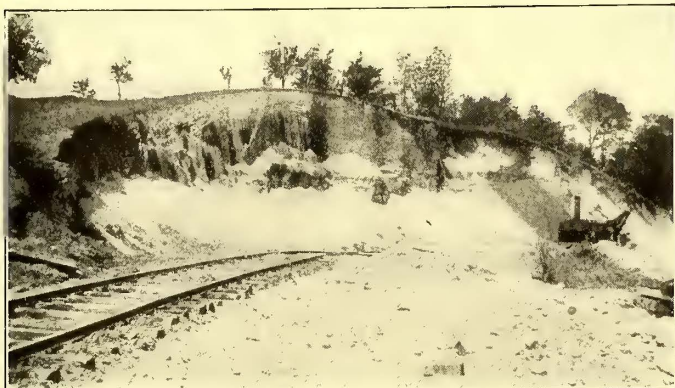
There are numerous small villages within a short distance of the line and contributing to it, and the population tributary to the line is figured at 160,000. It is the intention of the company to build a 12-mile spur to Bradford and Versailles, which have 1200 and 1500 population, respectively. The right of way for this extension has been obtained.

The road was projected by Judge Dennis Dwyer, one of the pioneer electric railway builders of Ohio, who is also responsible for several lines radiating from Dayton. He is now president of the company, although the control and management are



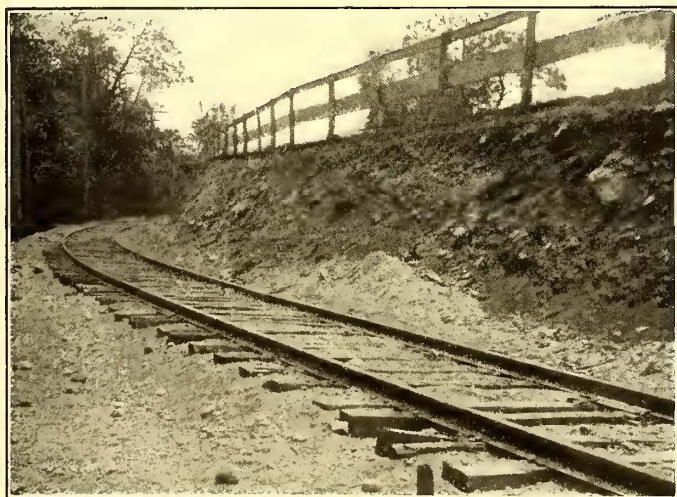
in the hands of the Boston Industrial Company, of Boston, who financed and built the road. The direct management is in the hands of Edward C. Spring, with the title of general superintendent.

From Dayton to Covington the line traverses the side of the main highway of the Stillwater Valley. The majority of its franchises are either perpetual or for fifty years, with a few of them for twenty-five years. The highway makes frequent changes, so that at times the line is in the valley and again



A GRAVEL BANK ON THE LINE OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

on the hillside, thereby necessitating numerous grades. However, only one of these exceeds 5 per cent. The section from Covington to Piqua is tangent, with no perceptible grade. The roadbed is maintained in excellent condition. The track is all 70-lb., with joints of the Continuous type. The rails are double bonded with the Ohio Brass Company's flexible all-wire bond on both sides of each joint beneath the plate. The track is cross bonded every 500 ft. with the Ohio Brass Company's bonds. The road was ballasted with a very coarse variety of gravel, of which a large bank was secured adjoining the right of way, and handled with a steam shovel and bottom dump



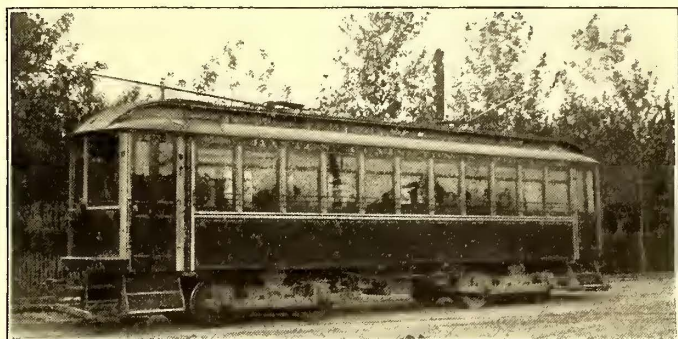
A CUT AND 5 PER CENT GRADE ALONG THE LINE OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

cars. There are several large cuts and fills and a number of stone culverts crossing small streams. At Ludlow Falls, crossing a deep gorge and the Big Four Railroad, the company built a three-span trussed bridge, 364 ft. long and 84 ft. high, resting on solid stone piers. The bridge was furnished by the New Castle Bridge Company. The bridge is almost over the falls, affording a view of a beautiful bit of scenery.

Over a considerable portion of the route the poles are 40 ft. high, and carry the lines of a telephone company operating in that district. On the balance of the route the poles are standard. The trolley is double 00 round wire. Three 0000 d. c.

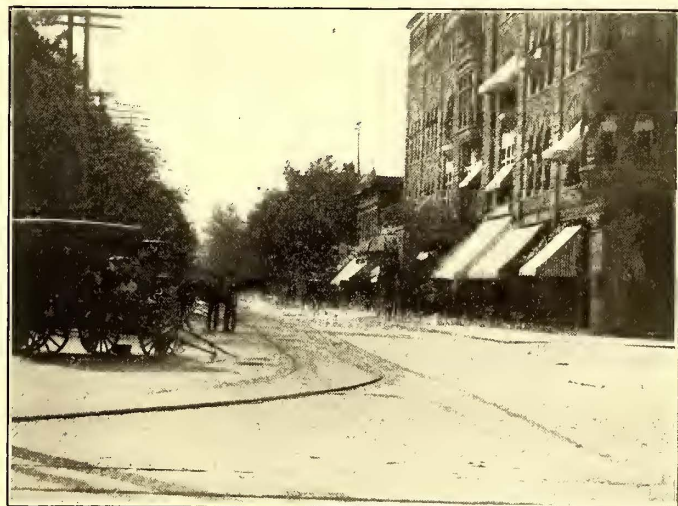
copper feeders extend the whole length of the line, carried on a cross arm above the side arm, and designed for six feeders. Above this cross arm is a smaller arm carrying the telephone wires for the despatching system.

The management believes in the use of comparatively small cars for a road of this character. With hourly headway the average loads are seldom up to the full seating capacity, and on heavy runs the practice is to run double-headers. The cars, which are 45 ft. in length, require about 125 amps. to start on a level, whereas some of the 60-ft. cars used by roads in this district require 300 amps. to start, and the additional weight



STANDARD PASSENGER CAR USED BY THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

and seating capacity are only used on occasional runs. The company has eight passenger coaches, two express and freight cars and two flat cars used as trailers. Three of the passenger coaches have combined baggage and smoking compartments, while the other five have passenger and smoking compartments. Each is furnished with a toilet room. They are equipped with four G. E. No. 57 and No. 67 motors, mounted on Barney & Smith class A trucks, and controlled by G. E. K-14 controllers. The car bodies were built by the Barney & Smith Car Company, of Dayton, and are of plain but substantial construction. The interior finish is of light oak. The auxiliary equipment in-



THE TERMINAL AT PIQUA OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

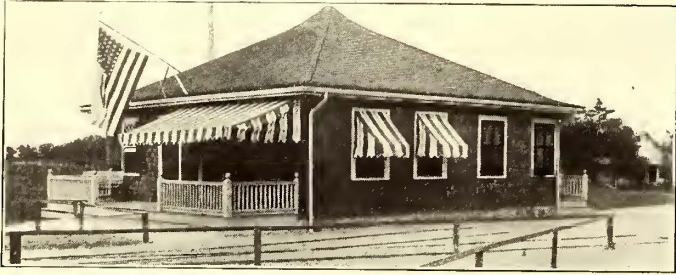
cludes Christensen air brakes, Consolidated electric heaters, Wilson trolley retrievers and two Ohmer fare registers. One of these is used for the interurban fares and the other for the city fares, as the cars enter the city for 2½ miles over the tracks of the People's Street Railway Company, the traffic agreement being on the Dayton plan, under which the city company takes 3 cents and the interurban company 2 cents of the city fare.

The freight cars are the same length as the passenger type, and have double doors to enable them to take on heavy freight. On the roof of each car is an elevated platform which permits



the use of the cars for line repair work. It is seldom that more than one of the freight cars is in service at the same time, hence there is no necessity for a line-car.

The main car house and power station are located at West Milton, together with the office and operating headquarters of the company. The arrangement of the buildings is shown in the accompanying illustration. The office building is a neat little one-story structure, the rear portion containing the dispatcher's office, a reading room and lavatories for the men, while the front portion contains the general office room and



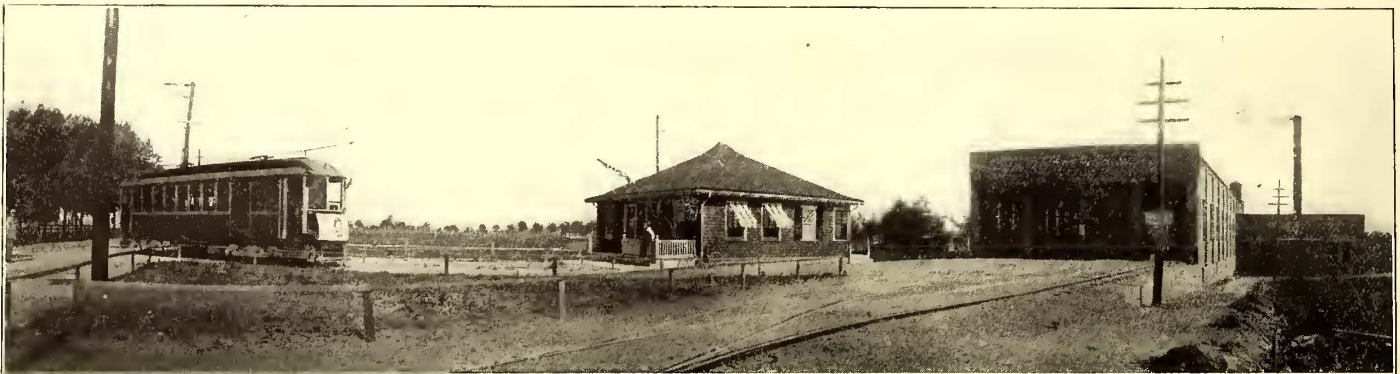
GENERAL OFFICES AND MEN'S WAITING ROOM AT WEST MILTON

private office for the superintendent. The car house is of brick, 174 ft. long x 48 ft. wide, and contains four tracks, one of them having a pit the entire length. The company does its own light repair work, but has not yet equipped a shop for heavy repairs. The equipment is new and very few renewals have been required. It is expected that this fall a number of machine tools and other necessary repair shop equipment will be installed. The power house adjoins and is connected with the car house. It measures 101 ft. x 50 ft., and is divided practically in the center by a brick wall separating the engine room from the boiler room.

Fuel for the house is handled in standard coal cars from a connecting track with the Cincinnati, Hamilton & Dayton (steam) Railroad within 500 ft. of the station. The coal cars are pushed by one of the company's freight cars through the

are 7-16 in. thick, and the heads 9-16 in. thick. They have plain grates, with 48 sq. ft. of grate surface, and operate at 120 lbs. of steam. They were built and installed by E. Hodge & Company, of Boston. A steel stack 72 ins. in diameter and 100 ft. high rests on its own foundation outside the boiler room. The breeching contains a Stillman automatic damper regulator operated from the main header, which is 12 ins. in diameter, and extends across the top of the boilers and is connected with them by 5-in. lines.

The engines are two Buckeye tandem compound, piston valve type, cylinders 78 $\frac{3}{4}$  ins., and 36-in. x 40-in. stroke, and revolve at 105 r. p. m. They are rated at 500 hp each, but frequently develop 800 hp. They consume about 18 lbs. of water per horse-power and about 4 lbs. to 4 $\frac{1}{2}$  lbs. of coal per horse-power. The engines are designed rights and lefts, and the stands for controlling the auxiliary equipment are between them. Below each engine is a Smith-Vaile jet condenser of the following dimensions: Steam, 9 ins.; air, 16 $\frac{1}{2}$  ins.; stroke, 18 ins. The exhaust piping is arranged with suitable gate valves, so that either condenser can be used on either engine. The auxiliaries are designed to make use of all hot water. The exhaust from engines passes through primary heaters before entering the condensers, and secondary heaters take the exhaust from the two condensers and the boiler feed pumps. The feed water is passed through three heaters and delivered to the boilers at 210 degs. The condensation from the heater system is used for heating the offices and car house. The water supply for the house is taken from the Stillwater River and is pumped 1600 ft. with a lift of 60 ft. to a 500,000-gallon cooling pond at the rear of the house. The pump house is on the river bank 12 ft. above high water, and contains a three-cylinder 7-in. x 8-in. Smith-Vaile pump direct-gearred to a 35-hp motor, which is started and controlled from the power house. The pump house is operated only a small portion of the time to keep the pond up to a certain level. Adjoining the pond is an 8-ft. well provided with a strainer from which the condensing and feed water are taken. The condensing water is conveyed back to the pond through a 16-in. tile overflow, and the warm water is



GENERAL VIEW OF THE OFFICE, CAR HOUSE AND POWER HOUSE OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY AT WEST MILTON, OHIO

second track in the car house onto an overhead trestle adjoining the boiler house. The fuel is dumped through the trestle into small industrial railway cars, which are pushed by hand into the boiler house in front of the boilers. The cars run into the house practically by gravity, as the boiler room floor is considerably lower than the surrounding property. All fuel is weighed as it enters the boiler room. The boiler room floor is 10 ft. below that of the engine room, while the engine room floor is 8 ft. below the level of the car house floor. The basement below the car house is used as a stock room and storage for material of all kinds, and the basement below the engine room contains the auxiliary steam equipment.

The boiler equipment consists of four return tubular boilers rated at 175 hp each. They are 72 ins. in diameter and 20 ft. long, and contain eighty-six 3 $\frac{1}{2}$ -in. flues. The boiler shells

carried around to the far side of the pond by a wooden trough, which assists in cooling the water. The overflow to the pond adjoins the point where the condenser discharge enters and impurities are carried off. There are two Smith-Vaile duplex feed pumps, one 6 ins. x 4 ins. x 6 ins. and the other 7 ins. x 4 ins. x 10 ins. Either can be used on the feed-water lines, and the larger is designed for fire protection and to supply the various buildings with water.

The lubrication of all bearings is automatically provided by a forced feed system in connection with a Columbus radiator filter furnished by the Columbus Oil Filter Company, of Columbus, Ohio.

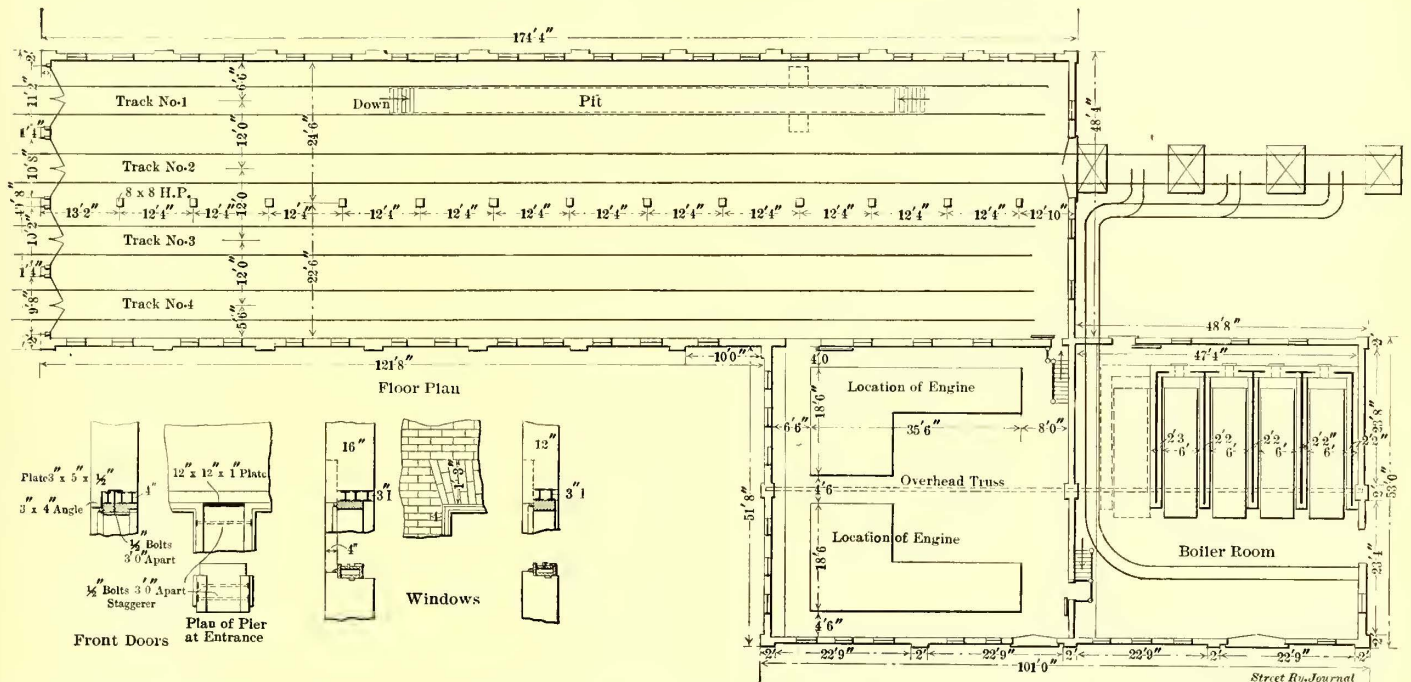
Direct current is used exclusively on this line, as it was not considered to be long enough to necessitate the use of alternating-current distribution. Three 0000 copper feeders cover



the line, and the voltage is well maintained at all points on the system. The generators are direct connected to the engines, and are of the General Electric direct-current type, rated at 300 kw, although it has been found that they were greatly underrated. Under normal conditions they develop 500 amps., and frequently have developed 850 amps. per machine. One machine has been found ample for the average load on 34 miles of track with five cars on regular headway, in addition to which they supply the West Milton Water Works with a small amount of power about equal to one car. The switchboard has six black enameled panels and occupies a bay. All switching is done from the negative side.

Before the road started, the company canvassed the freight and express situation very thoroughly and decided that more money could be made by pushing the freight business at steam freight rates, and also doing an express business at express rates, than by doing a purely express business and attempting to get express rates for everything, as is done by many of the roads in this district. The decision seems to have been a wise

The man acts as a go-between for the farmers along the route and the wholesalers and commission houses in Dayton. He calls up the farmers and inquires as to their offerings in fruit, grain, tobacco, live stock and other produce, and then calls up the city merchants and inquires as to their wants, frequently making deals on the spot. The company charges nothing for making these connections and is satisfied with the freight. Large quantities of grain and tobacco have been moved in this way and the company provides facilities for storing these goods when it cannot be moved at once. In handling tobacco it has a portable platform with scales, and the company's figures are taken by both parties, saving the time and expense of double weighing. A great deal of live stock, including sheep, pigs, calves and cattle, are handled to a stock yard at Dayton. These are handled in the closed freight cars and are carried through the city at night, the stock yard mentioned being on the Dayton, Springfield & Urbana Railway. The cars are well littered with straw and are thoroughly cleaned after each trip, so there is nothing offensive about their passing through the towns.



PLAN AND ELEVATION OF CAR HOUSE OF THE DAYTON, COVINGTON & PIQUA RAILWAY AT WEST MILTON, OHIO

one, as the freight business furnishes a very considerable portion of the gross receipts and is growing rapidly. Last year the freight cars showed earnings of 28 cents per car-mile as compared with 23 cents per car-mile for the passenger cars, while the operating expenses were practically the same in both cases, namely, about 14 cents per car-mile. In Dayton the company maintains a freight station in connection with the Dayton & Northern Traction Company, the two companies dividing the expense. The two companies also have a partnership arrangement on a passenger station and ticket office in the shopping district of the city. The freight station is in the wholesale district, and is a building 75 ft. x 50 ft., with track at the side and convenient platforms for both cars and teams. At Piqua the company owns a building 40 ft. x 80 ft., with teaming platform in front and track at the side. The car crews assist in loading and unloading the freight, and but one man is maintained by the company at each of the two stations. At other towns the company has an arrangement with some storekeeper for a waiting room and freight room, this being provided on a percentage basis. The secret of the success of the freight business is largely because the company maintains a solicitor, who pursues a number of unique methods in working up business.

Considerable dressed meat is handled from the stock yards to points along the line. For loading live stock the cars have been equipped with a special lattice work incline, which folds up into a door after the car has been loaded. From thirty to forty sheep or pigs can be handled at a time in one of the box cars. The rate charged is practically the same as on the steam road, but where the steam road would take a day to a day and a half to deliver the live stock to the stock yard, the electric line does it in three hours. Weight shrinkage is an important item in handling live stock, and owing to its quick delivery the electric company almost invariably gets the business. The company has a flat rate of 8 cents per cwt. on practically all classes of goods handled as freight. There are two regular freight runs each way a day, and there are a great many extra runs for car-load business. No package is handled for less than 25 cents. Every other car is a combination car, and a great many packages requiring immediate delivery, such as fruit, bread, etc., for the country merchants, are handled in these at the express rates—30 cents per cwt. Considerable business has been done in the handling of stone, lumber, gravel, bricks and other building material. This is usually handled at night on flat cars, which are hauled as trailers. A decided



novelty is the formation of an ice route along the line. The pond ice obtained throughout that district is not desirable owing to limestone deposits, and the company therefore made an arrangement with an artificial ice manufacturer at Dayton to deliver ice at the freight station in Dayton for 14 cents per cwt. The railway delivers it to stores, restaurants and families along the line at 28 cents per cwt., making a profit over

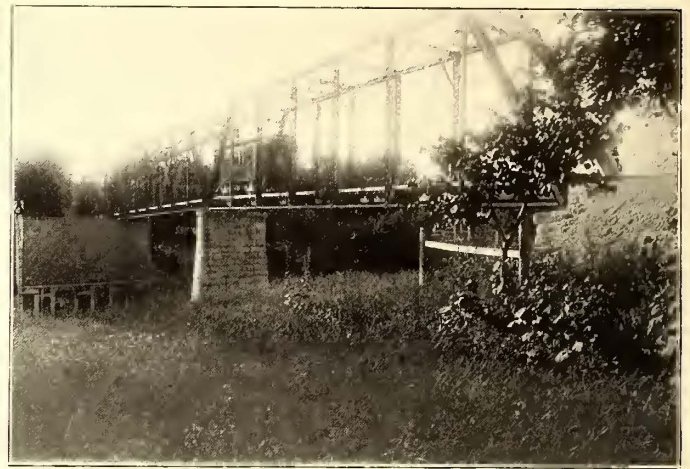


COOLING POND AND SLUICE FOR CONDENSING WATER

what the freight would ordinarily be. The shrinkage is not as great as might be supposed. The ice is delivered a few minutes before the departure of the first morning car on Mondays, Wednesdays and Fridays, these being the smallest runs of the week for other goods. The ice is in 300-lb. cakes, nothing smaller than this weight being sold. In many cases families in the same neighborhood club together and divide a cake. For handling ice the car is provided with a large steel pan with a drain through the side of the car, so that the water does not soak through the floor.

the company aims to act in conjunction with the traction companies, which will collect the produce and take it to the warehouse. It is the intention to place refrigerator cars on the traction line and handle dressed meat as well as produce. Owing to its territory, Mr. Spring's company will be a most important factor in the development of this new line of business.

Passenger business which is induced forms a considerable

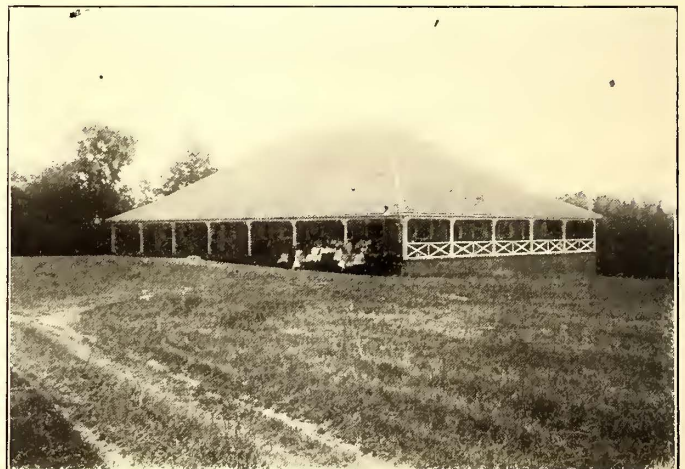


THE BRIDGE AT LUDLOW FALLS

part of the traffic of this line. The natural scenic beauty of the Stillwater Valley and the quaint villages through which it passes, makes the road a popular pleasure route, while the company's picnic resort, Overlook Park, at West Milton, is one of the most beautiful and popular in that section of the State. The company bought 80 acres adjoining its power house and office and bordering the Stillwater River, which at that point is quite wide. The resort was designed primarily as a picnic park and no attempt has been made to install the numerous attractions common with pleasure resorts near large



ALONG THE RIVER IN OVERLOOK PARK



THE DANCING PAVILION IN OVERLOOK PARK

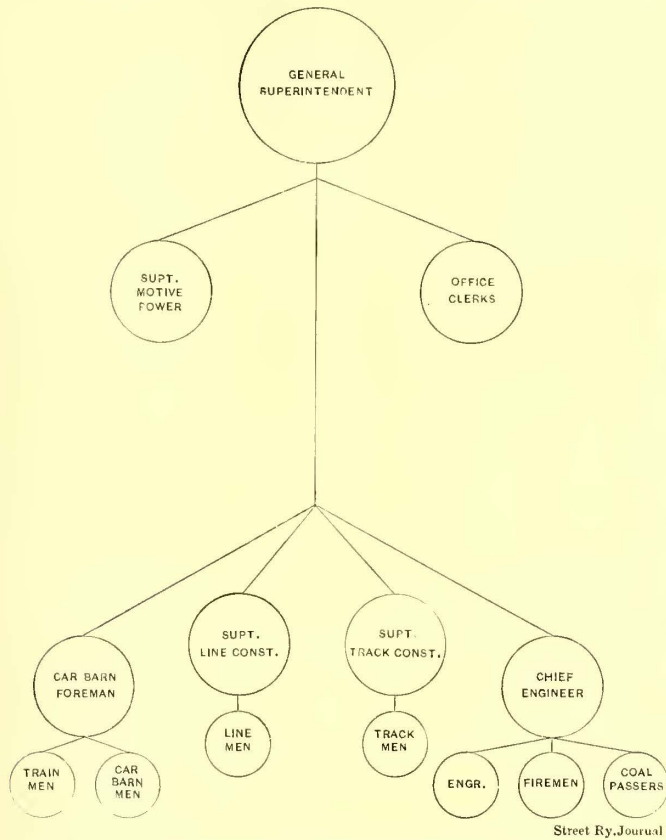
Superintendent Spring has been making a study of the most desirable methods to be pursued in developing the agricultural interests of his district, and he is endeavoring to induce the farmers to raise crops which find a ready market at Dayton. On several occasions he has arranged for public meetings in the various towns along the route, and addresses have been made by members of the State Board of Agriculture and other authorities on higher modes of agriculture, and already these meetings give promise of good results. Mr. Spring is cooperating heartily in the plans of the Ohio Cold Storage Company recently formed at Dayton for the purpose of establishing a large cold storage warehouse. The company will collect produce from the farmers and pay market prices for it and then distribute the goods over a wide territory. Wherever possible,

cities. A fine dance hall, 80 ft. x 100 ft., recently built, has a wide veranda extending all the way around, and has been constructed for winter as well as summer parties. It will be heated in winter by a steam pipe from the power station. There is an elevated platform for an orchestra, and the company has leased a Cecilian automatic piano, which has proven a very good investment, as it is operated for practically nothing. The night foreman at the car house does double duty on evenings when there are dances. He goes to the dance hall and plays a selection, then there is an intermission for five minutes while he goes back to the car house to look after his cars. The use of the pavilion and music are given free to a party chartering a special car, for which there is a fixed schedule of rates, according to what town the party is from. Suppers may be served, if de-



sired, as the building contains a kitchen. On Saturday evenings the hall is open to the public, and during the afternoons when there are no private parties, it is open to picnickers. The grounds are free to all who come on the company's cars. Nu-

been a day when the pavilion or grounds have not been let to parties. Some of the largest Dayton picnics have been held at Overlook Park this summer, and at times the company has had to borrow rolling stock to handle the traffic. Adjoining the park are the grounds and country quarters of the Dayton Club. In securing this Mr. Spring made an excellent move for his company. An old farm house occupied a beautiful site overlooking the river when the company bought the property. The management repaired it, beautified the grounds and offered



ORGANIZATION CHART OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

merous swings have been provided, and a number of steel row-boats have been placed in the river, which is exceptionally fine for boating and fishing.

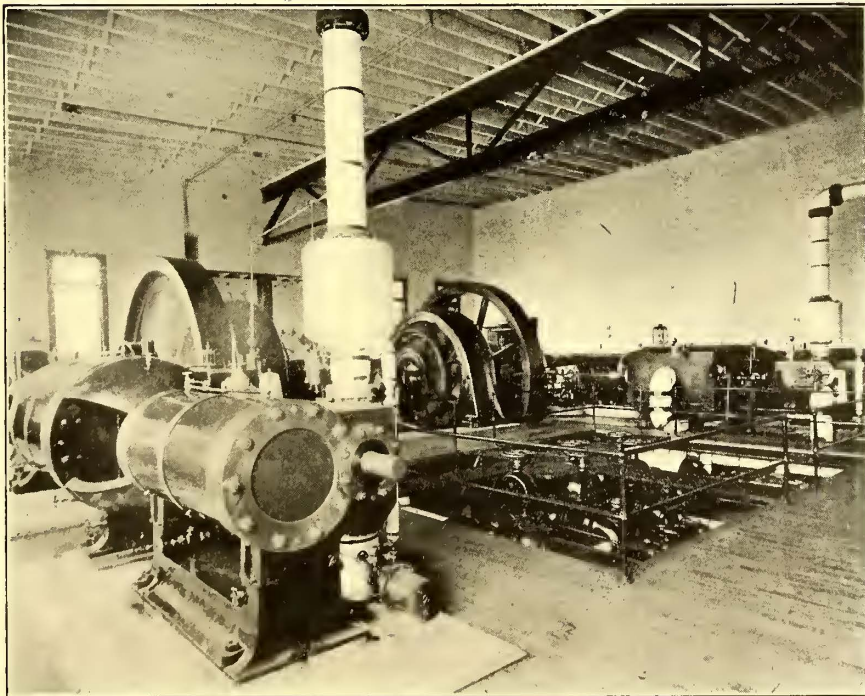


DAYTON CLUB HOUSE IN OVERLOOK PARK

the place at a nominal rental to the Dayton Club, one of the finest clubs in the city. The offer was accepted with alacrity. The place is pleasingly furnished in quaint country style, and the chicken dinners alone, not to mention the fine fishing and boating and delightful surroundings, serve to induce the club members to take advantage of every opportunity to run out to the club. Club members have free use of the park privileges, including dancing.

In addition to advertising quite extensively in the city and country papers, Mr. Spring has some rather diplomatic methods of making this resort known. When some society or organization plans to hold a picnic, free transportation for a committee to visit the park and a little lunch at the club go a great way toward deciding the matter when several resorts are being considered. Recently the Dayton Hotel Clerks' Association enjoyed a quiet little supper at the club, with a pleasant evening at the park, with the result that many strangers to the city seeking an outing are now advised to run out to Overlook Park. The daily newspaper men have been similarly entertained and columns of good advertising thus obtained at comparatively little expense.

Passenger rates on this road, as well as other Dayton interurbans, are comparatively low. The regular rates figure about 1½ cents per mile, and books containing 600 1-mile coupons are sold at \$7.50, giving 1¼ cents a mile. These books may be used by several in a party. With the exception of free transportation, these are the only forms of tickets handled by the conductors. The company believes in reducing to a minimum the opportunities and temptations for dishonesty among employees, and it is believed that a man is much less liable to take cash



ENGINE ROOM OF THE DAYTON, COVINGTON & PIQUA TRACTION COMPANY

The company has a passenger solicitor who is constantly employed in working up picnics, excursions, dancing parties, family reunions, etc., and during the past summer there has hardly

than effect collusions with ticket agents, or by other methods juggle with tickets. Fares and mileage tickets are rung up on Ohmer registers and duplex cash-fare receipts are



given. Each conductor is provided with a small hand satchel, and at West Milton, in both directions, he turns in his satchel with report and receives another. At the same time he is handed his train orders by the despatcher. These orders are issued in triplicate on an Egry automatic register and usually cover one round trip. The orders are in larger form than those generally used by interurban roads, and the details are carefully written out. Should it be necessary to call for an order from a siding, a verbal one is given, carrying the car to West Milton, where a new written order is given. Conductors and motormen are carefully selected and given a rigid examination. Although the road has been in operation for two years, not a man has been discharged or left the employ of the company. The men are sworn in as special police in the counties through which the road passes, and the company's rules regarding disorderly conduct or disturbances on cars are rather peculiar. A passenger who refuses to pay his fare or otherwise creates a disturbance is never ejected from a car. The crew stop at the first siding, call up the police at the nearest town and have the man arrested. The company has strenuously prosecuted a number of offenders until at present disturbances on its cars are rare occurrences. Crews are uniformed in a cadet gray, which it is claimed is neater and less liable to soil than the usual blue uniform. Crews are paid 20 cents an hour for the first five years of service, 23 cents after five years, and 25 cents if they remain ten years. Conductors are given \$10 and motormen \$20 extra at Christmas time, if during the year they have had no accidents which caused expense to the company.

Each Tuesday and Friday, Superintendent Spring meets his various heads of departments and assistants at West Milton and discusses with them methods of improving the service. Suggestions and complaints are then carefully investigated and acted upon, and this plan thus gives each individual a more active interest in his work. Special stress is laid upon keeping the company's property and service in good order. The buildings and cars are kept neat and clean, and a beautiful lawn with numerous flowers surrounds the buildings and office at West Milton, a practice which is uncommon with Western roads and which suggests the Eastern ownership of the property.

Superintendent Spring has had over eighteen years of experience in all departments of electric railway work, and is proud of the fact that he started as a motorman on the street car lines of Boston. He was the chief organizer and first president of the New England Street Railway Club, and was largely instrumental in the organizing of the Ohio Interurban Railway Association, of which he is vice-president. He believes that in handling a property of this class, whose business must be worked up to a large extent, that the operating manager must keep closely in touch with every detail of the business. Mr. Spring makes his home at West Milton and lives within a stone's throw of the power station and office, and is on duty practically all the time. In this way he oversees every move that is made and passes on an immense amount of detail work that is usually left to subordinates.

The property was placed in operation as far as West Milton on June 26, 1902; to the center of Dayton, Nov. 26, 1902, and to Piqua, May 12, 1903. The company has common stock authorized and issued of \$500,000, and 5 per cent preferred stock authorized and issued of \$550,000. The bonded indebtedness is \$450,000, authorized and issued. The company is paying its interest charges and owes practically no money except its bonded indebtedness, and it is expected that it will be in a position to pay dividends on its preferred stock within a reasonably short time. The officers are: Dennis Dwyer, Dayton, president; W. E. Geer, Boston, vice-president; George Whiting, Boston, treasurer; Thomas T. Robinson, Boston, general manager; E. C. Spring, West Milton, general superintendent; R. D. Colburn, West Milton, chief engineer and master mechanic.

## FLANGE WEAR AND SIDE-BEARING TRUCKS

An interesting paper on this subject was presented by Gustav Lindenthal at a meeting of the New York Railroad Club on Sept. 16. Although intended primarily for steam railroad work, many of the general principles apply to electric railway service. The writer refers to the great flange wear on sharp curves, and states that three causes may be assigned for it, viz: Centrifugal force, the force required for deflecting the direction of the wheels fixed on axles from a straight line, and, third, the frictional resistance of the center and side bearings on the truck.

The first cause he considers so small as to be negligible. Taking up the second cause he refers to the well established fact, first brought out by A. M. Wellington, that the front outside wheel of an ordinary double truck is the only one in lateral contact with the rail. The flanges of the three other wheels do not touch the rails. The front outside wheel, therefore, assumes the office of pushing the three other wheels of the truck sideways from a straight line, in which they otherwise would continue to roll, and takes up practically all the wear. The slippage of the wheels by reason of their inability of turning on the axles has no appreciable influence upon lateral pressure. This rubbing friction of the outside wheel increases with the angle of incidence—that is, with the degree of curvature, although the lateral pressure against the outside rail is the same on sharp curves as on light curves. The only way in which, for the usual center bearing truck, the lateral pressure from that cause (continuous change of direction on curve) could be reduced would be by lubricating the top of the rails on curves, reducing the coefficient of sliding friction from 25 per cent to less than 3 per cent of the vertical pressure. That, however, is impracticable. The wheel treads would, of course, become greasy, and the traction power of the locomotives and the holding power of the brakes would be greatly reduced. It is a choice of evils, and flange wear is the smaller of the two.

The length of wheel base has an important bearing upon flange pressure. If the base be long, as in a single-truck car, then the work of turning the car is performed by the front outer wheel and the rear inner wheels, and both these wheels have flange pressures, which for each wheel is less than the flange pressure upon the front outer wheel of a shorter wheel base, as in the double truck. But the angle of incidence is greater, and both the outer and inner rail are subject to lateral pressure and will show wear on curves.

Mr. Lindenthal then considered the friction of the center and side bearings and their effect on increasing the flange pressure. With a 160,000-lb. loaded freight car the following may be considered the separate values of lateral pressure on curves per single truck:

1. From centrifugal force, nil.
2. From change of direction, with fixed wheels. . . . 15,000 lbs.
3. From friction of center bearing, average. . . . . 3,000 lbs.  
which may grow to 5600 lbs. and, including  
side bearing friction, may reach. . . . . 13,000 lbs.

That is, the outer front wheel of each truck in a modern heavy freight car may exert a lateral pressure against the rail varying from 18,000 lbs. to 28,000 lbs., when the vertical pressure upon the wheel is 20,000 lbs. under a car weighing 160,000 lbs.

Several instructive conclusions can be drawn from this analysis:

The outer rail on a curve is subject to a lateral pressure, which is from 45 per cent to 70 per cent of the vertical wheel pressures, assuming both pressures distributed upon a rail 30 ft. long. Deducting coefficient of friction of rail upon wooden ties at 30 per cent, 15 per cent to 40 per cent of the lateral pressure is left to be resisted by the rail spikes. It is no



wonder that the spikes in hardwood ties are sawed off gradually, and that on soft wood ties the outside rail has a dangerous tendency to spread.

On new outside rails the resultant of vertical and lateral pressures from the outer front wheels has to overcome only rolling friction. But very soon the corner of the rail is abraded, and while the vertical pressure continues to cause only rolling friction, the lateral pressure against the side of the rail gradually causes rubbing or sliding friction, the coefficient for which is probably 100 times greater than that of rolling friction. The side of the rail head may therefore grind off faster from sliding friction than the top of the rail can wear from rolling friction. Naturally this sliding friction wears off also the wheel flange of the outer front wheel. But each wheel in a truck is at one time or another an outer front wheel. So all wheels wear more or less alike. Assuming that the metal of the wheel tread and flange is twice as hard and tough as the ordinary steel rail, which assumption is near to fact, then for every ounce of metal ground off the flange of a wheel 2 ounces of steel are ground off the inner side of the outer rail of curves.

One of the means used to reduce the flange pressure is greasing the center plates and side bearings of the trucks. But the inconvenience of lubrication and the difficulty of keeping it up have been found to be great impediments. A better plan is the doing away entirely with center bearings and to rely upon nearly frictionless side bearings alone. A construction of this kind is then described.

The side bearings consist in principle of large cast-iron balls (about 26 ins. in diameter) on which the car body rests, two such balls, as a rule, for each truck. The sides of the balls, being useless, are cut away, so that the form is that of columns of rockers, with spherical ends, which have hard chilled surfaces. In place of the center bearing there is a center pin or pivot, having a loose fit in a spring socket. The columns rest in pockets, one at each side of truck, and may have different forms. There is only rolling or ball friction at top and bottom of these columns, the coefficient of which will hardly exceed one per mill, even with unmachined surfaces, liable to get gritty with cinder and dirt.

The reduced curve resistance by reason of decreased flange pressure would permit of hauling, with the same locomotive in any given train, more cars, when equipped with nearly frictionless side bearings. One additional car for every five cars now hauled may be regarded as a moderate estimate. Other advantages of rocker side bearing trucks are the doing away of the car and truck bolsters, permitting of a simpler and lighter construction, and the prevention of the disagreeable rocking and swaying of the car, so characteristic of the center bearing truck.

The first trucks built on this principle a few years ago had spiral spring bearings above the journal boxes, and the rockers were of solid cast iron. Further improvements of details have been made, with the object to insure greater vertical flexibility of the truck frame on rough and uneven track. Careful estimates and comparison of weights show that the side bearing truck is lighter in weight than an equivalent center bearing truck.



A carload of wheat was shipped from Estacada, Ore., by electric car Aug. 27 for Portland. It was produced on a farm 2 miles southwest of Estacada. A large banner was strung along either side of the car, indicating the contents and the name of the producer. This is the inaugural of a large traffic to come to the Oregon Water Power & Railway Company from the regions on both sides of the Clackamas River, which have hitherto had no market except by trucking to Portland and Oregon City.

## THE RELATION OF THE TECHNICAL SCHOOL TO THE BUSINESS AND PROFESSION OF ELECTRIC RAILWAYS\*

BY PROF. H. H. NORRIS

The growing importance of the electric railway business as a field of usefulness for the young men of our country makes the consideration of a topic like this timely and interesting. The increasing complexity of the practical engineering problems which confront railway men demands that the most intelligent help must be employed. Every week new inventions appear which must be tested and adopted if found economical and efficient. In addition, the apparatus in use must be kept in first-class operating condition.

It can probably be taken as undisputed that no really practical man present has as much education as he would like, when by education is meant that very desirable mental training and equipment which makes his work easy and his field of usefulness extensive and satisfying. The education which develops mental strength and at the same time gives culture and refinement is appreciated everywhere, and it pays handsome profits upon the capital of time and money invested. What is better yet is the fact that any young man of sound body and mind can get this education if he really wishes it in any one of the many technical schools in which our country fortunately abounds.

With these facts in mind and with the hearty co-operation of the members of this association the writer has sought answers to a number of questions bearing upon the relation of the technical schools to the railway business. These schools are beginning to feel the demand for their graduates from railway corporations, not so much by direct applications for the services of the young men as by the readiness with which the latter are advanced to positions of responsibility when they start in at the bottom and are willing to adapt themselves to their work. The schools are establishing electric railway departments to meet this demand, not to turn out railway presidents and general managers, but to point out to the students the general nature of the practical problems which they must later solve. These colleges cannot teach a trade, a business or a profession, but they should expedite the acquirement of one or all of these after the college days are over.

As a means of discovering the attitude of the electric railway managers of this State toward technically trained men and to learn what improvements should be made in the curricula of the schools and in the method of teaching, a number of questions were sent to each member of this association. The answers to these questions are embodied in the following statements:

*Question 1.—Are any of your officers graduates of technical schools?*

Most of the roads have officers who are technical men, but at present the latter are largely in the engineering departments.

*Question 2.—Do you employ any technical graduates in subordinate positions?*

A large number of young men are so employed. These are engaged in all departments, and they are learning the business in the proper way, from the bottom up. As it is from these ranks that vacancies among the higher positions must be filled, it is an important matter.

*Question 3.—How do you regard an application from a young technical graduate for a position?*

The uniform reply is "favorably." That is, the fact that a young man has had a technical education commends him to a company's officers, but the prepossession in his favor may be modified by his after conduct. These answers are encouraging to the schools, as they show that past experience with their

\* Paper presented at Utica meeting of New York State Street Railway Association, Sept. 14, 1904.



graduates has led the companies to have no prejudice against the latter, to say the least.

*Question 4.—Do you find these young men, as a rule, humble or conceited?*

The writer regards this matter as worthy of attention. At one time young men felt when they left school that they "knew it all." It took some years after graduation to change this idea in their minds. This attitude aroused resentment in their fellow-employees and in their employers. At the same time a certain amount of self-confidence is expected and respected in young men who are to succeed in the business world.

The answers to this question are varied and interesting. One member of the association prefers the conceited young man, because he makes the best employee after he has had the conceit taken out of him. Another suggests that when a young man has an undue idea of his own ability it is due to lack of contact with business men while he was in school. This gentleman believes that business responsibility is the best thing to furnish the proper discipline. There is no doubt also that home training has a great deal to do with the matter. The general opinion is that the average young man from college is about the same as young men everywhere. It should be said that the schools are making great efforts to show to their students the relations which they will sustain to business. They are not to enter business thinking to take at once positions of responsibility and of good salary. The next question bears upon this point.

*Question 5.—Are they improving in this respect?*

The answers all show that the attitude of the young men is improving, which indicates that the schools are succeeding in their efforts. This has been brought about in different ways; partly as above; partly through the provision made by manufacturing and operating companies to supply apprentice courses to properly fit men for their work. The young men, knowing that they must go through some such course or its equivalent, do not expect to do more than continue their college work for a few years under business supervision.

*Question 6.—Which of two men would you prefer to put on an engineering problem; one who had no technical college training, but had ten years of actual experience in similar work, or a man who had graduated from a technical college and had had five years' experience?*

This question was designed to determine whether or not by the end of five years the technical man has caught up with his associate who had been in business while he was in college. The answers indicate that the college man will be preferred, other things being equal. This indicates that at any rate the young man will be able to earn as much as his associate five years after leaving school.

*Question 7.—Which of two men would you prefer to employ for general work; one with no technical training and ten years' experience of a general nature, or a recent technical graduate?*

This question is difficult to answer, because so much depends upon circumstances. It is evident that in a position requiring adaptability, alertness, mental perception and such qualities the technical graduate is better. Also if the position is one in which advancement is possible the college man will probably fit. But if the position is one which requires ability to do a particular thing well and at once the so-called "practical" man will bring the quickest returns to the employer.

*Question 8.—In other words, which is the deciding factor, "experience" or "technical training?"*

Like the preceding question, this matter is determined by circumstances. The selection depends partly upon the characteristics of the applicant, for neither experience nor training alone will make a good business man. The fact that a man has been employed for ten years, especially if it be in responsible work, about offsets the value of the diploma of a good school.

*Question 9.—In the engineer whom you assign to a position of responsibility, which do you expect or desire chiefly—"knowledge" or the "ability to apply knowledge?"*

The answers to this question indicate that while both knowledge and the ability to apply it are necessary, the latter is the essential element. It is comparatively easy to obtain knowledge if a man knows what to do with it after he gets it. The business of the technical school is to train for the ability to apply knowledge, at the same time pointing out the means for getting hold of information. In these times no engineer or business man cares to load his mind with many facts, but expects to put his hand upon them when he needs them. He merely keeps enough at hand to serve his every-day needs.

*Question 10.—How can the college graduate be made to realize more clearly that he must adapt himself to the practical conditions as they exist in the business world?*

This question covers the most important part of the ground as far as the school is concerned. The more he can learn while in college to adapt himself to his surroundings the more rapid will be his advancement afterward. He should first learn the value of industry, and the courses of instruction should be such as to bring him into contact with business conditions. He must be prepared for the hard knocks which are bound to come, and be taught the underlying principles of business success. He must realize that he has to make his own place in the world and he must be willing to develop in a natural and a logical manner. He must realize also that his commercial value at the start is small, but that whatever worth he has will be recognized in due time.

*Question 11.—How would you advise a young man fresh from college to try to enter the electric railway field?*

All the answers to this question point to but one course, namely, to begin at the bottom and work up. The exact position in which work is begun is of small consequence. One superintendent says, "Begin on the rear end of the car," another says, "Take any opening offered and do any work assigned by the superintendent." No one suggests applying for a superintendency or a general managership. And yet in the early days of the electric railway young men were put in charge of important work soon after graduation. This was unwise, as the results soon showed. It is evident that there is at the present time no systematic way for entering this field but the method prescribed above will undoubtedly bring satisfactory results. It is probable that an apprentice course with one of the manufacturing companies would prove very helpful in most cases.

*Question 12.—After all, does a college education in a technical school pay if a young man expects to enter this line of work?*

This is the conclusion of the whole matter. Every answer indicates an enthusiastic appreciation of the value of a technical education. As one superintendent says: "Undoubtedly. If he has got the proper stuff in him he will be all the better for his technical training. If he has not, he probably will not amount to very much, anyway." Another says: "Most decidedly it does pay to give a young man a technical college education, as he will find his knowledge invaluable when he comes to put it in practice. I do not consider it of very much value without the practice, but do consider it necessary to have both. In other words, the man with a technical college education and the practical experience combined is far more valuable than one with only the practical or the technical alone."

It is hoped that this canvass of the subject will result in enabling the technical schools of our vicinity to more fully appreciate their privileges and opportunities. On the other hand, the writer would appeal to the members of the association to value the young graduate by a different standard from that applied to men of more experience but less technical training. The latter will probably be profitable assistants in a shorter time, but in the long run the college training will count.



## THE DESIRABILITY OF TRAIL CARS IN CITY ELECTRIC RAILWAY SERVICE\*

Forty-two railway companies answered one or more of the questions asked by the writer, and the following are the questions, a resumé of the opinions of the different companies and some comments by the writer:

I. Under what conditions is it permissible and practicable to use one or more trail cars on city electric railways?

The replies to this question are generally harmonious and may be summarized as follows:

The best way to handle temporary increases in traffic is to use trailers during the busy periods. It is evident that if the railway desires to secure the patronage of those who have comparatively short distances to walk, it must be prepared to furnish sufficient cars running on short headways. It must be admitted that trail cars offer the cheapest solution of the rush-hour problem, this fact leading to their general adoption wherever local ordinances permit their use.

If the traffic is heavy for the greater part of the day, trail cars cannot be absolutely recommended. Under such a condition an experienced railway manager recommends the exclusive use of motor cars running on very short headways, stating that a single-motor car is handled more easily than a train, and that less time is lost in switching at terminals. A contrary opinion is expressed by the Grosse Berliner Strassenbahn, which says that despite double-track lines it would be impossible to handle the dense traffic in such places as Potsdamer and Leipziger Streets without using trailers. At present trains are operated under thirty seconds' headway, and the municipal authorities will not permit an increase in their number.

Both of the foregoing views are extreme, but it should be possible to find a happy medium that will be of general application. In this connection, the management of the Lyons tramways suggests that on double-track lines trailers should be employed as soon as more than 50 per cent of the seats are used when the motor cars are running on the shortest possible headway. As this seating coefficient is rather low, 75 per cent might mark the point of transition to trailers. Trail cars are recommended on single-track lines when the number of sidings is insufficient to operate the necessary single cars on short headways.

Although the question was confined to the use of trail cars in the interior of cities, replies were received relative to suburban conditions wherein trail cars were held to be preferable, as the amount of traffic in such cases was not seriously affected by a longer headway. In conclusion, it may be mentioned that in Marseilles, where two or three trailers are used per train, the cost of a trail-car-km is about one-half of the cost of a motor-car-km.

II. Do you use one or more trail cars per train? Are you permitted to attach any desired number? If the number is limited, what are the reasons for such limitation?

Of the forty-two companies replying to this question all reported that when necessary they used at least one trailer; nineteen used two; four used three; and ten companies reported that they were under no statutory limitations, but none of them ever used more than three trailers per train. Fifteen of the reporting companies are permitted to use only one trailer, the same number may use two, and two companies are authorized to attach three cars.

The limitations, in general, are due to police traffic regulations, grades of 5.5 per cent and above, narrow streets, necessity of maintaining the schedule since trains involve more stops, and lack of sufficient motor capacity and proper braking

mechanism. The experience gained in trail-car operation during the last few years has proved the former prevailing belief that they were more dangerous than motor cars to be erroneous, and the municipal authorities are beginning to realize this fact.

III. In how far is the use of one or more trailers required by your line (single or double track) or traffic conditions? If you operate a single-track line, does your traffic demand the occasional use of one or more trailers, and is this permitted? If you operate a double-track line, why do you operate trail cars, and how many per train?

It is apparent from the answers received that with few exceptions the same number of trailers per train can be used equally well on single and double-track lines. There can be no doubt that the necessity for trail cars arises more often on single-track than on double-track roads, and where a sudden increase in travel takes place in one direction it can be handled by holding a certain number of cars at one terminal and sending them forward at short intervals about a given time. That the foregoing instance may be considered as applicable to special cases only is evident from a communication sent by the Strassburger Strassenbahn to the effect that it maintains on its double-track lines a five-minute schedule connecting with a ten-minute schedule on the suburban extensions. The simplicity resulting from this combination would be lost by temporarily increasing the city headway, and hence trailers are used during rush hours to permit the maintenance of the schedule, despite the fact that the company believes that motor cars alone on shorter headways would be more advantageous at certain times.

IV. To what extent is the use of trail cars on your system affected by pedestrian and vehicular traffic, the width of the streets, etc.?

In general, the number of trail cars is not affected by vehicular traffic, although some municipalities in which there are narrow streets do not permit more than one trailer. In so far as streets with heavy pedestrian traffic are concerned, the experience of the Barmen-Elberfeld Company points out that the increased seating capacity and lower fares caused by using trailers is quite an incentive toward riding.

V. To what extent is your use of trail cars limited by heavy grades and other topographical difficulties involving heavy braking? What conditions must be fulfilled in this connection? How have you solved them? What brakes do you use? Do they act simultaneously throughout the train?

Grades below 3 per cent exert no appreciable influence on the effectiveness of the brakes. In Geneva there are numerous 4 per cent and 5 per cent grades, which make braking difficult, and in Königsberg no trailers are permitted on 8 per cent grades. Havre and Marseilles use trailers on grades up to 7 per cent. In Aachen the motorman is required to hold on to the brake handle on grades exceeding 3.3 per cent if the motor car and trailer are not furnished with simultaneously-acting brakes. Of the forty-two reporting companies, fourteen use simultaneously-acting brakes. In Berlin, Sperry, solenoid and air brakes are employed, Westinghouse brakes in Brussels, Siemens & Halske solenoid brakes in Cologne and Heidelberg, etc.

VI. To what extent is the use of trailers affected by congested crossings and inadequate switching facilities at terminals?

Congested crossings exert little influence on the number of trail cars. Two trailers per train can be used advantageously if there are enough sidings at the proper points along the line and at the terminals. It is customary to have a number of reserve cars at a switching point, thereby making it possible to leave a trailer on one track and run over to another for coupling on one of the reserve trailers.

VII. What, in your opinion, are the advantages and disadvantages of using one or more trailers?

\* Abstract of report to be presented this week at the Vienna meeting of the International Street Railway and Light Railway Association by M. G. Pavie of Paris.



## (A) Advantages:

1. Motor cars require a motorman and conductor, while trailers require a conductor only. In some cases one conductor can look after two cars.

2. As the trail cars are much lighter for the same seating capacity, the saving in current amounts to over 50 per cent.

3. The first cost of a trailer is about one-third that of a motor car.

4. Maintenance charges are reduced two-thirds.

5. The absence of controlling apparatus on the platforms of trail cars gives more room for passengers.

6. Reduction of accidents caused by the longer headway and fewer blockades.

7. The possibility of handling sudden increases in traffic without holding motor cars in reserve.

8. The preference shown by the public for the low-step easy-running open trail cars. The number of closed trailers need not be high, as the heaviest business is done during the summer.

## (B) Disadvantages:

1. An appreciable reduction in speed, which can be remedied only by installing auxiliary generators.

2. Where trailers are used the motors are often too small to do the additional work, and it is therefore necessary to have larger motors, which means operation at less than full load under normal conditions.

3. With trailers, more time is required for acceleration and deceleration, and additional stops must be made.

Some railways expressed themselves as being in favor of the abrogation of the regulations limiting them to one trail car, as experience had shown that two and even three trailers could be used safely, provided, of course, that the motors and brakes were of adequate capacity.

## TESTS OF THE INSULATION RESISTANCE OF ELECTRIC TRAMWAY SYSTEMS AND MAINTENANCE OF THE TROLLEY WIRE

The report on this subject at the Vienna convention this week of the International Tramways & Light Railways Association is written by M. G. Pedriali, chief engineer of the Brussels tramway system. The first part of the report deals with regular tests of the insulation resistance of the lines and the localization of faults.

All companies agree that it is necessary to test carefully the insulation resistance of the various portions of the lines in regular intervals—varying between three months and a year; it seems that tests repeated within regular intervals of six months should be sufficient to meet all requirements.

The insulation resistance of the total system, or of separately fed parts of it, is determined by means of instruments in the power station or in the sub-station. Some companies use a voltmeter, which is inserted between the positive pole of the dynamo and that part of the line, the insulation of which against earth is to be measured. In the voltage between the positive pole of the dynamo and earth is  $V$ , and the reading of the voltmeter is  $V'$ , the insulation resistance is  $R = (V - V') r / V'$ , where  $r$  is the resistance of the voltmeter. This method gives exact results only if the resistance is of about the order of magnitude of the resistance of the voltmeter, but it is not to be recommended for the determination of faults in insulated cables.

An effective and quick method for determining the existence of faults, without measurement, consists in observing the readings of the ammeter of the first dynamo during starting in the morning; if all cars are insulated from the trolley wires, and if the needle of the ammeter is still deviated, it shows that the system contains a fault; this may then be localized by opening

the different line switches. On conduit and surface contact systems the insulation should be regularly tested every day. "On lines both poles of which are insulated against earth, it is necessary to take into account the electrolytic phenomena which tend to transport moisture from the positive to the negative pole; the greatest attention should be paid to this point."

The measurements of the stray current which passes at a certain point between the rails and water or gas pipes, are very difficult; but it would be interesting to know the quantity of

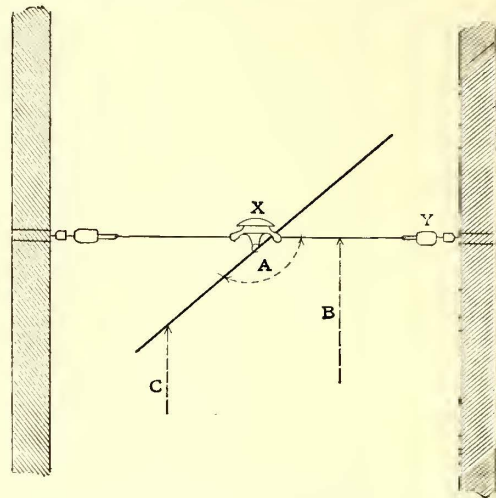


FIG. 1.—METHOD OF TESTING INSULATION RESISTANCE OF HANGER

electricity which passes per unit of pipe surface from the pipe to the rail. If a perfectly insulated joint is inserted in the pipe and both parts of the pipe are then connected by means of a cable in which an ammeter is inserted of a resistance equal to that of the original joint, the current may be approximately determined.

The author recommends the preparation for each system of a map on which those points are marked where the voltage difference between rails and pipes is largest, and to provide test pipes at these points which are tested in regular intervals.

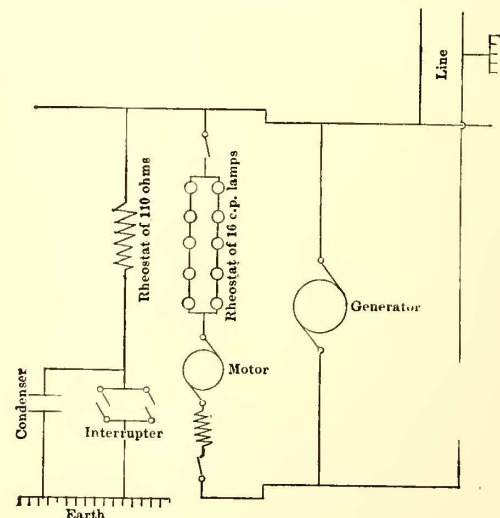


FIG. 2.—METHOD OF DETECTING FAULTS IN CONDUIT SYSTEM

Except when welded rail joints are used, it is necessary to test the resistance of the joints at regular intervals.

Tests of insulation of the trolley wire are made by some companies in a rough way to find whether the insulators have a fault or not. In this case the hanger X in Fig. 1 is tested to find whether the current passes over to the span wire. In most cases a voltmeter is used, which is connected with one pole to the span wire, and with the other pole to earth; afterwards the strain insulator Y is tested by connecting the span wire between X and Y with the trolley wire and connecting



the pole to the rails, a voltmeter being inserted. This method gives only approximate results.

The author states that the following "method of three readings" has often given good results: If A, B, C are the readings of the voltmeters as indicated in Fig. 1, R the resistance of the voltmeter, X the resistance of the hanger, Y the resistance of the pull-off, then  $X = (C-A-B) R/B$  and  $Y = (C-A-B) R/A$ .

For finding faults in conduits, two groups of test lamps are provided on the switchboard and are inserted between the two poles of the conduit, while the center connection between the two lamp groups is connected to earth. If one of the two poles is earthed, the lamp group connected to the other pole lights up. It often happens that a foreign body makes contact between the trolley wire and earth. Such a contact may sometimes be removed by sending through the line a strong current, adjustable by means of a rheostat. If this means is not sufficient, the fault must be localized. The author considers the following method of Prof. Eric Gérard to be very practical:

In parallel with the dynamo, a motor M of small capacity is provided, which is geared to an interrupter; the other arrangements will be seen from the illustration. As soon as it is found that a fault exists, the apparatus is connected to the negative pole and the motor is started. A regularly interrupted current of about 5 amps. now passes through the fault, the frequency of the interruptions being 70 to 80 per minute. A coil of 250 windings of 0.6 mm wire, which is closed through a telephone, is then passed along the conduit. The telephone then gives a regular steady noise until the fault is reached, when the noise disappears.

The second part of the report deals with the maintenance of the trolley wire. The author recommends that tests be made at regular intervals and the results be recorded. The span wire should be as elastic as possible. The tension of the trolley wire at 0 degs. C. should be between 450 kg and 550 kg (for wires of 52.5 sq. mm cross-section). Several other mechanical details of construction are dealt with.

The life of the trolley wire varies between 500,000 trips and 1,500,000 trips for wires of 8-mm diameter. The pressure of the trolley pole against the trolley wire should not be more than 5.5 kg.

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## CORRESPONDENCE

### SINGLE-PHASE VS THREE-PHASE TRACTION

Montreal, Sept. 8, 1904.

EDITOR STREET RAILWAY JOURNAL:

I have been much interested in reading the description of the compensated single-phase motor equipment of the General Electric Company and your editorial on the subject in issue of Aug. 27, and was more particularly struck with the fact that a modification of the Ryan compensating coils should first give really useful results on a motor which is primarily intended for alternating-current service. It shows how close after all the two systems are. The special apparatus which has been devised for interlocking the oil switches so as to prevent trouble should both trolley poles be accidentally on the wires at the same time, and also for running the lighting from both systems of supply, are interesting. The whole proposition, however, of combined alternating and direct-current traction strikes me as being of a tentative nature; in fact, as you say in your editorial, one reason why we are hearing so much of the combined system is that it would be such a very serious matter to have to scrap a whole heap of existing plant, much of which is practically quite new. My own views for some time have been that in the end we shall have universal alternating-current traction, and, further, that it will be by means of three-phase alternating

current. If you will spare me space I will give you my reasons for this belief.

As you know, the commutator has always been the bugbear of the dynamo-electric machine, and insurance and other statistics amply prove that the majority of the breakdowns which occur in motor work of all kinds are traceable to the commutator or its adjuncts. It is true that by highly organized manufacture the commutator has been developed into an exceedingly perfect piece of apparatus, but any ordinary railway man, seeing a polyphase and a continuous-current motor side by side for the first time, would not fail to plump for the simpler of the two, that is to say, the three-phase. This is more or less the standpoint which will eventually decide this electric traction question for railways, at any rate in Britain, for railway men have not studied, and do not want to know, the various phases through which the dynamo machine has passed, and they have no reverence for the commutator as such. When it comes to advising their directors as to the system to be finally adopted, I think they will only consider two things, namely, simplicity of apparatus and safety to human lives.

This, it appears to me, is given by the three-phase motor supplied with current from high-tension overhead wires. It is true that some of our railways are experimenting with direct current and a third rail, but I think it may be safely said that they are far from satisfied; indeed, if we have many more serious accidents on third rail there is likely to be a national outcry against it.

Now, with regard to the duty that we can get out of motors.

As you well know, the torque of an electric motor depends on the magnetic field, and the three-phase motor differs from a single-phase in that for a given load both the field and the torque are constant, that is to say, they do not pulsate. The torque of a single-phase motor varies from zero to maximum and back to zero with every alternation. To show what this means, let us suppose that a certain train requires a maximum draw-bar pull of 10 tons; then, with three-phase motors the locomotive will weigh, say (10 x 5) 50 tons, but if the locomotive is equipped with single-phase motor it must weigh, say 85 tons to 100 tons, because of the pulsating torque.

Again, on the general question of cost there is no getting away from the simple fact that a single-phase machine, whether it be a generator or a motor, must be larger and more costly, and in this question of cost we must consider not only the motor, but the whole system. What would be thought of a mechanical engineer who built a three-cylinder engine or pump and then only ran it with one single cylinder; the idea is, of course, absurd, and yet it is very fairly analogous to the single-phase versus three-phase proposition.

Finally, as to the question of the number of overhead wires. We are constantly having it dinned into our ears that overhead wires are inaeesthetic, but it is a well-known fact that people can become accustomed to almost anything, and many in Britain who had much to say against bare wires soon become accustomed to them. Familiarity is everything in this matter, and once overhead wires are accepted, a wire more or less is immaterial certainly. The extra wire required for three-phase work will not be noticed by the man in the street. As for the electrical engineer's point of view, surely the more copper there is overhead, the less has to be put underground, and, as you know, it is the underground wires with their insulation, trenching, need of repair, etc., which run up the cost of electric traction.

Since writing the above I have had an opportunity of riding on the Ballston single-phase line, and most sincerely congratulate the General Electric Company's engineers on the skill with which the series-wound motor and ordinary series parallel controller have been adapted for working with single-phase alternating current. I quite appreciate that the problem before us at the present time is in some respects similar to that before the



pioneers of the electric tramway when they fought the telephone interests in order to have only a single trolley wire, and yet, judging by the results in actual work of the three-phase railways in Switzerland and Italy, the supposed difficulties of dealing with extra wires are exaggerated. By coasting or running through on a single wire at very difficult crossings the complication disappears. At any rate, engineers will shortly have an opportunity on the London to St. Thomas line, Canada, of seeing what Ganz & Company can do with a combined three-phase and direct-current system of electric traction, for, owing to the difficulty of getting through the towns, except on existing direct-current tracks, the original idea of running this line altogether by three-phase has had to be abandoned.

The very original and solid construction work which Ganz & Company have done in the past in electric traction makes any particular line of action they take up all the more interesting, and it must not be forgotten that they were the first large firm to grapple with the single-phase motor problem and with some success. In going on with three phase, therefore, they are doing so with their eyes wide open. Of course, when the combined three-phase direct-current motor is working on three phase the commutator is cut out of action.

E. KILBURN SCOTT.

### THE LAGONDA MANUFACTURING COMPANY'S EXHIBIT AT ST. LOUIS

The accompanying illustration is a view of the exhibit at the St. Louis Exposition of the Lagonda Manufacturing Company, of Springfield, Ohio, the manufacturers of the well-known Weinland tube cleaners and other specialties. This exhibit is in the Steam, Gas and Fuels Building, between the several types of United States and foreign boilers used there for fur-

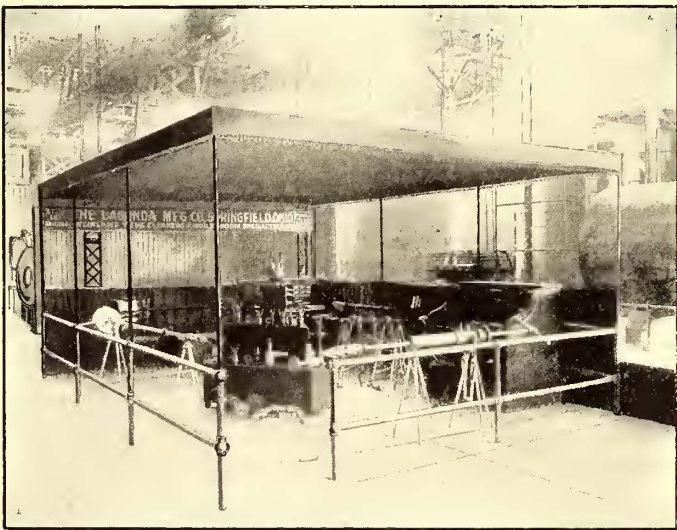


EXHIBIT OF THE LAGONDA MANUFACTURING COMPANY

nishing the steam for the entire Exposition plant. Here may be found a great variety of cleaners, as the Lagonda Company makes many different types of machines to meet the requirements for all kinds of boilers and for every size of tube—hand cleaners, turbine cleaners and power cleaners, so that it can successfully meet the requirements of every customer in this line.

In the front part of the exhibit, just inside the railing, is shown the mechanical cleaner, driven by an electric motor or other suitable power. On the left side, parallel with the railing, can be seen the company's direct-motor cleaner, which is something new in this line. It is a 12-in. water wheel, driving a very powerful cleaning head. With water at 150 lbs. pressure, it develops about 5 hp. Between the two desks can be

seen a power-driven cleaner for cleaning the tubes of boilers that use bent tubes, with horizontal drums at the top. A very interesting machine is the 8-in. turbine cleaner, made specially for one of the company's customers.

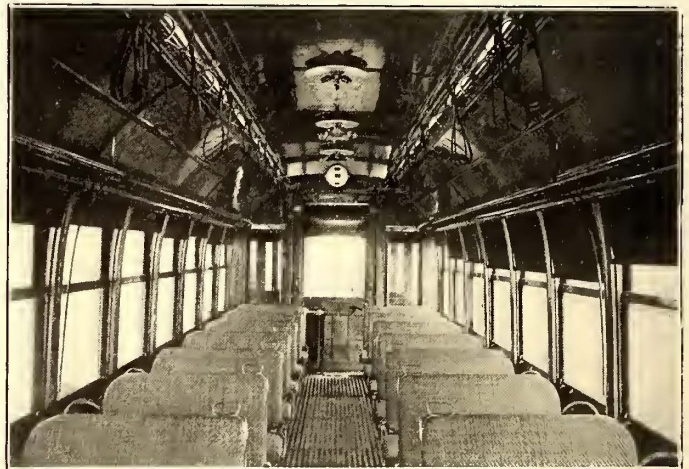
It is interesting to note the difference in sizes of machines. The smallest machine in the exhibit is but 1½ ins. in diameter. The cut also shows the reseating machine which this company has so successfully introduced; also its tube cutter and blow-off valve. A damper regulator made by this firm can be seen in practical use on one of the boilers, and those interested can see also the different types of tube cleaners cleaning tubes in the boilers in use at the Exposition, as the managers of the Exposition have selected these cleaners to be used exclusively, which is certainly quite a compliment to the merits of the Lagonda Company's manufactures.

The exhibit is in charge of J. W. Gunn, the treasurer of the company, who will be pleased to meet personally any engineers or others interested in this line of machinery. The company has issued a very attractive little souvenir in the shape of a watch charm which it will be pleased to give to any one who will take the trouble to call and ask for it.

### HANDSOME CONVERTIBLE CARS FOR ALBUQUERQUE, N. M.

Three convertible cars of the Brill type built by the American Car Company, of St. Louis, were recently delivered to the Albuquerque Traction Company, of Albuquerque, N. Mex. This is the first lot of cars of this type ordered by the company. They have now been in operation several weeks, and are reported to be giving entire satisfaction. Albuquerque is on the main line of the Atchison, Topeka & Santa Fe Railroad and is nearly at the center of the State. It has a population of 10,000.

The view of the car exterior gives a good idea of the appearance both open and closed. The system of raising the sashes



INTERIOR OF ALBUQUERQUE CONVERTIBLE CAR

and the flexible metal panels into pockets in the side roofs is well known, and therefore need not be described. Brackets connecting the backs of the seats with the posts serve as grab-handles, and are arranged to swivel when the seat backs are stepped over. The guard-rails are arranged to slide upon guides inside the posts, and may be seen in the illustration of the interior. The cars are seated for thirty-six passengers and have a large amount of standing room in the aisles, which are 24 ins. wide. The seats are 34 ins. long and are upholstered in spring cane. Guides are furnished at the tops of the vestibule doors to control their movement, and a special form of catch holds them against the ends of the body when folded. Pockets in the wainscoting of the vestibules contain the window sashes in warm weather. The platform timbers are reinforced with



angle-iron and protected at the ends with Brill angle-iron bumpers. The round-corner seat-end panels, brake handles, sand boxes and other furnishings, also the 27-G type of truck on which the cars are mounted, are of the same manufacture. The length of the cars measured over the bodies is 29 ft. 9 ins., and over the crown pieces 34 ft. 9 ins.; from the end panels



CONVERTIBLE CAR OPERATED BY THE ALBUQUERQUE TRACTION COMPANY

over the crown pieces 4 ft. 6 ins.; width over sills, including sill-plates, 7 ft. 10½ ins.; width over posts at belt, 8 ft. 5 ins. The sweep of the posts is 3½ ins.; distance between centers of posts, 2 ft. 7 ins. The side sills are 4¾ ins. x 6¾ ins., with 8-in. x 5/8-in. plates on the outside. The end sills are also 4¾ ins. x 6¾ ins. From the rails to the platform steps is 16 ins., and from the steps to the platforms 13 ins.

**ST. LOUIS EXHIBIT OF THE ELECTRIC STORAGE BATTERY COMPANY**

In section 20 of the Palace of Electricity, at the Louisiana Purchase Exposition, is located the exhibit of the Electric Storage Battery Company, of Philadelphia. As this is the

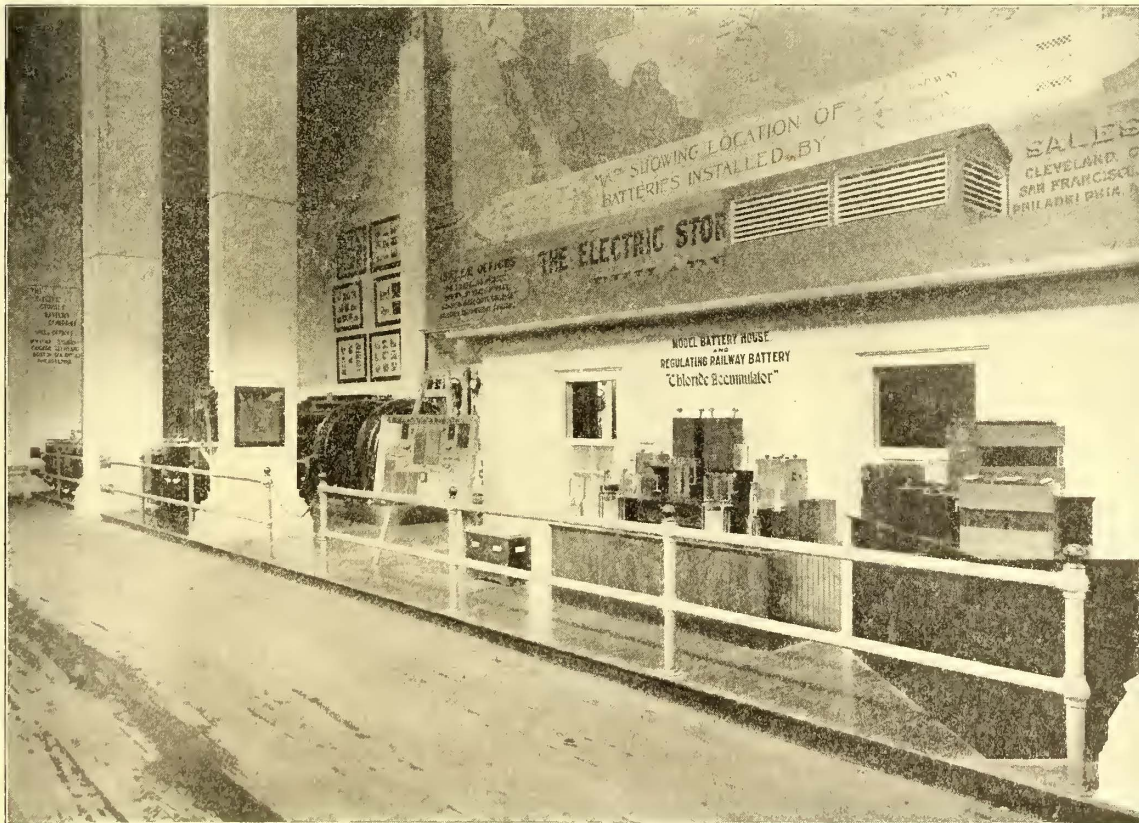


EXHIBIT OF THE ELECTRIC STORAGE BATTERY COMPANY AT LOUISIANA PURCHASE EXPOSITION

largest, most comprehensive and instructive exhibit ever made of storage batteries and apparatus used in connection with battery installations, a visit to this display will be of great interest to electrical engineers.

One of the prominent features is a large map of the United States, about 30 ft. x 45 ft., on which is indicated, by means of colored jewels, the location and character of the various installations of the "chloride accumulator." The exhibit includes a model battery house, in which is installed a model regulating railway battery operating on a variable load. Five standard marble switchboard panels are shown, including the panels for controlling the model railway battery. The other panels are an Edison central station three-wire panel, the panels for regulating combined lighting and power loads, the railway feeder panels and panels for regulating railway power house loads. Two motor-driven boosters are also shown, the smaller being used in connection with the model battery, and the larger a standard 100-kw railway regulating booster.

Among the types of chloride accumulators are three H-61 cells, with a discharge capacity of 4800 amps. for one hour, six cells type G-77, capacity 3000 amps. for one hour, and type G-17 and F-17, all of these being in standard lead-lined wooden tanks.

The smaller cells shown are types "F," "E" and "D" in glass jars, and types "E" and "D" in rubber jars for train lighting and yacht lighting. There is also shown a very complete set of Exide cells for automobiles, and Exide sparking sets for gas and gasoline engine ignition. The Exide exhibit includes a large easel, showing in detail the various component parts of the Exide battery.

At one end of the space is a group of three large end-cell switches, operating from the Edison three-wire panel. Each of these switches is of 2000 amps. capacity, and is motor driven, with electrical indicators. These end-cell switches are in actual operation and are so arranged that each switch may be driven by its own motor, or by means of clutches any two or all may be driven by any one motor. Clutches and hand wheels are

also provided whereby the motors may be thrown out of gear and the switches operated by hand.

The model battery, with its booster and switchboard, forms a very interesting working exhibit. The battery is of type E-15, in lead-lined wooden tanks, and is mounted on white enamel brick tiers. The battery is in every particular an exact model in miniature of the larger railway installations. The battery is insulated from the brick tiers by means of standard double insulation, consisting of vitrified bricks, then glass insulators, then prepared wood stringers and another

set of glass insulators. On the switchboard controlling the model battery are the necessary battery and booster switches and automatic circuit breakers with their interlocking devices, a Bristol recording voltmeter and the

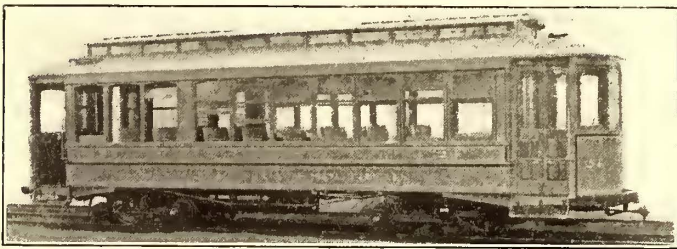


Weston instruments, consisting of voltmeter, the O center battery ammeter, the generator ammeter and the total load ammeter. The conditions under which the model battery operates are exactly similar to street railway conditions. The generator delivers the average current required, and as a heavy external load is thrown on the system, the battery assumes the load, the needle of the generator ammeter remaining almost stationary. As the load is thrown off the battery automatically charges. The external load is caused by starting up the 100-kw booster and by throwing on a bank of 80/100-cp lamps. As an example of how well the battery regulates the load, it may be stated that the direct-current circuit supplying power to the exhibit is limited to 100 amps. With the battery regulating, a load of 300 amps. is thrown on the system, causing a drop in the lighting or generator circuit of less than 1 volt in 110, and a rise in current in the line, or generator circuit, of less than  $7\frac{1}{2}$  per cent of the total load. The action of the battery is automatically controlled by the small booster and its carbon regulator.

Referring again to the type G-77 chloride accumulator, it may be stated that 584 cells of this type have recently been installed on the system of the St. Louis Transit Company. This is stated to be the largest individual installation of storage batteries in the world.

### SEMI-CONVERTIBLE CARS FOR SEATTLE, RENTON & SOUTHERN RAILWAY

The Seattle, Renton & Southern Railway Company has received from the J. G. Brill Company a number of combination passenger and smoking cars of the builders' semi-convertible type. The railway company operates about  $13\frac{1}{2}$  miles of lines, connecting Columbia City, Dunlap and Renton, the last-named being the southern terminus of the line. The country traversed by the road is noted for its fine scenery, Lake Washington being on one side and Admiralty Inlet on the other. At



SEATTLE, RENTON & SOUTHERN RAILWAY COMPANY'S LATEST SEMI-CONVERTIBLE CAR

night the lines are used for the freight service, which requires fifteen cars.

The new passenger cars are seated for twenty-eight in the passenger compartment and twelve in the smoking compartment. These compartments are divided by a hardwood partition having a single sliding door. The illustration shows several of the windows raised to different heights and some of them raised entirely into the roof pockets. The windows in the vestibules are arranged to drop into pockets. The interior finish of the cars consists of cherry, with ceilings of decorated birch. The seats of both compartments are upholstered in cane, and are of the step-over type. Arm rests are provided on the window sills, as the window sills are but  $24\frac{5}{8}$  ins. from top to floor, too low to be used comfortably by adult passengers. Because of the increasing demand for low window sills, the car company has made this height its standard for the semi-convertible car, as there are no wall window pockets to interfere.

The length of the cars over the end panels is 29 ft., and over the vestibules 38 ft. 5 ins. The length of the smoking com-

partments is 9 ft. 2 ins. The width over the sills is 7 ft.  $10\frac{1}{2}$  ins., and over posts at the belt 8 ft. 2 ins. The sweep of the posts is  $1\frac{3}{4}$  ins. The side sills are 4 ins. x  $7\frac{3}{4}$  ins., and the end sills  $5\frac{1}{4}$  ins. x  $6\frac{7}{8}$  ins. The sill-plates are 12 ins. x  $\frac{3}{8}$  ins., and are upon the inside of the sills. "Eureka" maximum-traction type trucks are used with 4-ft. wheel-base, 33-in. and 20-in. wheels,  $4\frac{1}{2}$ -in. and  $3\frac{1}{2}$ -in. axles, equipped with motors of 50-hp capacity each.

### THE RUSSIAN WESTINGHOUSE COMPANY AT THE ST. LOUIS FAIR

Russia's only building at the Louisiana Purchase Exposition is the pavilion in the Palace of Transportation, which was erected by the Westinghouse Company, Ltd., of St. Petersburg, as a feature of the Westinghouse brake exhibits. It is representative in every feature of Russian art and workmanship, and is recognized as the general Russian rendezvous at St. Louis. In the Palace of Machinery the same company, which has made every effort to ensure a characteristic Russian exhibit at the Fair, has furnished a small Russian kiosk at the head of the row of national booths erected by the different Westinghouse companies of Europe and America, and at both places, as a manifestation of Russian hospitality, Russian tea, brewed in curious old samovars, and suchari, a sweet native biscuit, are served to visitors of the company by Russian girls wearing richly embroidered boyarin costumes. The pavilion in the Palace of Transportation covers a space 20 ft. by 25 ft., and is 25 ft. high. It was constructed by peasant builders in the Possade Sergiewo, near Moscow, after designs by the native architect, Baranowsky, who has done much important work in St. Petersburg. U. Grant Smith, of the Russian Westinghouse Company, is in general charge of the exhibit.

### INCREASED LIFE OF STEEL-TIRED WHEELS

Increased life of steel-tired wheels is being secured by the Boston Elevated Railway Company upon its elevated divisions by the use of a larger size of tires than was originally adopted for use under elevated cars. The standard wheel center of the system is 28 ins. in diameter, while the thickness of tire formerly used was  $2\frac{1}{2}$  ins. Now, however, steel tires 3 ins. thick are applied in re-tiring all wheels, with the result that wheels go into service 34 ins. in diameter at the tread instead of 33 ins., as formerly.

This results in a considerable addition to the life of tires, which is of importance owing to the extreme service met in the operating conditions upon the elevated and underground lines. The tire wear is very severe, requiring truing up of every wheel upon the system twice a month; this is done by grinding, and further truing is resorted to by periodically turning off to true shape in a car-wheel lathe, a complete description of which processes, together with the methods of handling the cars and trucks in such repair work, were presented on pages 464-467 of the March 26, 1904, issue.

The result of the numerous truing, by grinding and turning, proved to effect a rapid reduction of tire thickness, which resulted in the decision to use the thicker tire. The increased diameter of wheels by 1 in. did not interfere materially with established clearances, while it results in providing for a considerably longer service per tire. It is now found that tires will run about 150,000 miles before becoming too thin to be safe. As the average mileage per car per day is 150 miles, 1000 days or practically three years' service per tire is obtained.

As less than 1-32 in. is removed per grinding, the twenty-four grindings for each tire per yard do not reduce the tire thickness more than  $\frac{1}{2}$  in. or  $\frac{5}{8}$  in., or in extreme cases  $\frac{3}{4}$  in. per year.



**THE UTICA CONVENTION**

As this issue goes to press, reports received from the Utica convention of the New York State Street Railway Association indicate that it is one of the most successful in the history of the association. There is a large attendance, and as the association is being favored with clear and cool weather, no more favorable conditions could be supplied.

A novel feature of the convention is the unique badge adopted. It consists of a medallion bearing the coat of arms of the State of New York, which is surrounded by the name of the association. On the reverse side is a list of the previous conventions. The medallion is carried on two bars, one bearing the word "Delegate," or whatever the wearer may be, the other is stamped "Utica, 1904." In addition, if the wearer is an officer of the association or a member of the executive committee, a third bar is attached, marked with the office held by him. This badge is to be retained, and at each succeeding convention a new bar will be attached with the name of the city and the year of the convention. The bars or the badges at future conventions will be furnished by the association. Anyone desiring a badge in the future can get them from the secretary at \$1 each.

The arrangements made for the various business meetings and social entertainments were perfect, and reflected great credit on C. Loomis Allen, manager of the Utica & Mohawk Valley Railway, who, with his corps of able associates connected with this company, were indefatigable in providing for all the needs of the attendants.

At the close of the session on Sept. 14, the following officers were elected for the ensuing year: President, C. Loomis Allen; first vice-president, J. H. Pardee; second vice-president, A. B. Colvin; secretary and treasurer, W. W. Cole; executive committee, officers and E. G. Connette, R. E. Danforth, B. B. Nosstrand, Jr., E. F. Peck.

In this issue it is possible to publish only one or two of the papers presented and the "Question Box," but the other papers, reports and discussions, together with a full report of the meetings, will be printed in the next issue. The "Question Box" follows:

**THE QUESTION BOX  
POWER-STATION CONSTRUCTION**

No. 1. (a) What is the life of a good storage battery when well taken care of? (b) Is a floating battery preferable to a booster installed in station? (c) How much attention does a battery require?

(a) Charge 6 per cent depreciation. (b) A booster with the battery is preferable. (c) Examination and readings once a day.  
CHARLES K. STEARNS.

(a) Without any renewals, 4 to 8 years. (b) Depends on service. (c) Much or little, depending how the battery fits the service, and also the owner's standard of maintenance.  
JOHN J. STANLEY.

(a) The life of a good storage battery when well taken care of is dependent on the amount of work which it does. A battery working up to or above its capacity every day will wear out earlier than one worked to its capacity every second day. (b) The booster is or is not necessary, according to the purpose for which the battery is used. If it is desired to maintain the initial voltage under an increasing load, it will be necessary to use the booster in connection with the battery. (c) The attention which the battery will require will vary according to the extent to which it is used. It is safe to say that a storage battery will cost in time and material about 7 per cent of its cost price each year if properly looked after.  
M. G. STARRETT.

(b) I would submit for your consideration an abstract from a lecture delivered by me before the Stevens Institute recently, and published in the "Stevens Indicator." You will find in this lecture a comparison between a line battery with shunt wound booster at the power house, and a series booster without a battery. This, of course, is a special case. It is impossible to give any general comparison of the two systems, on account of the many variable quantities which enter into the problem, such as the distance of transmission, the average load, the maximum load, the minimum voltage permissible, the power house voltage, etc. It will generally be found, however, that the advantageous use of a series booster is confined to rather narrow limits. In many cases which have come under my personal observation, the series booster

scheme, while quite satisfactory to meet the conditions obtaining when first installed, has soon been outgrown by an increase of load, and it has been found necessary to install a line battery later. The question of whether a shunt booster should be installed at the power house in connection with a line battery is also one which cannot be generally answered, owing to the wide variation of conditions. It is frequently found desirable to install such a booster, its use being confined to days of exceptionally heavy load, while under normal conditions the battery will float satisfactorily connected directly across the line without boosting.  
J. LESTER WOODBRIDGE.

No. 2. Is the specific heat of superheated steam constant, and, if not, what law will give the specific heat of superheated steam at various temperatures and pressures?

Experiments have proven that saturated steam is not a true gas, and that upon the addition of heat the increase of volume is at first much greater than would be the case with a true gas. After about 20 to 25 degs. Fahr. of superheat, however, the behavior of the superheated steam is very close to that of a true gas, and the ordinary gas governing the relation of volume, pressure and temperature with a true gas may be used without any appreciable error. Data are lacking regarding the relations of pressure, temperature and volume with superheated steam at high temperatures, but there is no doubt that the higher the temperature the closer is the resemblance to a true gas.  
M. G. STARRETT.

See paper read before the Society of Mechanical Engineers at Chicago meeting, 1904, on "Potential Efficiency of Prime Movers," by C. V. Kerr.  
JOHN J. STANLEY.

No. From a series of experiments of recent date it has been shown that the specific heat of superheated steam is not constant, but varies directly as the temperature and independently of the pressure. Mathematically, it is believed to be a straight line function of the temperature. The one hundred or more experiments carried on by Greissmann would seem to bear out this belief, although he worked only up to 325 degs. Fahr. He established the formula:

$$\text{Sp. ht.} = \frac{.00222 T_s - .116}{2} - .116$$

The values obtained from the above, checked by observation, taken in separately fired superheaters, seem to show a value a trifle high, and in August, 1904, "Power," George Orrok suggests the form:

$$\text{Sp. ht.} = .0016 T - .041 \text{ as being nearer the actual.}$$

CHARLES K. STEARNS.

No. 3. One company has in its power house one 800-kw 550-volt, direct-current generator with compound fields. In the armature there are 800 coils and 800 commutator bars, 12 poles and 12 brush holders. Would like to know the proper connections to make to balance the magnetic circuits of this machine and size of wire necessary?

It is not practicable to cross-connect this armature, as 800 bars cannot be divided into six equal parts. In order to cross-connect a 12-pole generator, there should be six available points of equal potential which may be interconnected.  
WESTINGHOUSE ELECTRIC & MFG. COMPANY.

Would suggest that it would be well to obtain from the makers of this machine a connection diagram, which, presumably, would give the proper connection.  
M. G. STARRETT.

**TRACK CONSTRUCTION**

No. 4. What type of rail has given the best satisfaction for city service in unimproved streets, and what troubles, if any, have been met with in the 9-in. girder rail?

The ASCE standard T. rail has given us the best satisfaction.  
J. N. SHANNAHAN.

Standard T-rail. High girder rails, being sidebearing, tip outward, producing wide gauge, especially with heavy suburban cars now commonly used on city streets. The deep wheel flanges of these cars are liable to cut down the lip of the half groove type rail, forcing the rail further out of gage or causing derailment by crowding against gage of opposite rail. Either girder rails should be discarded in favor of high T-rails or the manufacturers should be induced to make center-bearing girder rails with heads at least 1¼ ins. deep on gage line. The recommendations of the Rail Committee of the National Association Convention of 1902 in favor of high T-rails should be indorsed by this convention.  
M. J. FRENCH, JR.

For unimproved street 60 or 70 lb. T-rail. If street is not paved trouble has occurred on account of stones in groove.  
CHARLES K. STEARNS.

The girder rail. No cutting of grooves. Grooves break wheels pulling out. Wagons cut grooves in dirt roads, requiring constant filling in where T-rail is used.  
J. W. HICKS.



T-rail has given best satisfaction in unimproved streets. Girder rails in unimproved streets, whether tie rods were used, or whether they were omitted, have proved troublesome, in that the rails would not stay to a true gage. This trouble is eliminated by the use of T-rail. C. LOOMIS ALLEN.

Six-inch Shanghai T best type of rail for dirt or macadam streets. Question too broad; is semi-groove, full-groove, tram, center-bearing or Trilby girder rail meant? T. E. MITTEN.

I consider T-rails the best for city or suburban service in unimproved streets. They are no more of a menace to vehicles than any other section of rail in a dirt road. They are easier to maintain and make much cheaper construction. W. BOARDMAN REED.

If paving is not imminent, standard T-rail; otherwise high T-rail. If streets are wide enough to provide driveways alongside of tracks, so that wagons will not follow rails, T-rail is superior from every point of view of railway company. If wagons habitually follow rails, there is no satisfactory way to maintain the unimproved roadway without paving. A. S. KIBBE.

No. 5. Cannot a limited number of standard rail heads be adopted for paved streets?

Two heights of T-rails and two each of tram-head and grooved girder rails would seem to be sufficient; either 6 ins. or 7 ins. high for asphalt pavements, and 9 ins. high for brick and block pavements. These rails will allow 3 ins. to 4 ins. of concrete above base of rail. M. J. FRENCH, JR.

We believe so.

J. N. SHANNAHAN.

It seems to me that the question of standard rail head for use in paved streets depends fully as much on the caprice of the local city government as it does upon the theory and practice of the railway companies. M. G. STARRETT.

It would be possible and would be a step in the right direction to design a number of standard rail heads for use in paved streets. C. LOOMIS ALLEN.

Yes, through a limited number of standards. Fish-plates with standard drilling would be preferable. T. E. MITTEN.

There is no reason why a limited number of standard sections of rail heads could not be adopted for paved streets, if engineers of the various street railway companies would get together and come to some decision upon this subject, and it would be greatly to the advantage of street railway companies could this be done. The greatest obstacle in the way of accomplishing this result is, I believe, the innumerable ideas held, not so much by street railway men as by engineers or other officials connected with municipal corporations. If, however, the street railways could decide upon certain sections, and no other sections were rolled upon special order, I think the municipal authorities could be forced to adopt one of a few standard sections. W. BOARDMAN REED.

No. 6. What rights has a railroad company in arranging drainage for its tracks? Where the company pays for paving between tracks and for a certain distance on each side, can it claim any jurisdiction in arranging grades for drainage?

If the authorities granting the franchise neglect and refuse to establish grades and methods proper for drainage of the railway strip, a company has the right to provide drainage for the protection of its property, and the property and persons of others. M. J. FRENCH, JR.

Depends almost wholly on statutes governing this point and varies in different States. In private right of way the drainage cannot be thrown on abutting property. No jurisdiction, but must conform to grades approved by the city, State or town engineer. CHARLES K. STEARNS.

They should be allowed to connect to sewers. J. J. STANLEY.

If the city engineer insists on his grades, none. J. W. HICKS.

Yes. In city streets the street railway company which pays for paving between its tracks should have absolute right to drain same, but not necessarily fix grade for such drainage, as it will have to conform to grade as established by city authorities, which should be sufficient for drainage. T. E. MITTEN.

I believe the matter of the grading of streets is one solely in the hands of the municipal authorities, and do not believe there is any way in which such authorities can be compelled to accede to the demands of street railway companies. An amicable adjustment of such difficulties as might arise is, in my opinion, altogether the best way out of difficulties that street railways are likely to meet with in this direction. W. BOARDMAN REED.

No. 7. Which is the better material for paving—Medina sandstone or granite block?

We are not prepared to say which is the best material for paving, whether sandstone or granite block, but we do know that all paving, whether brick, sandstone, granite block or asphalt, along the line of the railway track is greatly benefited by the use of marginal protecting strip. This strip, being continuous, distributes the pounding from the miscellaneous street traffic and from the car wheel over a large distance, and prevents the disintegration of the paving in the immediate vicinity of the track, due to the springing

of the track, and in the discussion of the merits of various paving the advantages of the marginal protecting strip should not be lost sight of. F. W. SARGENT.

Some authorities claim that Medina sandstone will outwear granite. If this is so, sandstone would be much preferable, as its gritty surface makes a much better foothold for horses, especially in winter weather. It can also be kept much cleaner, and it does not get greasy and slippery like granite. In heavy vehicular traffic, in the writer's opinion, sandstone will not stand. T. E. MITTEN.

I am not familiar with the merits of Medina sandstone for paving purposes, except as I have seen it occasionally in my travels through the country. I have never seen it compared with granite block on streets with heavy traffic. I do not believe it will wear as well as the best of granite block, but probably better than most of the granite block that is used, there being as much or more difference between the various granite blocks as there is between Medina sandstone and the average granite block used. W. BOARDMAN REED.

If Medina sandstone is specified a specific kind of granite block should be named in the question. Westerly granite paving blocks are more durable than any sandstone, and in all other respects are of equal merit. M. J. FRENCH, JR.

Granite block.

CHARLES K. STEARNS.

Medina block stone.

J. W. HICKS.

Medina sandstone.

JOHN J. STANLEY.

No. 8. What type of rail-joint has proven best in paved streets?

Weber joints.

J. N. SHANNAHAN.

Electric welded preferred; Weber joint next. J. J. STANLEY.

Weber joint. Goldschmidt joint in the future. CHARLES K. STEARNS.

Continuous.

J. W. HICKS.

The experience on the lines of this company shows that the standard 36-in. ribbed plates, having twelve 1-in. x 3-in. bolts per joint, do not offer sufficient resistance to vibration to prevent wear and loosening of joint and ultimate failure through sagging and spreading at joint before the life of the rail is exhausted. A type of plate affording a deeper cross-section than the rail, combined with the feature of a tie-plate, is preferable. The electrically or cast-welded joint, provided it secures at least the tensile strength and rigidity of the full rail, without in any way harming the chemical and physical wearing properties of the rail, in addition to securing sufficient conductivity for return current, is most preferable. M. J. FRENCH, JR.

In my opinion, the electrically-welded joint, as used in Buffalo, or the rivet joint, as used in Philadelphia. T. E. MITTEN.

A railway joint is, and always has been, the greatest cause of trouble to the trackmaster. To say which is the best joint is difficult. In New York City, I think 9-in. girder rails, angle-bars 36 ins. in length, with twelve holes, have been used for the past five or six years, and are now failing. They are being replaced with a continuous joint plate, and this seems to overcome, in a measure, the trouble had with the other plate. Cast weld joints have been used to a considerable extent in Manhattan, and many of them have failed. The electric welded joints have been used extensively in some quarters, and have held up exceedingly well. The Thermit welded joint is new in this country and has been tried experimentally in Manhattan, but not to a sufficient extent to enable one to judge of its merits. It has the advantage of being easily applied at a moderate cost, and if it holds well will, I believe, overcome many of the difficulties under certain conditions. W. BOARDMAN REED.

No. 9. (a) What is the best method of detecting broken bonds? (b) Is the electrical drilling machine practicable?

(a) Probably the best method at the present time of detecting broken bonds or bonds giving defective contact is by the use of a bond-testing instrument as furnished by R. W. Conant or Machado & Roller. It is almost necessary to employ some such device where the bond is concealed. There is, however, a bond now on the market which is attached by means of solder to the outside of the ball of the rail; the use of this bond makes it unnecessary to use instruments to determine whether the bond is broken or to what extent defective, as an inspector can by mere observation determine the condition of each bond and cover many miles of track per day, and if he examines the bonds carefully all doubt as to the condition of the bond is eliminated, which is not always the case if the bond is concealed and dependence placed upon an instrument for testing its condition. "Seeing is believing."

(b) The electrical drilling machine is entirely practical wherever current is available for operating it. It is not, however, an economical device where there are only a few holes to drill, as the investment in the drill is quite large, and should this investment be charged up to the drilling of holes it would run the cost considerably over that of drilling the holes by means of a Buda Track Drill. If, however, there are 5000 or 6000 or more holes to



be drilled, we should say that the electric drill would pay for itself in such case and be a paying investment. G. A. MEAD.

(a) Looking at them. The best method of detecting imperfect conductivity is by application of a measuring device that will determine the relative conductivity of the joint and the whole rail, taking into consideration the conductivity of the bonds and rail with relation to their composition and cross-section. The conductivity of the joint plates, being variable, should be disregarded.

(b) The principle is certainly practicable. The Ludlow track drilling machine, manufactured in Cleveland, Ohio, and practically tested in that city, is a most economical and successful machine for use on continuous work of any magnitude.

M. J. FRENCH, JR.

(a) We detect broken or defective bonds readily with the Conant Bond Tester. J. N. SHANNAHAN.

(a) Millivoltmeter and comparison method. (b) Yes.

CHARLES K. STEARNS.

(a) The best method for detecting broken or loose rail bonds is undoubtedly the electrical method, making use of the varying resistance of the bonded joint. There are several good instruments on the market for this purpose. (b) The electrical drilling machine is certainly practicable. We have used it to quite an extent on track in New York City.

M. G. STARRETT.

The handiest method is by using some portable bond tester, such as the Conant. By means of Wheatstone Bridge a given section of rail is compared with the same length of rail across the joint. A better method would be to determine the drop in the line.

T. E. MITTEN.

(a) The Conant machine is very satisfactory. (b) Electric drilling machines are practicable where current is at hand. When mounted on a small car so that they can be easily and quickly shifted and adjusted they are economical, but they are adapted more particularly to structural work, requiring many holes drilled in close proximity, than to rail bonding or joint drilling.

A. S. KIBBE.

No. 10. What is the better type of bond—the compressed head or the pin head?

The compressed terminal type of bond will no doubt give more uniform and satisfactory results than the pin-driven type of bond. In the pin-driven type of bond it is necessary that the relations between the diameter of pin, the size of hole in the bond terminal and the size of hole in the rail be exact in order to obtain the best results. This condition is not always to be obtained, and is not necessary with the compressed terminal bond for the reason that it is only necessary to continue the compression to its limit, in which case the hole will be thoroughly filled and the terminal pressed into firm contact with the rail. And unless the terminal is in firm, strong contact with the rail, the terminal will loosen up and corrosion will soon set in, thus destroying the efficiency of the joint.

G. A. MEAD.

The "compressed head" type of bond can be made tighter, and will afford a greater contact surface if a compressor of sufficient power is used to "head" the terminal in the form of a rivet; a portable pneumatic riveting plant with electrically-driven compressor, on a small car, being practicable and economical for continuous work. The "pin head" type does not afford equal area of contact, as the plug spreads the head of the bond and crowds it away from the rail.

M. J. FRENCH, JR.

There is no doubt in my mind that the compressed head rail bond is the best type of rail bond as compared with the pin-head type.

M. G. STARRETT.

We believe the pin expanded head bond the better, though it is not entirely satisfactory.

J. N. SHANNAHAN.

Heads of bonds should be pressed in place, not hammered.

CHARLES K. STEARNS.

Compressed head. J. W. HICKS.

Compressed head if great care is taken to do a first-class job.

JOHN J. STANLEY.

The compressed head. T. A. MITTEN.

The compressed head bond is better. C. LOOMIS ALLEN.

No. 11. Has the soldered type of bond been found to be practical?

Soldered bonds have been in practical use in constantly increasing quantities for the past three years, which would seem to demonstrate that the soldered type of bond is entirely practical. Many large and important roads have adopted it as a standard after careful trial. This type of bond is meeting with increased favor among practical railway operators.

G. A. MEAD.

No. 12. What are the advantages, if any, of the soldered type of bond over that of the compressed terminal bond?

The advantages of the soldered type of bond over that of the compressed terminal or the pin-driven terminal are many and quite evident.

First—The type most generally favored is the one which is attached to the balls of the rail, and for this reason is always in a

position to be thoroughly inspected as to its conditions at any time without the use of instruments.

Second—The soldered bond will permit of the use of a shorter bond than is the case with the compressed terminal or pin-driven bond, and at the same time the same amount if not more flexibility is maintained. This decrease in length reduces the resistance of the bond, thereby decreasing the drop across each joint.

Third—The contact resistance between the terminals of the soldered bond and the rail, as compared with the cross-section is less than in the compressed terminal or pin-expanded terminal type of bond.

Fourth—Its first cost is less than that of a compressed terminal or pin-expanded bond of the same capacity.

Fifth—The cost of installing the soldered bond is less than for installing the compressed type. Official reports from various roads show that the soldered bond can be installed at a total cost of from 10 cents to 13 cents, while the cost of installing the compressed terminal bond is practically twice this amount.

Sixth—The bond can be removed, without destroying, and re-installed, which is not the case with the compressed terminal and pin-driven terminal bond.

Seventh—The bond can be applied without the necessity of removing or disturbing fish-plates.

The point has been raised in a few instances that on account of the bond being exposed it is very liable to be stolen, but careful investigation of this point has shown that on account of the small amount of copper in the bond and the difficulty of removing the bond, copper thieves recognize at once, without actually trying, that it does not pay to steal this type of bond.

G. A. MEAD.

No. 13. Is a concealed bond which has the flexible portion made of cable as practical as one in which the flexible portion is made of flat strips?

It has been shown that a concealed bond in which the flexible portion is made of cable and having the wires slightly twisted together is more practical than one in which the flexible portion is made of flat strips. The reason for this seems to be from the fact that the bond in which the cable is used, on account of the wires being bound together slightly, has a tendency to transmit any movement in the flexible portion, due to a movement of the rail, throughout its length, while in the case of the bond composed of flat strips, as they are not bound together in any manner, tend to take up all the motion of the joint at some one particular point of the flexible portion of the bond, thereby decreasing the life of the bond. These flat strips also become wedged in between the plate and the rail, and the movement of the rail causes them to work out between the head of the rail and the fish-plate, thereby cutting them off. This has been found to be the case in a great many instances.

G. A. MEAD.

OVERHEAD LINE CONSTRUCTION

No. 14. What wood is best adapted to stand the elements, and what paint; how many coats, and how often should same be painted?

No wood is better adapted to stand the elements than red cedar; next to red cedar, white pine. As to paint there is no better preservative and no paint more enduring than white lead reduced to the proper consistency for flowing with pure linseed oil and turpentine. No less than three coats should be applied at the beginning, permitting at least three or four days to elapse between each coat. Thereafter, one coat of the same material every three years should be sufficient to maintain the wood against decay for an indefinite period. My opinion is based upon an experience with wood and wood finish of various kinds covering a period of thirty-five years.

JOHN F. OHMER.

Cedar is best wood for trolley poles. As to paint, either a graphite paint or lead and oil paint are efficient.

T. E. MITTEN.

For poles, Norway pine, dressed and painted, seems to combine greatest carrying strength and resistance to storms, together with uniform soundness and resistance to decay. Paints combining graphite and rubber are most durable for iron work. Pure lead and oil has given the best results for wood, although a zinc paint is gaining in favor. A heavy coat should be applied before erection of work and another immediately following. The work should be given one coat the succeeding year and then one coat every second year.

M. J. FRENCH, JR.

White cedar, covered with two coats of white lead and oil, colored to suit. Painting should be repeated every two years.

J. N. SHANNAHAN.

Locust and chestnut. Red lead. On the coast once in two years; away from the coast, five years.

CHARLES K. STEARNS.

Cedar in this soil. One coat filler, two coats lead and oil—every three years, one coat lead and oil.

JOHN J. STANLEY.

No. 15. What is the most economical size of trolley wheel to use on city and interurban lines?

No. 16. What is the best hanger—a mechanical or soldered clip?

We believe that the best form of hanger to use is that known as the Type N Round Top Hanger, which consists of a body casting containing an insulating compound in which is embedded a



threaded stud. This produces a neat, compact device of one piece in which the various parts are not detachable—or the Type D Hanger, similar to the well-known West End form, which contains an insulated bolt and can readily be removed from the hanger by unscrewing the cap, which is provided with lugs. These lugs, however, can be clinched over after the hanger has been assembled, thereby preventing any movement of the stud or the unscrewing of the cap. In order to suspend the trolley wire from these types of hanger the preference at the present time seems to be more in favor of a mechanical clamp than a soldered clip. In case of round wire the ordinary clinch ear or the Walker ear are used extensively. In the case of grooved or Fig. 8 trolley wire, the preference seems to be for the mechanical clamp, in which the two halves are made to grip the wire by means of screws. The use of solder in connection with devices to be attached to the trolley is not looked upon with as much favor at the present time as in the past, as it is very easy to reduce the tensile strength of the trolley wire by overheating if the soldering is not done with care. Mechanical forms of clamps for supporting the trolley wire have for a great many years proved themselves to be perfectly practical and safe, and their use eliminates the possibility of injuring the trolley wire, for the reason just given.

G. A. MEAD.

We have found the soldered clip to give best satisfaction, as the mechanical ones used by us did not allow for the wear in the wire and where thin would pull out.

W. H. POUCH.

If the question is intended to refer to the relative merits of a hanger soldered rigidly to the wire, combining an ear in the same piece with insulators on span wire, it would be preferable to any of the hangers combining insulating parts in contact with the vibrating metal of the hanger, as the latter ultimately crumble from vibration. If the question refers to the relative merits of soldered and mechanical ears, practice shows the long, deep-grooved soldered ear to be more economical, as the soldered ear ultimately breaks and releases the wire, whereas the stiff mechanical ear is more liable to saw the wire in two at the receiving end.

M. J. FRENCH, JR.

J. N. SHANNAHAN.

CHARLES K. STEARNS.

J. W. HICKS.

The mechanical clip.

Mechanical clip.

Soldered clip.

If soldered without overheating the wire, soldered clip. Practically, we use mechanical clinch type.

JOHN J. STANLEY.

Soldered—especially for high speed.

C. LOOMIS ALLEN.

No. 17. What is the best method of spacing d. c. lightning arresters along the line?

We have spaced two to the mile, except in especially exposed places. In such places we have arbitrarily placed one or two arresters, as the case might seem to warrant.

C. LOOMIS ALLEN.

D. c. lightning arresters should be located on the feed-in spans close to the feeder. As the power house is supposed to be sufficiently protected by devices in its immediate vicinity, its consideration is eliminated, the line arresters being intended to protect the line and cars. Lightning following the feeder would, in part, naturally be diverted at a feed-in span, as it follows the flow of line current. Lightning following the trolley wire, unless reaching the ground through the car, would have no other outlet except through the feed-in spans.

M. J. FRENCH, JR.

The spacing given to d. c. lightning arresters along an overhead line should depend on the configuration of the country through which the line runs and the liability to trouble from lightning, which, of course, is much greater in some sections of the country than others. Where electric storms are frequent and violent the d. c. lightning arresters should be installed about eight to the mile, but under any conditions I consider there should be at least four to the mile.

M. G. STARRETT.

Depending somewhat on conditions. We place d. c. lightning arresters about 1800 feet apart.

J. N. SHANNAHAN.

Every half mile.

CHARLES K. STEARNS.

Determined by local conditions.

JOHN J. STANLEY.

No. 18. How many lightning arresters to the mile in the best practice? Should more arresters be used in suburban than city lines?

Suburban lines are generally more exposed than city lines, and should have more arresters. Six arresters per mile of wire is a good rule to follow for suburban lines.

WESTINGHOUSE ELECTRIC &amp; MFG. CO.

Once every half mile in any case.

CHARLES K. STEARNS.

Every half mile.

JOHN J. STANLEY.

(a) Every 1000 ft. (b) Yes.

J. W. HICKS.

Three arresters to the mile is considered good practice under ordinary circumstances. Suburban lines, as they traverse country affording fewer diverting agencies than does a city, require better protection than city lines.

M. J. FRENCH, JR.

Our experience has shown that more arresters should be used in suburban work than on city lines.

J. N. SHANNAHAN.

Four arresters to the mile on suburban lines and two in city lines.

ANONYMOUS.

No. 19. Has it been observed that the presence of a high-voltage transmission line running along the same right of way with the trolley has a tendency to relieve the d. c. line from some of the lightning disturbances to which it would normally be subject?

Lightning seems to prefer the company of a high voltage transmission line to that of a d. c. line.

M. J. FRENCH, JR.

We have experienced less trouble on our d. c. line where it is paralleled by the 20,000-volt transmission line. The transmission line runs on the poles on the opposite side of the tracks from the feeder line. We are using Garton arresters, and our replacements have been much more frequent on sections not occupied by transmission lines.

C. LOOMIS ALLEN.

Decidedly so.

J. N. SHANNAHAN.

Determination of such a question is difficult. No such tendency has been sufficiently pronounced to be apparent to the writer.

A. S. KIBBE.

No. We are, however, inclined to believe that the presence of the trolley line running parallel with the high tension has some tendency to relieve the strains on the high tension, due to the fact that the insulation of the trolley is much lower than that of the high-tension and presents a much easier path to the ground.

B. E. MORROW.

## POWER TRANSMISSION LINE CONSTRUCTION

No. 20. Information is requested with regard to the use of aluminum for a. c. high-tension lines and for d. c. trolley feeders; also for use bare in underground conduit as an auxiliary to the rail return?

The use of aluminum for a. c. high-tension lines and for bare d. c. trolley feeders has given considerable trouble on account of its low fusing point. Short circuits through cobwebs, kite strings and large birds on lines carrying 20,000-volt a. c. have resulted in the fusing of the wires, where copper conductors, carrying practically the same voltage, have withstood short-circuiting from limbs and scraps of fence wire.

M. J. FRENCH.

Results good.

J. W. HICKS.

Aluminum for d. c. trolley feeders and rail return not recommended on account of difficulty in making proper joints.

JOHN J. STANLEY.

(a) Aluminum conductors for these purposes have been in use for a number of years, and seem to be giving satisfaction; their use is too general to require any extensive argument as to their wide acceptance.

(b) Not recommended. The increased cost of conduit for the larger conductor will probably more than offset the saving in aluminum conductors. No advantage gained by reason of reduced weight of the conductors. Aluminum will not ordinarily last as long as copper underground.

HENRY FLOY.

Aluminum is admirably suited to long-distance alternating-current transmission. Its weight being one-third that of copper, admits the use of fewer poles and farther spacing, thereby lessening the first cost and chances of insulator leakage, and at the same time maintaining a high standard of line construction. The aluminum on the market to-day is about 20 per cent of copper, when copper is taken at 98 per cent, hence, to secure equal conductivities it is necessary to increase the cross-section of aluminum in the ratio of 1.58 to 1. It has been noticed that soon after erection of an aluminum line the wire turns black, due to oxidation, and from that time no apparent change takes place. In an instance under the writer's observation an 11,000-volt aluminum line was built across the tracks of a steam road, and at a point some few hundred yards distant an iron telephone lead also crossed the tracks, both lines being some 40 ft. above the rails. It has been noticed that the iron wire rapidly deteriorated under the action of the sulphur gases from passing locomotives, while the aluminum wires have suffered no deleterious effects. Owing to its extreme lightness, aluminum is also well suited for use as trolley feeders, materially lessening the strain on poles and crossarms. The lack of experience with the use of bare cables in underground conduits makes the question one of conjecture to the writer, but from the nature of the metal it is hardly likely that it would successfully withstand the action of the salts, acids and gases to which it would be subjected.

CHARLES E. WADDELL.

Aluminum wire satisfactory for d. c. overhead lines. No experience as rail return or a. c. lines.

C. E. ROEHL.

The writer has employed aluminum for a. c. and d. c. feeder lines for nearly five years with a high degree of satisfaction. As compared with copper conductors of equal conductivity they possess the advantages of: (1) Lower first cost. (2) Less liability to be stolen.

The principal disadvantages under which aluminum labors are: (3) Lower temperature of fusibility. (4) Higher coefficient of expansion.

In the following respects they are to all intents and purposes



equal: (5) Durability and cost of maintenance. (6) Liability to damage from sleet. (Aluminum probably enjoys a slight advantage over copper in this respect.) (7) Cost of erection, with small probable advantage in favor of aluminum. (8) Proportion between new and scrap values.

A large proportion of the difficulty encountered with aluminum conductors in recent years is attributable to failure to properly provide for item No. 4. In the use of high-tension conductors of all kinds our knowledge of the requirements has failed to keep pace with the rapid increase in voltages employed. As a result many high-tension circuits have been installed with too small a space between the different legs. With proper provision in these respects the writer believes that aluminum will not suffer in comparison with other metals. In a word, the subject resolves itself into a question of comparative cost of materials, and this is, of course, determined by quotations at the time of purchase.

A. S. KIBBE.

Aluminum wire has a conductivity of 62 in the Matthiessen Standard Scale, tensile strength of 26,000 pounds per sq. in., specific gravity of 2.68, and is a very durable metal when erected on pole lines. It is put on the market only in the form of stranded conductors. Comparing it with copper conductors of 97 conductivity, and of the same resistance per unit of length, it has 1,565 times the cross-section, 1.25 times the diameter, the same strength as a copper conductor of 40,000 lbs. per sq. in. ultimate and .47 the weight of the copper conductor. Its coefficient of expansion is about one-third more than that of copper and its coefficient of temperature resistance is the same.

From inspection of the above it will be seen that practically the same results are obtained either with aluminum or copper, so far as concerns the two principal considerations necessary in conductors for use on a pole line, i. e., low resistance and high strength. The principal differences are: (1) Aluminum costs about 10 per cent less, for the same results. (2) The aluminum weighs less than one-half as much, thereby causing an additional saving in the cost of transportation and in maintenance of the poles, pins and cross-arms. (3) On account of its greater coefficient of expansion, aluminum has a maximum sag of about 20 per cent more than copper in spans of customary length. (4) Aluminum cannot be readily soldered, and mechanical joints are used in place of soldering. (5) On account of its greater diameter, lead-covered aluminum cables cost more than lead-covered copper cables. (6) On account of its chemical nature, aluminum is almost certain to be corroded if placed underground without being waterproofed.

The first two items enumerated above constitute distinct advantages for aluminum, and have been the cause of the fact that many thousands of miles of aluminum conductors have been installed for high-tension transmission and for railway feeders, since their manufacture began in 1898. The two most notable instances in the East are the line of The Niagara Falls Power Company, from Niagara Falls to Buffalo, over which 17,000 hp has been transmitted, and the line of The Shawinigan Water & Power Company, from Shawinigan Falls to Montreal, on which power is transmitted for 80 miles at a pressure of 55,000 volts. The earliest installation in this section was that of The Hartford Electric Light Company, of 36 miles of 342,600 c. m. aluminum in 1900.

The third item enumerated constitutes a disadvantage where wires must be crowded closely together on account of greater liability of wires to cross. In the case of transmission and feeder systems, this slightly greater sag makes no difference whatever, except, perhaps, from an aesthetic standpoint. The fourth item once was a very serious drawback to the use of aluminum, but a variety of mechanical joints have since been brought out by the manufacturers of aluminum wire, which are so effective and so readily applied that what was once a disadvantage has become decidedly the reverse.

The method of splicing conductors of smaller size than No. 0000 B. & S. gage is to twist them in a McIntyre joint. Larger sizes are joined by means of a right and left handed aluminum stud which screws into terminals compressed on the ends of the cable in the factory. A good emergency joint consists of the ordinary dovetail cable splice, without solder. Joints are also made in the field by compressing cast sleeves on the cable by means of a small portable hydraulic jack, the ends of the cable butting together in the center of the sleeve. Tap connections are made by means of aluminum clamps which bolt together on the cable, one of the clamps carrying a lug into which the tap wire is soldered. This piece of soldering presents no difficulty, because the inside of the lug is tinned before leaving the factory.

The fifth and sixth items show the impracticability of the use of aluminum for underground work. Copper seems to be the only material possessing the requisite properties for such work.

WILLIAM L. ROBB.

On the Utica & Mohawk Valley Railway Company lines we have a three-phase, 20,000-volt transmission line 28.5 miles in length. Aluminum cable of the size equivalent to No. 2 copper is used. When the line was originally built the spacing of the wires was in the form of a triangle, 24 ins. on each side of the triangle. During eighteen months' operation of this transmission line, after construction, there were fifteen short-circuits on the line that could not be accounted for. After going into the matter it was determined that these short-circuits were due to objects coming in contact with the line, such as limbs or brush, rope, kites, and even large birds. Early in the spring of 1904 the spacing was changed from 24 ins. to 52 ins., and since that time there have been no short circuits on the line that have not been accounted for. In the winter of 1903-1904 temperature change in twenty-four hours in this locality would range from 23 degs. above zero to 32 degs. below zero, and in one instance the low point of 36 degs. below zero was registered. The only breaks that were found in the aluminum line during the winter were at points in the line that had been weakened previously by some of the unaccounted for short-circuits.

C. LOOMIS ALLEN.

No. 21. What are the most efficient methods of joining the main conductors and of attaching trolley taps to the main feeders?

In the case of copper feeders of large size the ends of the cables are very often joined together or spliced by spreading the individual wires composing the cables for a foot or more back from the end and braiding or twisting the wires of the two cables together and then soldering and taping. This, however, while it makes a first-class joint if done properly, is not as a rule given the necessary care and the joint has a high resistance. Another method is to make use of a feed wire splicer, which makes it necessary simply to bare 5 ins. or 6 ins. of the end of each cable, insert them in the splicer, heat the splicer and fill with solder. This produces a strong, efficient and neat union of the two cables. In case of high-tension lines where small copper wires or cables are used, probably one of the best methods is to use a connector similar to the soldered connectors used in joining the ends of trolley wire or some of the various forms of twist connectors. To tap the feed wire to the trolley wire can be very readily done by soldering a 1/0 or 2/0 insulated wire to the feeder wire, and bringing the tap out to the trolley wire alongside to the feeder wire, and bringing the tap out to the trolley wire alongside of the span wire supporting the trolley. The tap is connected to the trolley by means of a feeder ear of any of the various forms. If the mechanical ear is used, several taps should be made to the trolley at several consecutive poles in order to get the full benefit of the capacity of the feeder, as the contact which will be obtained between the mechanical clamp and the trolley wire is very liable to be less than the capacity of the tap itself. Probably a neater arrangement would be to substitute an insulated copper wire for the span wire, attaching one end to the feeder wire and baring the insulated wire directly above the trolley wire and suspending the trolley wire by means of one of the various forms of feed-hangers which resembles an ordinary insulated hanger without the insulation. In bracket construction similar methods as just given hold good.

G. A. MEAD.

Clamps—if current density is not too high. The long splice is always satisfactory.

C. E. ROEHL.

For feeder taps the most satisfactory device is a two-piece aluminum clamp with socket and set screws for tap and bolts to clamp the other end to the main feeder.

For joints in main conductors, the writer has employed a large variety of devices, but he has found nothing so satisfactory as a span wire splice. This is made by unravelling the ends of cables for a length of eighteen to thirty inches, depending upon the size of the cable. The ends are then enmeshed in each other and the strands of each cable flattened out along the other end and shaped up smoothly. One of the wires is then wrapped from four to ten times around the center of the joint. A second wire is then started lapping the end of the first one. The latter is then cut close off at the lap, the end turned over and under, and the wrapping of the second wire continued for the same number of turns as the first, and the process repeated until all of the strands have been wrapped in succession. The ends of the last two are twisted together and turned down, and the result is a smooth tapered joint which is hardly perceptible in bare cable, and after tapping properly cannot be detected in insulated cable. The conductivity of the joint is about 25 per cent in excess of that of an equal length of the unbroken cable, and it is stronger mechanically than the unbroken cable. In thirty-seven strand cable the joint consumes a length of 2 ft. off each end joined.

A. S. KIBBE.

See No. 20 for Dr. William L. Robb's answer.

Soldered joint on feeder ear.

CHARLES K. STEARNS.

For small wires the most easily applied and the most satisfactory splice is the McIntyre twist sleeve; for large cables the



single piece and the three piece compression joints make neat, satisfactory and good electrical and mechanical unions.

CHARLES E. WADDELL.

(a) The well-known mechanical McIntyre joint for size not too stiff to be twisted, namely up to about No. 0000. For larger sizes aluminum "compression joints" are furnished by the cable manufacturers. The "joints" consist of two heavy sleeves joined by screwing into their terminals a right and left handed stud. Each sleeve is put on the end of two cables to be joined by hydraulic pressure, which causes the metal of the sleeve and cable to "flow" together, making a joint with two or three times the conductivity of the cable itself. The ordinary wireman's splice, made by twisting the ends of the cable together, may be used, but there results the loss of several feet of conductor in making this joint, which is objectionable. Furthermore, the joint is a purely mechanical one.

(b) Use a copper tap from the trolley to the feeder, and connect to the latter by means of a "tapoff joint," namely, a two part aluminum plate clamp, secured to the feeder by set screws. The copper tap is inserted in a lug of the clamp and secured by set screws and solder.

HENRY FLOY.

No. 22. What are the advantages and the disadvantages in the general use of aluminum for such purposes?

For high-tension, a. c. work: Disadvantage—Low fusing point. Advantages—Minimum mechanical strain on pins and insulators and line. Lightness and method of joining facilities; quick repairs, one man being able to carry material and make repairs in a few moments.

C. LOOMIS ALLEN.

See No. 20 for answers by Dr. William L. Robb and A. S. Kibbe.

Advantages—Weight, cost. Disadvantages—Size, joints, subject to corrosion from gases; high expansion coefficient; fuses readily on short circuit.

C. E. ROEHL.

(a) Advantages—(1) The price, as aluminum will be delivered on the ground for about 10 per cent less than copper having the same conductivity. (2) Lightness, as aluminum will have about 47 per cent of the weight of copper for the same conductivity, strength of the two conductors being about the same, thus permitting greater spans and reducing cost of line construction.

(b) Disadvantages—(1) The aluminum will have about 20 per cent greater sag for the same span, which, under some circumstances, is objectionable. (2) The aluminum conductor is usually made as a cable, in all sizes, whereas in the smaller sizes the copper is a single conductor. In case of short-circuit or arc, a cable will burn off more easily than a solid conductor of the same conductivity. (3) The greatest objection to the use of aluminum feeders in connection with trolley work is the liability to galvanic action between the copper tap and the aluminum feeder at their point of juncture. If, however, the tap-off clamp has its lug turned down toward the ground the moisture will drip off, reducing this risk to a minimum; moreover, the interior surface of the lug, if tinned, as would be the case when soldered, will almost entirely prevent galvanic action. The objections argued as to the effects of greater wind pressures, damage from sleet, increased charging currents, mutual induction, corrosion, etc., do not amount to anything worthy of consideration, as a matter of practical experience.

HENRY FLOY.

The principal disadvantage possessed by aluminum—and the objection is more theoretical than actual—is that it has a greater coefficient of expansion than copper. In high-tension work it is therefore necessary to space the wires a little farther apart. Briefly, in conclusion—Of the 60 or 70 miles of high-tension aluminum lines and 2 or more miles of trolley feeders that have been under the writer's direct observation for the past four years, it may be said that the metal has been perfectly satisfactory; that it is easily erected and maintained, and that the building gangs like to handle it. Experience demonstrates that extraordinary care is not required in the erection of an aluminum line, nor is the question of sag of any practical consequence; the line is usually drawn sufficiently taut to present a pleasing appearance and the effect of wide temperature changes has not proved detrimental.

CHARLES E. WADDELL.

No. 23. What is the maximum distance direct current can be advantageously transmitted for the operation of interurban cars

The maximum distance direct current can be advantageously transmitted for the operation of interurban cars depends upon the relation of the cost of generating electric current—including all fixed charges—to the cost of copper feeder lines. Given cost of all the items which go to make up the cost of producing power, equations can easily be written which will give the maximum distance for any specific case.

M. G. STARRETT.

Five to 8 miles.

JOHN J. STANLEY.

From 5 to 7 miles, depending on the frequency of the service and the grades of the line. It is a question of balancing the

interest on the copper investment and the saving in line losses per year.

CHARLES K. STEARNS.

The maximum distance to which direct current may be transmitted advantageously is not a fixed quantity, but is one which must be determined for each particular set of conditions encountered. It depends upon the number and character of cars to be operated, grades encountered, service required, cost of conductors and cost of construction, maintenance and operation of power plants. Generally speaking, of interurban roads handling a moderate business 10 to 12 miles will be found the commercial limit without the use of a booster. The writer has operated cars by direct current for a distance of 30 miles from the power station, but in cases of emergency only, and the number of cars was very much reduced below that required by the regular schedule.

A. S. KIBBE.

#### SELECTION OF ROLLING STOCK

No. 24. Have the semi-convertible cars given as good satisfaction for summer service as the open cars, and to what extent have double-truck cars replaced single-truck for strictly city service?

Semi-convertible cars give as good service, if not better, than open cars, particularly on account of freedom from accidents to passengers.

CHARLES K. STEARNS.

Yes, practically replaced.

JOHN J. STANLEY.

No semi-convertibles for us any more. We are replacing single with double trucks.

J. W. HICKS.

In the first place, this question is, until analyzed, difficult to answer. There is at the present time but one make of semi-convertible car—i. e., the car original in name and original in construction to the degree of providing interior length of seating arrangement transversely and aisle width equivalent to within 4 ins. of the overall width of the car body at belt rail, and at the same time providing for opening the entire window space between posts, rails and letter board. I appreciate that there are cars of many makes masquerading under the alias "Semi-Convertible," but if you investigate you will find in each and every instance a case of the old-timed, old-fashioned car of the drop sash variety and the "semi-convertible" feature is semi-convertible in name only.

Now, having described what I am writing about, I will proceed to the question. The "semi-convertible" car has in many instances given not only as great, but greater satisfaction than open cars; where this satisfaction is apparent is in cases where suburban runs are concerned, exclusive of excursion travel. Generally speaking, all suburban roads operate at a rate of speed at times from 20 to 30 m. p. h., and even more. Riding in a typical open car at any such speed, irrespective of the actual temperature, is highly uncomfortable, owing to the excessive breezes. Side running-board steps from the standpoint of accidents are an objection (some city railways even now going to the semi-convertible car on this account alone), even at the average rate of speed of city cars; they are infinitely more dangerous on high-speed suburban roads, and more seriously uncomfortable for egress and ingress where "stopping" of the roadway sometimes fixes the starting or landing point for a passenger several inches lower than the head of the rail.

I do not pretend to state that the semi-convertible car will entirely supplant the open car. In some cities, even without consideration of the accident portion of the proposition, open cars will forever be a factor; the average city populace will not accept the "large window, virtually an open car" gold brick, and may insist upon the open car to the point of becoming demonstrative. On the other hand, for excursion and park travel, I doubt the economy of hauling the crowds naturally assembling in the semi-convertible car when it can be so much more cheaply handled with the large seating capacity open car. My answer briefly is both "Yes" and "No" under the condition explained.

Double-truck cars have very largely replaced single-truck cars for city service—more largely, possibly, than many people imagine. I know positively of the product of one quite large car builder who ten years ago was turning out 90 per cent single-truck cars, and 10 per cent double-truck cars; for the last three years the average has been directly reversed to over 90 per cent double-truck cars and less than 10 per cent single-truck cars, and I have no reason to believe the situation is different with the output of cars by builders other than the one I have in mind. Within the past eighteen months two large systems in the East have "experimented" in going from double-truck cars back to single-truck cars under grade and power conditions a trifle more severe than anything I know of, and I am watching it carefully. Before the publication of the next question box there may be some interesting developments in this direction.

W. H. HEULINGS, JR.

Referring to semi-convertible cars—For high-speed suburban and long interurban roads, open cars with side steps would not be popular. The writer has built semi-convertible cars since 1880, of



various types and descriptions. He was instrumental in assisting Mr. Brownell in getting up the first type of semi-convertible cars and has had all opportunities to follow the semi-convertible cars since that time, and there is no doubt in his mind that the semi-convertible cars will increase in popularity, especially for long stretches and high-speed interurban service; and the simplest in construction that will neither disfigure nor interfere with the practical construction of the car will be the winner. This question in reality can better be answered by a railroad operator than by a car builder.

PETER M. KLING.

I have found that semi-convertible cars have given universal satisfaction to the public, to our employees and to our company, and I would prefer them, in this climate, to open cars. In summer they are as pleasant and airy as an open car, having the further advantage that if a sudden change of temperature or a storm occurs the car can be made into a closed car quickly. In winter they have been found to be warm and comfortable, and no difficulty whatever to heat them.

At all times you have a good broad aisle in the car, without reducing the width of your seats, and they are considerably lighter than a box car of the same length of body. On the Utica & Mohawk Valley Railway we have had them in use since the fall of 1901, and have found them so desirable that our orders for new cars, since the first ones were placed in operation, have been to duplicate our first orders.

C. LOOMIS ALLEN.

No. 25. Has any practical type of power brake been developed to take the place of air-brakes?

The Westinghouse traction brake is to our minds the most practical type of power brake developed to take the place of the air brake for electric equipment.

F. W. SARGENT.

From what I have seen lately, I am satisfied that there will be a hand brake exhibited at the convention that will be of great interest to railroad managers and operators. This brake has great advantages over the ordinary hand brake. It will apply the brake 100 per cent quicker than any other hand brake on the market, and will furnish 100 per cent more power in stopping the car.

PETER M. KLING.

If you believe the inventors—Yes. From experience—No.

J. W. HICKS.

Fair results from a rope drum brake developed by a local inventor.

JOHN J. STANLEY.

No. 26. What is the difference in current consumption of two and four-motor equipments?

Sixteen-ton four-motor equipment required 2.70 kw per car mile; ten-bench open car requires 1.67 kw per car mile. Both in city service.

ANONYMOUS.

Fifteen to 20 per cent more current for the same weight of car or load and same speed.

CHARLES K. STEARNS.

With the same weight of car body and trucks and same horsepower rating of motors, the current consumption will be approximately 10 per cent less for two motors than for four, owing to lower weight and higher efficiency of larger motors.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

No. 27. What is the best method of determining the life of motor parts?

By mileage record.

J. N. SHANNAHAN.

Generally from record of car-miles run.

JOHN J. STANLEY.

By numbering the parts and keeping a card record of the repairs on each car.

CHARLES K. STEARNS.

No. 28. What type of snow-plow has given the best satisfaction for city streets

McGuire.

JOHN J. STANLEY.

Side wing plow.

J. W. HICKS.

On streets having single track—the nose plow. On streets having double track—the shear plow. The plow that has proven best to me is the steel plow built by Smith & Wallace. The principle of the plow is to fight or buck the snow with the truck and not with the body. If there is any room to push the snow from the track this plow will do it. In this locality, in the winter last past, we had 142 days consecutive sleighing. We think we know something about snow and snow plows.

C. LOOMIS ALLEN.

No. 29. (a) Are electric heaters economical? (b) What other system is more efficient and convenient?

(a) Electric heaters have not proven economical with us. (b) Hot water heat is much more economical and efficient, though possibly not quite so convenient to operate.

J. N. SHANNAHAN.

(a) If by economical is meant the measure of actual cost of heating cars as compared with other methods of heating the same cars, electrical heaters are not economical. But when the other features of electric heating are taken into consideration, viz.: Absence of coal gas, ashes and dirt from the car; the saving in room

by using the electric heaters, and the ease with which the heat is cut off or turned on to the car; these are the features which more than counterbalance the actual increase in the cost of producing heat. (b) In my opinion there is no other system more efficient, when all things are considered, and none as convenient.

M. G. STARRETT.

(b) Hot water gives a more even temperature per car and probably at less cost.

C. LOOMIS ALLEN.

(a) No. (b) Hot water more efficient, but not so convenient as electric heaters.

CHARLES K. STEARNS.

(a) No. (b) None so convenient. Efficiency (?).

J. W. HICKS.

(a) No. (b) Stoves.

JOHN J. STANLEY.

No. 30. Have any experiments been made, or any one had experience with hot-water heaters, and if so, what has been the difference in expense between them and electric heaters?

Yes, the difference is very marked, and entirely in favor of hot water heat. (See answer to Question 29.)

J. N. SHANNAHAN.

Utica & Mohawk Valley Street Railway Company uses hot water heaters.

CHARLES K. STEARNS.

No. 31. Viewed from the standpoint of maintenance, which is preferable: the split or solid gears?

Solid gears.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

BLOCK-SIGNAL SYSTEM

No. 32. Which is more reliable: automatic signals or those manipulated by hand?

Automatic, properly installed and regularly inspected and maintained.

CHARLES K. STEARNS.

An automatic signal that sets "danger" when out of order is as reliable as hand. Otherwise hand signals.

J. W. HICKS.

I believe that signals operated by hand are the better kind. We have never had any experience with automatic signals, but have operated hand signals for several years and they have proven very satisfactory. I would prefer them to automatic signals, as the motorman is compelled to stop in order to operate the hand signal and depends solely upon himself for the proper operation of the same, and not upon the car, trolley or other mechanical device which may get out of order as is the case with automatic signals.

FRANK J. GERDON.

No. 33. Is there a satisfactory automatic block-signal system used that will take care of any number of cars passing through the same block?

A signal manufactured by Eureka Automatic Electric Signal Company, Lansford, Pa., claims to do so. It might be well to have a representative of that company answer the question.

W. H. POUCH.

Almost every record of "patents issued" which appears in the STREET RAILWAY JOURNAL contains one or more patents of block signals for electric railways. Hundreds of patents have been issued, and it is safe to say, from a standpoint of practical and economical railroading, 90 per cent of them are absolutely worthless. Almost without exception, electric railway signal companies have failed to receive sufficient encouragement to warrant any extensive or permanent organization. They come and go and are soon forgotten, simply because their signals fail to cover the absolutely essential requirements. A reliable counting device which protects a plurality of cars passing through a block together has been the worst stumbling block so far; another, is the circuit-maker or device for operating the controller when the cars enter or leave the block. These two, which are important features of "Eureka Signals" are proving highly satisfactory in service, and this is due entirely to a total lack of complications in either mechanical or electrical construction.

The circuit-maker has no mechanically operating parts, and the counting device in the controller is a ratchet-wheel which operates forward one notch for each car entering the block, and backward one notch for each car which leaves the block. The targets are conveniently placed so that the motorman always gets his signal in front of his car. Intermediate targets are also placed in each block. These intermediate targets are in series with the target which allows the car to enter the block. If, for any reason, a car enters the block against cars already in the block, the intermediate targets are set to danger, warning the motorman, even though he is half way through the block.

Points to be emphasized: Positive in operation. Reliable in all kinds of weather. Regular cars need signals only; extra cars can be sent out and called in without notice to other cars on line. Targets indicate direction cars are moving. Any number of cars can follow each other through a block. First car in sets "control target" at near end of block and "danger target" at distance end of block. Last car out sets the signals to "clear."

A great deal of time has been spent developing and improving "Eureka Signals," and to-day an installation can be furnished which



covers all requirements and is at the same time comparatively inexpensive.

EUREKA AUTOMATIC ELECTRIC SIGNAL COMPANY.

No. 34. Are telephonic train orders satisfactory?

We have used the telephone for ten years, and never have we had a case of misunderstanding the orders. In connection with a dupliograph would consider it perfectly reliable.

W. H. POUCH.

Yes. If triplicate records in the telephone booths are regularly kept and inspected by the dispatcher every day.

CHARLES K. STEARNS.  
J. W. HICKS.

They are to us.

In my opinion telephone train orders would not prove entirely satisfactory. It seems to me there would be great possibility for a misunderstanding of orders, especially during cold or stormy weather. In the event of trouble it would also be very difficult to get at the facts of the case, as there would simply be one man's word against another's

FRANK J. GERDON.

#### OPERATION.

##### ACCIDENT DEPARTMENT

No. 35. Where and when should derailing switches be used, excluding steam railroad crossings?

Derailing switches, besides being used at steam railway crossings at grade, should be used where practicable on any grade above 8 per cent where there is danger, should a car become unmanageable on the grade, of this car plunging down an embankment, colliding with a car on another line or running into buildings on the street. Care should be taken, however, that the derailing switch should be so constructed that the car, instead of being simply diverted from the main rail, should be carried up a sufficient grade in the opposite direction to check its momentum.

J. N. SHANNAHAN.

All railway crossings at grade should be protected by derailing switches; also such other points as local conditions may require.

FRANK J. GERDON.

In most cases, steam railroad crossings should be protected by derailing switches placed 75 ft. from the first rail of steam railroad track.

T. E. MITTEN.

No. 36. Give experience with accidents with derailing switches.

We have had no accidents at derailing switches, but at one time we had a narrow escape. At that time there was installed on the Haganan Line at the foot of an 8 per cent grade a derailing switch which was closed by the conductor when the car was descending the grade. During a sleet storm the rail was in a very bad condition, and the crew of the car ascending the grade, being aware of this fact, closed the derail and left it closed. The car descending the grade became unmanageable, due to some trouble with the brakes, and passed over the derail at a high rate of speed. If this derail had been open the car undoubtedly would have gone into one of the line poles and caused a serious accident. This derail at that time was not furnished with a track running up a grade in the reverse direction in order to stop the momentum of any car which would become unmanageable on the grade.

J. N. SHANNAHAN.

During the year ending June 30, 1904, we had forty-nine cases of cars leaving the track at the derailer. Of these forty-nine cases forty-four have resulted from the neglect of the employee to hold the derailer handle firmly until the car had passed the switch, three have been the result of the motorman forgetting the location of the same, and two the result of the conductor dropping the handle to avoid a possible collision with a steam train. The number of claims for personal injury caused by cars leaving the track at the derailing switch has been very small; in fact, there have been only two cases of personal injury from this cause during the period above mentioned. There has, however, been considerable damage done to the property of others, such as broken pavement or curbstone, a broken crossing gate or collision with vehicles from the sudden and unexpected derailment of the car. There is one objection, however, to the derailer that is of considerable moment, and that is the accident happening from passengers getting off the car as the same is about to start, during the absence of the conductor at the handle. On a closed vestibuled car it is physically impossible for the motorman to see whether the rear platform and steps are clear without getting off his car, and this is more especially true when the aisle is crowded or the front vestibule curtained at night. We have had several instances of passengers having been in the act of stepping from the rear platform to the lower step in alighting, entirely out of the line of vision of the motorman on the front end of the car or the conductor at the derailer handle, when the car started, and they were thrown to the ground. As far as the purpose for which the derailer was invented is concerned, it practically eliminates the possibility of a collision between an electric car and a steam train.

R. B. HAMILTON.

Very few accidents occur at derailing switches other than derailment of car.

T. E. MITTEN.

No. 37. Have you used the premium system with your employees for avoiding accidents; if so, what percentage have the accidents been reduced?

We have used the premium system with our employees; a slight decrease in accidents resulted.

T. E. MITTEN.

No. 38. Has not the practice of giving premiums to conductors and motormen for avoiding accidents made them careless in reporting slight accidents?

Under the system of giving premiums, trainmen are inclined to be careless in reporting accidents.

T. E. MITTEN.

No. 39. What is the best method of training employees to avoid accidents?

The best method of training employees to avoid accident is to take up each accident immediately after it has occurred and fix the responsibility definitely after careful investigation. Meetings of the men should be held and these things should be discussed, so that all will be fully conversant with the rules of operation and what is expected of a man who is in responsible charge of a car. Too much care cannot be used in the selection of employees and in their training and examination in the operating rules.

J. N. SHANNAHAN.

The best method of training employees to avoid accidents is careful supervision and the administering of punishment for the slightest infraction of the rules.

T. E. MITTEN.

#### CAR HOUSES

No. 40. What is the best design for a car house?

Pits all over and twice as large as service calls for.

ANONYMOUS.

Fireproof construction, concrete and steel, subdivided so as not to include more than 5000 sq. ft. of floor space.

JOHN J. STANLEY.

#### EMPLOYEES

No. 41. What has been the benefit, if any, of forming an association among employees?

The principal benefit in forming an association among the employees is that the officials and the men can come to know one another in a friendly and social way, and are thus enabled to take up a great many subjects in an informal way which are a benefit to all concerned. The employees who are banded together to advance the interests of the corporation for which they are working and to mutually protect themselves against sickness and accident take more interest in the welfare of the road than if they were simply working as individuals.

J. N. SHANNAHAN.

A good thing here.

J. W. HICKS.

(1) To assist members of an association in times of sickness and death in such a way that the afflicted will realize it is not charity, but a duty, that the association has to perform. (2) To promote good fellowship among the employees. (3) To throw in the way of members of the association a few periodicals that will show to them that there is a future ahead of them if they will but be ambitious and work.

C. LOOMIS ALLEN.

An association among employees tends to create a feeling of good fellowship and of loyalty to the company.

T. E. MITTEN.

No. 42. (a) Can associations of employees be made sufficiently attractive to take the place of union organizations? (b) Can a successful benefit fund be established by contributions from employees alone without assistance from the company? (c) If so, would not such a fund be more appreciated by the men than one on which they had received assistance? (d) Would not a written examination at the end of each year of all conductors and motormen employed during the year, somewhat in the nature of the competitive civil service examination, be the best method of determining seniority?

(a) An employees' association can be made more attractive than a trade union organization, for the reason that the policy of the association is dictated by men whom they know and are in daily touch with, rather than by outside influence which is foreign and unknown to them. (b and c) A successful benefit fund could doubtless be formed by contributions from the employees, but we believe in the company contributing, for the reason that the employees in this case realize that the company is as much interested in the success of the association as they are. (d) I do not think that seniority should be determined by the results of competitive civil examination, for the reason that long and faithful service, granting a man is competent, should be recognized in railroadings as well as in any other profession.

J. N. SHANNAHAN.

Associations of employees, we think, can be made sufficiently attractive to take the place of union organizations.

T. E. MITTEN.

(a) Not in a city so strongly union as Rochester. (b) We are doing it. (c) Doubtful. (d) The best motormen in many cases are unable to read or write.

J. W. HICKS.

No. 43. What is the best method of disciplining employees?

The Brown system, with such modifications as are necessitated by local conditions.

J. H. SHANNAHAN.

We believe in reprimands, and, in continued disobedience, dismissal.

J. W. HICKS.

Beg to advise that the best method for disciplining employees



is to have all work done systematically. Where there is no system there can be no discipline.

PETER M. KLING.

We have tried disciplining by letter, but find this method not so satisfactory as disciplining by the superintendent at his office, where men are called up on charges.

T. E. MITTEN.

No. 44. Give experience of the merit system in connection with discipline of employees.

Our experience with the merit system in connection with the discipline of employees has been very satisfactory.

J. N. SHANNAHAN.

No. 45. Does the merit system entail extra office expense, and to what extent has it helped discipline?

The merit system does not entail any extra office expense.

J. N. SHANNAHAN.

No. 46. Do all roads subject their intending employees to a physical examination?

All roads should subject their intending employees to a physical examination for the reason that the office which employs a man is not sure that he is physically able to perform his duties until a competent surgeon has certified to that effect.

J. N. SHANNAHAN.

We subject all intending employees to a physical examination.

T. E. MITTEN.

We do.

J. W. HICKS.

No. 47. What benefit or check has resulted in the securing of bonds from employees?

Many men fear bond companies attaching their homes.

J. W. HICKS.

No. 48. Should conductors furnish bonds, and if so, who should pay the premium?

The better system is compelling a moderate sized deposit—\$20 or less.

J. W. HICKS.

Only such conductors as have a large belt are required to furnish bonds, the premium being paid by the company.

T. E. MITTEN.

FARES ON INTERURBAN RAILWAYS

No. 49. What is the best method of collecting and accounting interurban fares?

All fares collected on interurban cars, and also those collected upon city cars, should be along those lines which afford expediency to the conductor and at the same time provide a separate accounting for each fare collected, thereby enabling the conductor to make settlement with the company upon the basis of fares collected and recorded. This can only be done by a register system that registers and indicates, separately, a multiplicity of fares.

JOHN F. OHMER.

We insist upon passengers buying tickets at agencies.

J. W. HICKS.

With this company the plan of ticketing one way or round trip and collection of cash fare for one way trip to passenger's destination has been found quite satisfactory. All tickets are recorded on fare registers. Conductor's trip sheets show denomination of tickets collected, and these are compiled by auditor on daily report, showing separately all denominations of tickets and cash fares collected, together with total revenue from each conductor.

T. E. MITTEN.

No. 50. Are there any data available to show the percentage of tickets used to tickets sold, and what is a fair per cent of shrinkage?

No data available. There being no inducement to purchase tickets in Buffalo, the number used is very small and for convenience of carrying only. Difference on some interurban lines of this company varies from 5 to 10 per cent, but tickets being valid indefinitely, this doesn't prove that they will not be presented at some future time.

T. E. MITTEN.

PARKS AND PLEASURE RESORTS

No. 51. Is it better to operate all attractions at parks or to induce outsiders to put them in on a percentage basis? Are any pleasure parks self-sustaining or can they be made so?

Pleasure parks adjacent to cities where attendance is good, numbering from 5000 people up daily, are more likely to support attractions operated by outside parties on a percentage than parks with smaller attendance. These attractions, being operated by experienced persons in that line of business, are more likely to be maintained economically than if managed by the railway company, as the latter would have to pay high salaries to experienced attendants. The average pleasure park with a daily attendance of 5000 or over should be easily made self-sustaining.

T. E. MITTEN.

No. 52. What is the most effective method of advertising, for the least expense?

Exchange transportation for news matter in papers.

J. W. HICKS.

The most effective method of advertising is the most expensive, as the quality of advertising is usually measured by the cost. News

paper advertising by insertion of display ads of one-quarter to one-eighth page and accompanied by reading notices in the same publication are usually of the greatest benefit. Billboard advertising with large spaces liberally distributed is also of much benefit, and advertising in car windows where practicable is another good means of reaching the public.

T. E. MITTEN.

REPAIR SHOPS

No. 53. What is the proper test to give equipment before leaving the shop for service?

Assuming the fields and armatures to have been properly tested before equipment is mounted, a test should be made to ascertain if motors have been properly connected, and car given a trial run, to test brakes, etc. When the facilities are at hand it is desirable to take temperature of motors and readings of voltage and current consumption during the experimental trips.

J. N. SHANNAHAN.

High voltage, then regular running test.

JOHN J. STANLEY.

Straight air brake equipment may be tested before leaving the shop in the following manner: When all the piping has been fully completed, pump up the maximum pressure in the reservoir, leaving the operating valve handles at the release position. The cocks in the reservoir pipe at the operating valves and governor should then be closed and the pipe disconnected at these points. The reservoir pipe should then be thoroughly blown out by opening these cocks, the piping having been previously sprung to one side to give free exit to the air. It is well to exhaust a full tank of air through each one of these cocks. These joints should then be reconnected and the above cocks opened, while the pipe leading to the brake cylinder should be disconnected at the union placed near the cylinder. With both operating valve handles in release position, full pressure should be pumped up in the reservoir and discharged through the disconnected union by applying the brake in full emergency at both operating valves simultaneously. If only one valve were open at a time foreign matter might readily blow past the orifice of the branch leading to the brake cylinder and consequently not be discharged from the pipe. Having blown out the piping in this manner, full pressure should be pumped up throughout the system and every joint tested by painting it with soapsuds. When all leaks have been stopped, the piping should be securely clamped to the car to avoid vibration. In testing the brake equipment on trains by means of air plants or with a motor car, the following method is recommended: After the hose couplings are all united and the angle cocks have all been opened the air should be turned into the train pipe. When ample time has elapsed to insure a sufficient train pipe pressure the train should be examined and all leaks stopped. After this the brakes should be applied, piston travel adjusted where necessary, and any defective brakes repaired or carded according to the rules of the road. In making car and shop tests of automatic brakes it is advisable whenever possible to have a motorman's brake valve with which to apply and release the brakes. In every case the levers and pins which go to make up the foundation brake rigging should be carefully inspected. Piston travel should invariably be adjusted before the car leaves the car house.

JOS. R. ELLICOTT.

No. 54. What is the best method of keeping shop record of cost of maintenance: bodies, trucks and motor?

Individual record of bodies, trucks and motors

J. N. SHANNAHAN.

Card index.

JOHN J. STANLEY.

No. 55. Considerable trouble has been experienced with broken car axles from crystallization, especially during cold weather. The axles break either at the end of the key way or at the shoulder next to the journal bearing. We would like to know the cause; also, if salt water getting in to a small check will cause it to spread or deepen? From the appearances of some of the breaks, those are the indications. Also would like to know which grade of steel is considered best for car axles?

No. 56. Which is productive of the best results—pit work or overhauling from above?

Overhauling from above.

J. N. SHANNAHAN.

Use pit work only.

JOHN J. STANLEY.

I have found that overhauling from above gives better results. Defects in trucks, body and motors are more readily discerned.

C. LOOMIS ALLEN.

No. 57. Is it best to overhaul equipment by mileage?

Unquestionably.

J. N. SHANNAHAN.

No.

JOHN J. STANLEY.

SNOW REMOVAL.

No. 58. What amount of snow can the city authorities demand removed?

They can demand all removed, but how much they get is another question.

J. W. HICKS.

Depends on the ordinance and franchise.

T. E. MITTEN.



No. 59. What is the best form of organization of snow fighting forces?

You cannot rely upon organization where snowstorms come up quickly. Then it is a case of up and at it with the first men you can find.

J. W. HICKS.

Switch cleaners and shovelers in large systems come under Way and Structures Department; snow plows under Operating Department. Switch cleaning work should be divided in sections, each in charge of a foreman who will require no orders for getting out other than the condition of weather.

T. E. MITTEN.

#### TRAFFIC DEVELOPMENT

No. 60. Has it proven beneficial in moderate sized cities to largely increase the number of cars during rush hours over the ordinary times of day?

No; unless it rains or storms.

J. W. HICKS.

No. 61. What has been found to be the best method of advertising to develop traffic?

This question is answered in No. 52.

T. E. MITTEN.

No. 62. What has been the experience with the use of trailers as regards accidents, and have they proven more satisfactory than the use of larger cars with no trailers?

We are compelled to put three men on a train—two on a large car.

J. W. HICKS.

The use of trailer cars on surface roads inside of cities will certainly increase accidents. I have seen this demonstrated on both cable and electric roads.

PETER M. KLING.

Trailers, in our opinion, have decreased the number of accidents. They have proven more satisfactory than the use of large cars with no trailers.

T. E. MITTEN.

No. 63. Does not the use of trailers increase the number of derailments?

Not if heavy truck is used under trailers.

J. W. HICKS.

Trailers certainly add to the increase of derailments.

PETER M. KLING.

We cannot see that the use of trailers has in any way increased the number of derailments.

T. E. MITTEN.

No. 64. Should the extra list be a revolving one (i. e., after an extra has had work, should he go to the bottom of the list and work up again)?

The extra list should be a revolving one on all roads which carry more than fifteen extra men on each end; otherwise the extra men at the bottom of the list get so little work that it will be very difficult to induce a competent man to stay in the employ of the company.

J. N. SHANNAHAN.

The extra list should be a revolving one. After an extra has had work he should go to the bottom of the list and work up again.

T. E. MITTEN.

#### WHEELS—CHILLED IRON, STEEL-TIRED, FUSED WHEELS AND SOLID

No. 65. Would not the trouble, which was experienced by many roads during the past winter, of motors dragging on the ice, be eliminated by the use of 36-in. wheels?

I think so. It seems to me that with the large motor equipments now being used it will become necessary to increase the diameter of wheel to get proper clearance at bottom of motor. We experienced considerable trouble during the past winter with snow and ice, and also some trouble with pavement in city streets heaving badly, allowing motors to drag. This trouble could be largely eliminated by the use of a 36-inch wheel.

J. N. SHANNAHAN.

I am personally much opposed to 36-inch wheels. I believe today that strong efforts should be made to induce the manufacturers of motors to make a motor that will operate on a 30-inch diameter wheel. This would be a great convenience to the public, and would help the railroad to reduce accidents, and would facilitate passengers in getting in and out of cars.

PETER M. KLING.

Certainly. But that means a double step.

J. W. HICKS.

No. 66. What are the relative merits of steel and cast-iron wheels?

The steel tired wheels, with flanges and treads now in use, are probably safer, but the cast iron wheels are cheaper.

J. N. SHANNAHAN.

No. 67. (a) How does the life of cast-iron wheels compare with steel-tired, fused and solid-steel wheels? (b) Is not the cost of maintenance per mile in favor of the cast-iron wheel?

(a) Very favorably. (b) We have not had the steel-tired wheels in use long enough to give the exact figures, but the indications are that the cost per mile will be in favor of the cast iron wheel.

J. N. SHANNAHAN.

No. 68. Is not a 550-lb. double-plate cast-iron wheel as safe to run under our modern interurban cars as the steel-tired wheels now being used?

Do not think so, unless the special work will permit of the use of an M. C. B. wheel-tread and flange.

J. N. SHANNAHAN.

No. 69. What is the principal cause of wheels being flattened on air-brake interurban cars?

Untrained motormen.

J. N. SHANNAHAN.

Applying brakes with leaves or grass on track causing skidding.

J. W. HICKS.

The cause of wheels being flattened on air brake cars is undoubtedly due to the fact that the brakes are not released soon enough to prevent locking of the wheels, as wheels cannot be flattened unless they slide.

F. W. SARGENT.

We believe that the principal cause of flat wheels on air brake cars in interurban service is a braking pressure that is too great for the average condition of the rail surface. It is a well recognized fact that cars equipped with four motors can be braked up to considerably over 100 per cent of the light weight of the car, including trucks and motors, provided the rails are in good condition and sand is freely used; when, however, the rails are in a slippery condition a much lower pressure is sufficient to cause skidding of the wheels. The proper pressure to use depending so largely on the condition of the rail resolves the whole matter to the question of good judgment on the part of the motorman. Many wheels are damaged by improper use of the air pressure by the motorman. For example, it is a common thing in making a stop to let about 5 pounds of air into the cylinder, increasing it at frequent intervals by 5 pounds additional at each interval until when the car comes to a standstill there is a large pressure in the cylinder. This is exactly the wrong way in which to use the brake pressure. As the speed decreases, the cylinder pressure necessary to obtain a suitable braking power becomes less.

JOS. R. ELLICOTT.

Ease and speed of application of brakes, speed and weight of cars.

A. S. KIBBE.

The principal cause, in my opinion, is a too vigorous application of the air by inexperienced or careless motormen.

FRANK J. GERDON.

No. 70. What are the causes, all of them, of flat wheels?

Sliding, worn through chill, shelled out spots, and from mechanical causes, such as bolt or nut getting in gears, etc.

J. N. SHANNAHAN.

Some of the causes of flat wheels are: Defects in casting; tread shelling out in spots; binding of brake rigging on curves, which often cause the idle or trailer wheels to slide; brake rigging of improper design, which brings too much force to bear on the brakes; a brake rigging without equalizing levers, in which case the pressure is unequally divided owing to certain wheels wearing faster than others.

JOS. R. ELLICOTT.

This question is answered by the word "sliding," which is the sole cause of flat wheels. The cause of sliding has a multitude of answers, but the principal one is answered in the same manner as question 69. The chilled wheel may not be flattened by sliding, but it may be burned by being highly heated by the brakes being applied just inside the point of sliding, so that the thread is burned and begins to shell out, and then this shelling out soon develops a flat spot and condemns the wheel. It may be that there is a slight slide due to the brakes not being released quickly enough, which does not make the wheel flat enough to pound, but yet has burned it clear through the chill. Subsequent grinding may remove the flat spot, but it will not restore the original texture of the chilled metal, and the soft spot remains to be flattened again at the first opportunity, or to be pounded out and form a shelled out spot, which in time gives the flat spot. The remedy for flat wheels is not to slide them, for a rolling wheel will not get flat unless highly heated to the danger point.

The use of the very soft and high-holding brake-shoe or a brake-shoe which clings to the wheel when highly heated may be the cause of wheel sliding, inasmuch as such a shoe may not release as quickly as a harder shoe. Slow speeds and slow pressures do not require the excessive braking effort for the train control that high speeds and heavy loads necessitate, and the condition does not exist with low speeds and loads, therefore, for the highest brake-shoe friction with the modern braking facilities. It has been demonstrated at high speeds and heavy pressures where the rate of heat generation by the brake-shoe is very rapid and extreme, that the harder and more durable brake-shoe stops the car as readily as the softer and less durable shoe, and the harder shoe is, for such traffic, to be preferred, because of the danger from wheels sliding.

F. W. SARGENT.

The principal cause is due to the brakes being applied too vigorously so as to lock or skid the wheels, then sanding the rail and allowing the wheels to slide over the rail that has been sanded. I know of no other way by which the wheel could be flattened except by sliding the same.

FRANK J. GERDON.

No. 71. What weight and model of chilled car wheels, 33 ins. in diameter, are proper and safe for an 8-ton single-truck electric car for city service, and the probable life of the same?

Four hundred and twenty pound spoke wheel. Life of wheel will depend largely on the condition of track; probably from 35,000 to 30,000 miles.

J. N. SHANNAHAN.



## NOTES ON THE EXHIBITS AND EXHIBITORS

The Eureka Automatic Signal Company, of Lansford, Pa., had an elaborate exhibit at the convention. This company's signal system was set up to illustrate a complete block. Current was supplied by the Utica Electric Light & Power Company. All phases of the system were shown in actual operation, and delegates to the convention examined carefully its manipulation and operation by those in charge of the exhibit. To further demonstrate its operation under actual service conditions a complete block of the Eureka Automatic Signals were installed between Walker Station and Oriskany. A delegation of railroad men was taken over the line and shown the actual working of the system. The company was represented by John Early, Jr., Walter Drumheller and Edward Hammett, Jr.

The J. G. Brill Company, of Philadelphia, was represented by Geo. M. Haskell.

The Security Register Company, of St. Louis, exhibited types of its fare-recording register. An interesting feature of this exhibit was a register taken apart so that each part could be examined by itself, showing its mechanical strength, shape and workmanship. The company was represented by its president, Giles S. Allison; R. C. Hallett and Daniel J. Fitch.

The Shanahan Trolley Specialty Company, of Little Falls, N. Y., had an exhibit of its controller in actual operation on the veranda of the clubhouse in which the convention was held. The company was represented by E. S. Van Valkenberg, B. F. Shanahan and R. J. Snyder.

Elmer P. Morris, of New York, was represented by E. D. Hinman.

The American Brake-Shoe & Foundry Company, of New York, was represented by H. S. Bradfield.

The Utica Fire Alarm & Telephone Company was represented in the person of A. F. Balfeild.

C. W. Garhart took care of the interests of the Crocker-Wheeler Company, of Ampere, N. J., at the convention.

The Carnegie Steel Company, of Pittsburg, was represented at the convention by Frederick C. Brunke.

W. N. Mathews was himself present to represent W. N. Mathews & Bros., of St. Louis, Mo.

The Western Electric Company's interests were ably and hospitably taken care of by R. M. Campbell, the manager of the railway department in New York, and F. D. Killson.

Geo. F. Brandau, of Utica, N. Y., had a car equipped with his emergency brake, which was shown to many of the delegates to the convention.

Daniel M. Brady and C. P. King attended the convention in the interests of the Brady Brass Company, of New York.

The Jewett Car Company, of Newark, Ohio, was represented by A. H. Sisson.

The National Brake Company, of Buffalo, N. Y., had as representatives W. D. Brewster and E. B. Stone.

The Electric Storage Company, of Philadelphia, Pa., was represented by Albert Taylor.

The Taylor Electric Truck Company, of Troy, N. Y., was present in the person of its president, John Taylor.

The H. W. Johns-Manville Company, of New York, was represented by F. R. Austin.

The Owego Bridge Company, of Owego, N. Y., was represented by M. W. Denman.

The Continuous Rail Joint Company had a neat and well-arranged exhibit of its various types of rail joints. The company was represented by B. M. Barr, W. A. Chapman and W. J. Bradley.

The American Electrical Works, of Phillipsdale, R. I., was represented by its New York sales agent, W. J. Watson.

The Pittsburg Reduction Company, of Pittsburg, Pa., was represented by B. M. Polley and Wm. Hooper.

The Ham Sand Box Company, of Troy, N. Y., was represented by A. W. Ham, its president.

Mayer & Englund Company, of Philadelphia, Pa., was represented by John McSorley.

R. C. Norton represented Roberts & Norton, of Utica, N. Y.

The Solvay Process Company, of Syracuse, N. Y., was represented by H. W. Sykes and W. E. Hopton.

The Archbold-Brady Company, of Syracuse, N. Y., was present in the person of Wm. K. Archbold.

The Stromberg-Carlson Telephone Company, of Rochester, N. Y., was represented by Eugene L. Brown.

The Ohmer Fare Register Company, of Dayton, Ohio, was represented by J. H. Stedman, of Rochester, N. Y., and C. W. Kettelman, of Dayton, Ohio.

The Crouse-Hinds Company, of Syracuse, N. Y., had a very complete exhibit of the various specialties manufactured by this company for street railway service. The company was represented

by A. F. Hills, Frank Buchanan and its president, H. B. Crouse.

The Westinghouse Traction Brake Company was represented by J. R. Ellicott, G. E. Baker and F. V. Green.

The interests of the Peckham Manufacturing Company were well attended to by Wm. Wampler and J. M. Hoadley.

The Safety Insulated Wire Company was represented by A. P. Eckert.

The National Electric Company, of Milwaukee, Wis., exhibited its Christensen air brake and some fine photographs of its motors, generators and air compressors. J. T. Cunningham, H. N. Ransom and Robert Long were present in the interest of the company.

The Railway Steel Spring Company, of New York, had an interesting exhibit of four full-size steel-tired wheels pressed on the axle and ready for service. The company was represented by Alexander S. Hurd and Frederick C. McLewee.

The Bossert Electric Construction Company was represented by F. B. Chapman.

The American Automatic Switch Company was represented by H. N. Powers.

The Garton-Danics Company, of Keokuk, Ia., had on exhibition various types of its lightning arresters.

The Consolidated Car Heating Company, of Albany, N. Y., had one of the largest and most complete exhibits at the convention. All types of electric heaters manufactured by this company were on exhibition and carefully examined by most of the delegates present. The company was represented by C. S. Hawley and S. B. Keys.

The Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y., was represented by its popular vice-president, W. R. Kerschner, of Allentown, Pa. Mr. Kerschner also looked after his many other interests in the street railway field.

The Downward Light Electric Company, of New York, was represented by George S. Jenkins.

C. F. Davey was present to show his new trolley retriever.

The O. J. Childs Company, of Utica, N. Y., was represented by Jos. H. Corbett.

The Barbour-Stockwell Company, of Cambridgeport, Mass., was well represented by Wm. W. Field.

The Federal Manufacturing Company, of Elyria, Ohio, was represented by C. B. Tewkesbury.

The O. M. Edwards Company, of Syracuse, N. Y., had an exhibit of its window fixtures and vestibule trap-doors. O. M. Edwards and J. E. Simons were in attendance.

A. E. Cortis & Company (Inc.), New York, was represented by W. J. Howey.

The Chase-Shawmut Company, of Newburyport, Mass., was represented at the convention by F. D. Masterson.

The Hildreth Varnish Company was represented by Charles C. Castle and F. T. Savage.

E. J. Lawless, of the John Stephenson Company, of Elizabeth, N. J., liberally entertained the many customers and friends of this company present at the convention.

The Stearn-Ado Company, of Cleveland, Ohio, was represented by M. Rohrheimer.

The Lorain Steel Company's interests were well taken care of by Major H. C. Evans, of New York.

The Scranton Bolt & Nut Company, of Scranton, Pa., was represented by F. B. Butler.

D. W. Phelan, the well-known New York pole and tie dealer, ably took care of his friends and customers at the convention. He was also represented by H. H. Mills.

The McGuire-Cummings Manufacturing Company, of Chicago, was represented by B. F. Stewart.

The New York Leather Belting Company had an exhibit of its leather belting and leather register and bell cords. The company was represented by F. F. Despard and N. H. Glatt.

The Home Rubber Company, of Trenton, N. J., was represented by J. C. Berranz.

The Sterling-Meaker Company, of Newark, N. J., was represented by its president, J. A. Stowe, C. E. Gierding and George E. Willis. An extensive and complete line of the products manufactured by this company was on exhibition, viz.: The Sterling brake, the momentum brake, safety fender, five types of registers, register fittings, etc.

The Franklin Railway Supply Company, of Franklin, Pa., was represented by K. S. Hequembourg.

The Erie Trolley Wheel Company, of Erie, Pa., was represented by A. B. Halleck.

C. S. Knowles Company, of Boston, Mass., was represented by C. H. Clark.

The Sherwin-Williams Company, of Cleveland, Ohio, was represented by F. A. Elmquist.

The Heywood Brothers & Wakefield Company was represented at the convention by its popular New York railway department manager, Bertram Berry.



Charles I. Earll, of New York, exhibited his trolley retriever in actual operation. The railway public seemed very much interested in its absolute reliability and manifested its interest in watching its operation.

The Ohio Brass Company had an extensive exhibit of its overhead materials, rail bonds and various other products manufactured by this company. N. M. Garland, New York sales agent, and F. H. Jameson were present at the convention.

The National Car Wheel Company was represented by its New York sales agent, E. H. Chapin.

The Frank Ridlon Company, of Boston, Mass., was represented by Charles N. Wood and Robert Mathias.

The Gold Car Heating & Lighting Company, of New York, was represented by A. E. Robbins.

The R. D. Nuttall Company, of Pittsburg, was represented by its well-known president, F. A. Estep.

The Pantasote Company, of New York, was represented by John M. High.

The Dayton Manufacturing Company, Dayton, Ohio, was represented by Joseph Leidenger.

The George S. Hastings Company, of Cleveland, Ohio, was represented by George S. Hastings.

The Curtain Supply Company, of Chicago, had an exhibit of its curtain fixtures. The company was well represented by L. W. Whipple.

The Wheel Truing Brake-Shoe Company had an exhibit of its brake-shoes. J. M. Griffin was present.

The Yale & Towne Manufacturing Company, New York, was represented by William Hazelton.

The Duff Manufacturing Company, of Allegheny, Pa., had an exhibit of the "Jack that Duff built." It was represented by George A. Edgins and Charles A. Foster.

The Consumers' Rubber Company, of Cleveland, Ohio, was represented by F. W. Hitchings.

The Recording Fare Register Company had a complete exhibit of its fare registers and accessory trolley supplies. The company was represented by M. De Forest Yates, president, and Frank B. Kennedy, secretary.

The Ludlow Supply Company, of Cleveland, Ohio, was represented by W. E. Ludlow, president, and J. R. Grant. A complete motor-driven track drill was shown in actual operation.

The Nichols-Lintern Company, of Cleveland, Ohio, was represented by William Lintern, president of the company.

The Van Dorn & Dutton, and the Van Dorn-Elliott Electric Company, of Cleveland, Ohio, had a complete exhibit of its gears and pinions, armature and field coils and commutators. The representative present was J. N. Elliott.

The American Iron & Steel Manufacturing Company, of Lebanon, Pa., had a complete exhibit of its products. It was represented by Thomas S. Brenholtz.

The Lehigh Car Wheel & Axle Works, Catasauqua, Pa., was represented by B. F. Swartz.

The Atlas Railway Supply Company, of Chicago, Ill., had an exhibit of its rail joint. It was represented by C. D. Porterfield.

The Pennsylvania Steel Company, of Steelton, Pa., was represented by William M. Henderson and John C. Jay, Jr.

The Hale & Kilburn Manufacturing Company, Philadelphia, had an exhibit of its car seats. It was represented by S. A. Walker.

The Anti-Friction Handle Company, of Amsterdam, N. Y., was represented by A. O. Lindsay.

The General Electric Company had on exhibition its new a. c. motor, referred to elsewhere, and which attracted wide attention. Among those present in the interest of the company were: H. G. Grier, H. H. Crowell, G. deB. Green, W. Gibson Carey, J. S. Pevear, J. C. Calisch, J. J. Mahoney, C. E. Eveleth, H. D. Hawks and E. R. Scott.

S. C. Schenck, L. W. Hershey, Frank B. Erwin, W. E. Parker and George W. Pulver were present in the interests of the Westinghouse Electric & Manufacturing Company, of Pittsburg. The Westinghouse Traction Brake Company was also represented separately, as mentioned above.

The Galena Signal Oil Company, of Franklin, Pa., was represented by A. F. Miller and W. H. Pape.

Frank W. Edmunds represented the interests of the Dressel Railway Lamp Works, of New York.

The Lumen Bearing Company, of Buffalo, N. Y., was present in the person of E. P. Sharp.

The New York Car Wheel Company, of Buffalo, N. Y., was represented by C. L. Jackson.

The Standard Underground Cable Company, of Pittsburg, was represented by H. P. Kimball, of the New York office.

The Taylor Iron & Steel Company, of High Bridge, N. J., was represented by Knox Taylor, whose text was "Steel-Tired Wheels."

Alvin S. King was present for the Sterling Varnish Company, of Pittsburg.

The interests of the Weber Railway Joint Manufacturing Company, of New York, were ably cared for by James C. Barr.

## POSSIBLE ENLARGEMENT OF THE AMERICAN RAILWAY MECHANICAL & ELECTRICAL ASSOCIATION

Secretary Mower, of the American Railway Mechanical & Electrical Association, has issued a circular notice to members of the association in regard to the proposed enlargement of the association. The circular, which is dated Sept. 10, reads as follows:

During the past year, an effort has been made by the superintendents of the way department to organize an association of their own on lines similar to ours. As yet, however, no definite action has been taken by them.

The suggestion has also been made that, in view of the close relation existing between their department and those which we represent, our association ought to be extended to include that branch of the service.

This idea has been carefully considered by the executive committee for several months, and it is our judgment that if the superintendents of the way department prefer to combine with us, rather than to form a separate organization, action should be taken by our association at this year's convention.

In order, therefore, that the matter may be brought to a vote at our next regular meeting, notice is hereby given, thirty days in advance, of the following proposed amendments to our constitution and by-laws, which may be necessary in case the question is decided in the affirmative.

### PRESENT READING

Name—Article I. The name of this association shall be "The American Railway Mechanical and Electrical Association," and its office shall be at the place where the secretary resides.

### POSSIBLE CHANGES

Name—Article I. The name of this association shall be ..... and its office shall be at the place where the secretary resides.

(To be so changed as to include the way department. Suggestions will be welcomed.)

### PRESENT READING

Members—Article III., Section 1.

The heads of mechanical and electrical departments of railway companies may be elected active members, and shall be entitled to one vote each, and all privileges of the association.

### POSSIBLE CHANGES

The heads of mechanical, electrical and way departments of railway companies may be elected active members, and shall be entitled to one vote each, and all privileges of the association.

### PRESENT READING

Members—Article III., Section 3.

Employees of mechanical and electrical departments, not eligible as active members, may become eligible to junior membership upon the written recommendation of at least one member, and shall be entitled to all privileges except that of voting.

### POSSIBLE CHANGES

Members—Article III., Section 3.

Employees of mechanical, electrical and way departments, not eligible as active members, may become eligible to junior membership upon the written recommendation of at least one member, and shall be entitled to all privileges except that of voting.

Article II. of the by-laws may also be changed to provide that a certain number of the executive committee be way men; also Article VII. regarding the arrangement for meetings.

The first electric cars ever built entirely in the city of San Diego are nearing completion at the car houses of the San Diego Electric Railway Company, at the foot of E Street. Three of them will soon be ready to take their places on the various city lines. General Manager Clayton has had a number of the old cars rebuilt since he came here, has lengthened a number of the old Fourth Street electric cars, and remade several of the old cable cars into the handsome double-enders now in service on some of the lines. All of the rebuilt cars have double trucks. Mr. Clayton stated recently that the company has all the single-truck cars that it would ever have use for, meaning that as soon as the traffic warranted it large double-truck cars will be put into service and the smaller cars reserved for emergency use. The three new cars will be supplied with double trucks and double ends, with side seats on the outside capable of carrying twenty passengers.



## FINANCIAL INTELLIGENCE

WALL STREET, Sept. 14, 1904.

**The Money Market**

The money market this week reflected to some extent the continued heavy losses in cash sustained by the local banks, which, for the two weeks ending last Saturday, amounted to over \$15,000,000, while the surplus reserve has been reduced by nearly \$19,000,000 within the same period. Naturally, rates for all maturities have hardened perceptibly, especially in the time loan department, where the asking rates rule full  $\frac{1}{4}$  per cent above those prevailing at the close of a week ago. Sixty-day contracts which were in abundant supply last week at  $2\frac{1}{2}$  per cent, now command  $2\frac{3}{4}$  per cent, while ninety-day funds are in fair demand at 3 per cent. Over-the-year maturities are also in better request at  $3\frac{1}{2}$  per cent, but the banks and trust companies are not inclined to put out their funds for fixed periods at less than  $3\frac{3}{4}$  per cent. The supply of money at the latter figure is very moderate. Some of the larger lenders refuse to do business at the current rates, there being a disposition on their part to hold off for better returns, which are expected to prevail in the near future. The opinion is held in certain quarters that the season's shipments of currency to the interior will be larger than those of last year, despite the statements of large supplies of cash at Western and Southern points. Call money was again in abundant supply at last week's close. At the opening, transactions were reported at  $\frac{7}{8}$  per cent, but on Monday the price was advanced to  $1\frac{1}{2}$  per cent. Only a few small loans were made at that figure, and subsequently there was a decline to 1 per cent, which was the average rate for the week. Commercial paper shows no appreciable change. Specialists report a further falling off in the supply of prime material, but the demand continues good, and all offerings are readily taken. Rates are unchanged at 4 per cent as the minimum for the choicest grades. The sterling exchange market displays a decidedly easier tendency, prime demand bills sustaining a further loss of 25 points to \$4.8690. The receipts of cotton bills are considerably larger than a week ago, and indications point to a more liberal supply in the near future.

The statement of the Associated Banks, published last Saturday, showed an increase in loan of \$13,243,600 to \$1,130,486,200, a new high record, while deposits increased \$4,625,400 to \$1,221,700,400, also a new high record. The cash item showed a loss of \$7,908,800, while the surplus reserve decreased \$9,065,150. The surplus is now \$38,438,250, compared with \$15,372,200 in 1903, \$715,075 in 1902, \$7,110,550 in 1901, and \$20,836,175 in 1900.

**The Stock Market**

Increased activity developed in the securities market this week, the total transactions on several occasions being the largest for the year. The dealings, however, were attended by considerable irregularity, induced by heavy profit-taking sales. At the opening the general tendency of prices was toward a higher level, but later the market was subjected to heavy selling, directed principally against St. Paul and Union Pacific. The selling of these issues by Western houses was the signal for a general profit-taking movement, but all stock offered found a ready market on the way down. On Thursday and Friday the market grew decidedly stronger, and on Saturday prices for many issues reached the previous high records for the year, despite the unfavorable bank statement, which showed a further decrease in the surplus reserve of over \$9,000,000. At the beginning of the present week prices broke sharply on the poor showing made by the Government crop report, especially as to spring wheat. The selling at first was directed against the granger stocks, but subsequently the movement became general and proved to be the severest check the bull forces have had to contend with in several weeks. At the close the market was decidedly confused, but in certain parts attempts to cover stock were clearly discernible.

Notwithstanding the severe reaction in the general list, the local traction issues showed relative strength. Manhattan Elevated moved up  $1\frac{3}{8}$ , while Metropolitan Street Railway and Third Avenue rose  $2\frac{1}{8}$  and 1, respectively. Metropolitan Securities were conspicuously weak, the price sustaining a net loss of  $6\frac{5}{8}$  points. There was the usual crop rumors affecting the property, none of which could be confirmed. Brooklyn Rapid Transit was firm.

**Philadelphia**

Dealings in the Philadelphia traction issues were considerably more active, and prices generally ruled well above the previous week's final figures. Philadelphia Rapid Transit was the overshadowing feature, both as regards activity and strength, the trading being stimulated by the announcement that the entire holdings of the William L. Elkins estate, amounting to 35,000 shares, had been sold to a New York and Philadelphia syndicate. It was also stated that the stock will soon be listed upon the New York Stock Exchange, the preliminary steps having already been taken. Opening  $14\frac{7}{8}$ , a slight advance over the previous closing, the price advanced steadily to 18, an extreme gain of  $3\frac{1}{4}$  points, but subsequently it reacted to  $17\frac{3}{8}$  on profit-taking sales. In all, close on to 30,000 shares were dealt in. United Traction continued the upward movement, about 2000 shares changing hands at from  $55\frac{7}{8}$  up to  $56\frac{3}{4}$  and back to  $56\frac{1}{2}$ , which was the closing price. Philadelphia Traction sold at  $99\frac{1}{4}$  to  $99\frac{3}{4}$  for moderate amounts, and closed the week with sales at  $97\frac{3}{4}$  ex-dividend. Fairmount Park Transportation declined from 17 to 16 on the exchange of a few hundred shares. Consolidated Traction of New Jersey was fairly active and steady, upward of 600 shares being transferred at 72 and  $71\frac{3}{4}$ , a loss of  $\frac{1}{4}$ . Philadelphia Electric was active, about 20,000 shares changing owners at from  $65\frac{7}{8}$  up to  $7\frac{3}{8}$ , from which it reacted to 73-16, a net gain for the week of about  $\frac{1}{2}$  point.

**Chicago**

The principal feature of the Chicago market was the extreme dullness prevailing in the traction stocks. Chicago Union Traction issues, which were active and strong last week at 8 and 41 respectively, for the common and preferred, were entirely neglected this week. Chicago City Railway was very quiet, about 300 shares changing owners at 190, an advance of  $3\frac{1}{2}$  points. West Chicago moved up from  $55\frac{1}{4}$  to  $56\frac{1}{2}$  on the exchange of 470 shares, an advance of  $1\frac{1}{2}$  points, and 20,000 of the 5s brought  $96\frac{1}{2}$ . South Side Elevated was firm at 92, 125 shares selling at that figure. Metropolitan Elevated advanced to  $23\frac{3}{4}$ , but later it ran off to  $23\frac{1}{4}$ . The preferred sold at 60 in the early dealings, but subsequently there was a reaction of  $\frac{1}{2}$  point. Chicago & Oak Park Elevated common sold at 6 and  $6\frac{1}{4}$ , while small lots of the preferred changed owners at 25 and 23.

**Other Traction Securities**

Interest in the Boston traction centered largely in Massachusetts Electric issues, both of which sustained further substantial losses. The common opened the week with sales of 185 shares at 13, but later the price ran off  $1\frac{3}{4}$ , recovering at the close to  $11\frac{3}{4}$ . The preferred opened at 60, and advanced to 61, but later in the week there was a decline to 58, with a final rally to  $58\frac{1}{2}$ . It is said that the earnings of the system for the month of August increased \$30,000, as compared with the corresponding month last year and that the net earnings for the year ending Sept. 30 will be about  $2\frac{1}{2}$  on the preferred stock as against 2 per cent paid in dividends. Boston Elevated was quiet, but strong, the price ranging from  $152\frac{3}{4}$  to 154, and closing at the highest. West End opened strong at  $92\frac{3}{4}$ , but toward the close it eased off to  $91\frac{7}{8}$ . A small lot of the preferred brought  $111\frac{1}{2}$ . The feature of the Baltimore trading was the break of  $2\frac{1}{8}$  in United Railway incomes from 46 to  $43\frac{7}{8}$ , with a subsequent rally to  $44\frac{1}{8}$ . The 4s were fairly active and strong, prices ranging from 90 to  $90\frac{1}{2}$ , and closing at the latter figure. Lexington Street Railway 5s sold at  $100\frac{1}{4}$ , and Washington City & Suburban 5s brought  $100\frac{1}{2}$  and 101. One \$1000 Knoxville Traction 5s sold at 103. Interborough Rapid Transit was one of the prominent features on the New York curb. Dealings in it were comparatively small, amounting to about 6000 shares for the week, as against 27,000 shares traded in in the preceding week, and price fluctuations were confined to a rather narrow range—from 148 at the close, the price ran off to 145, but subsequently it rallied to 146, at which figure it closed. There were various rumors concerning the much-talked-of "deal," but none of them could be confirmed. Washington Railway and Electric issues were extremely quiet, but strong, small lots of the common and preferred selling at 18 and  $69\frac{1}{2}$ , respectively. The 4 per cent bonds were traded in to the extent of \$27,000, at  $83\frac{3}{4}$  and  $83\frac{1}{2}$ . St. Louis advanced  $1\frac{1}{2}$  points to  $11\frac{1}{2}$  on the purchase of a single hundred shares. The gross earnings of the company continue to show large gains. Those for the month of August



amounting to \$1,014,776, an increase of \$355,241, or about 54 per cent over last year, and it is expected that the gross receipts for the year will exceed \$9,000,000. A meeting of the stockholders will be held on October 19 to ratify a proposition to cause the issue of \$20,000,000 improvement and refunding bonds, authorized last May, and to issue in place of them bonds not exceeding \$12,500,000, of which \$10,000 will be issued at present, as the cost of the proposed improvements has been less than previously estimated. The collateral loans amounting to \$6,000,000 coming due in November can also be met by this issue.

Tractions were again active in Cincinnati, the majority of the purchases apparently being for investment purposes. Cincinnati Street Railway lead in the selling, the sales for the week aggregating about 2700 shares. The prices ranged from 144½ to 145½, practically the same as last week. Cincinnati, Newport & Covington common came into the trading after an inactive period, sales being about 23,000 shares with a range of from 30¾ to 31½. The preferred was again very active, sales being 2251 shares, with the range from 92½ to 94½. Several blocks of the first 5s of this company sold at 109¾ and 110, while one lot of the second 5s sold at 107½. Twelve thousand Northern Ohio Traction 5s sold at 99¾. Detroit United sold at 67, Cincinnati & Hamilton Traction at 46 and Toledo Railways & Light at 21. A lot of Miami & Erie Canal sold at \$1 per share, indicating very little faith in the future of the canal stock.

Northern Texas Traction continues in strong demand in Cleveland. The property is showing gains in earnings. The stock, however, is scarce. Over 600 shares sold in small lots with a range of from 38¾ to 40½. Cleveland Electric advanced to 73 on sales of 279 shares. A small lot of Northern Ohio Traction & Light sold at 13½. Northern Texas 5s advanced to 85 and Northern Ohio Traction & Light 4s sold at 59½.

A report from Cincinnati says that the deal for the purchase of \$800,000 worth of the 4 per cent bonds of the Northern Ohio Traction & Light Company by a syndicate of brokers headed by W. E. Hutton & Company, has been practically declared off for the present. A representative of that company was quoted as saying that his company was not satisfied with the proposition of the Cleveland holders of the bonds. E. W. Moore, of the Everett-Moore syndicate, who negotiated the deal, says that the sales of the bonds has been deferred only temporarily, and that the option has not been declared off. It appears that some of the outside Cleveland bondholders were unwilling to sell at the prices offered by the Cincinnati syndicate, and the latter desired to secure the entire holdings in Cleveland.

### Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with two weeks ago.

	Closing Bid	
	Sept. 7	Sept. 14
American Railways .....	48¾	48½
Aurora, Elgin & Chicago .....	a15	a15
Boston Elevated .....	153	153
Brooklyn Rapid Transit .....	55½	55½
Chicago City .....	183	180
Chicago Union Traction (common) .....	7	7
Chicago Union Traction (preferred) .....	31	31
Cleveland Electric .....	71	72¾
Consolidated Traction of New Jersey.....	72	72½
Consolidated Traction of New Jersey 5s.....	108½	108½
Detroit United .....	67	67
Interborough Rapid Transit .....	144½	148¾
Lake Shore Electric (preferred) .....	—	—
Lake Street Elevated .....	3½	3½
Manhattan Railway .....	155¼	157
Massachusetts Electric Cos. (common) .....	13	12¼
Massachusetts Electric Cos. (preferred) .....	61	59
Metropolitan Elevated, Chicago (common).....	21½	—
Metropolitan Elevated, Chicago (preferred).....	60	—
Metropolitan Street .....	120¼	122
Metropolitan Securities .....	87¾	81¾
New Orleans Railways (common) .....	—	—
New Orleans Railways (preferred) .....	—	—
New Orleans Railways, 4½s .....	—	—
North American .....	92¾	—
Northern Ohio Traction & Light .....	14	14
Philadelphia Company (common) .....	40½	44¾
Philadelphia Rapid Transit .....	14¾	16¼
Philadelphia Traction .....	99½	99¼
St. Louis (common) .....	—	—
South Side Elevated (Chicago) .....	91	—
Third Avenue .....	122	122

	Closing Bid	
	Sept. 7	Sept. 14
Twin City, Minneapolis (common) .....	98¼	98½
Union Traction (Philadelphia) .....	55¾	56
United Railways, St. Louis (preferred) .....	55¾	—
West End (common) .....	92½	92¼
West End (preferred) .....	111¼	111½

a Asked.

### Iron and Steel

The "Iron Age," in its weekly review, says: The all-absorbing question whether the recent open reduction in prices of finished material has stimulated serious buying cannot be answered as yet. With due reserve the statement may be made that thus far the indications are not particularly favorable. There has certainly not been any rush of buying. From all accounts current tonnage in the steel trade is good. A clear indication of this is furnished by the fact that the independent mills are taking their purchases right along, with a few insignificant exceptions, and the United States Steel Corporation has in blast 80 per cent of the furnace capacity, including a number of new stocks.

### Metals.

Quotations for the leading metals are as follows: Copper 12½ cents, lead 4.20 cents, tin 27.62½ cents, and spelter 5.10 cents.

## CONSOLIDATION IN PORTLAND, OREGON

The consolidation of the Portland Railway Company and the City & Suburban Railway Company, of Portland, Ore., became a certainty when the stockholders of the latter company met on Sept. 1 and unanimously decided to join with the Portland Railway Company. The stock of the Portland Railway is owned entirely by the Portland Traction Company, which is not an operating company. It is a close corporation with few stockholders, all of whom have been in favor of consolidation, so that the City & Suburban meeting was the decisive step in the merging of the two properties. All that remains now is for the transfer of the stock of the new corporation. This will not take place for more than a month, as some of the stockholders are in Europe. The new company is to be known as the Portland & Suburban Railway Company, and will be capitalized at \$5,000,000. Of this amount \$4,000,000 will be issued in exchange for the properties and for cash subscriptions, the remaining \$1,000,000 being held in reserve for insurance, as the growth of the system demands. As the cash subscriptions will amount to about \$1,000,000 it will give the new company a good working capital with which to make extensions and improvements to the existing properties. The stockholders of the City & Suburban Railway Company will receive about one and one-third shares in the new company for their holdings and the basis of exchange of the Portland Railway Company is about the same. The new company will have a bonded indebtedness of \$2,607,000.

When the two companies have been merged and brought under one management the new company will own 108.2 miles of track in Portland and vicinity. At the present time the City & Suburban Company has in operation 67.2 miles of track, including its suburban lines, while the Portland Railway Company has 41 miles over which it is running its cars. To operate this system the former company has 147 cars in use, while the latter has 107. The City & Suburban employs 600 men, while the Portland Railway Company has 400 workmen on its payroll.

The officers of the new corporation will probably consist of: President, A. L. Mills, president of the First National Bank of Portland; vice-president, C. F. Swigert, secretary and general manager of the City & Suburban; secretary and treasurer, J. C. Ainsworth, president United States National Bank and treasurer of the Portland Railway; general manager, F. I. Fuller, general manager of the Portland Railway. The executive management of the combined properties will be jointly in the hands of C. F. Swigert, as vice-president, and F. I. Fuller, as general manager. Although no definite arrangements have yet been made, it is probable that the mechanical and engineering features of operation will fall to Mr. Fuller.

While no detailed plans for the new company have been arranged at present, several improvements have been outlined and will probably be put into effect soon after the incorporation of the new company. Among these plans may be mentioned the building of a large car construction and repair shop and a large car house in East Portland. New motor equipment will be purchased, new standard types of cars will be constructed, and considerable track will be relaid. It is likely that a loop system will be established in handling cars in the down-town section and at the terminals.



**THAT NEW YORK CONSOLIDATION**

The stories of the merger of the local traction companies in New York go merrily on, a new variation being rendered almost every day. The story that comes to hand as the STREET RAILWAY JOURNAL goes to press, has been worked out with greater regard for details than any other that has yet appeared, the actual price being given at which the companies will be taken over. According to this story, Thomas F. Ryan has been empowered by the majority interest in Metropolitan Street Railway to dispose of the shares pledged to him in whatever manner he disposes of his own. There are absolutely no restrictions as to this disposition, so it is said. Metropolitan Securities, Metropolitan Street Railway and Interborough Rapid Transit shares are all to be deposited with a holding company or the present Metropolitan Securities Company, which will issue \$140,000,000 of 6 per cent preferred stock, which stock is figured at present to have a value of 128, and will take up share for share Metropolitan Street Railway stock; will give an additional bonus to Interborough shares, either common or preferred, so as to make Interborough shares worth 148, and will also place a value of 104 upon Metropolitan Securities.

**MANHATTAN ELEVATED REPORT**

The following statement has been filed with the New York State Railroad Commission in Albany by the Manhattan Railway Division of the Interborough Rapid Transit Company:

Year ended June 30	1904	1903
Gross earnings .....	\$14,187,686	\$12,208,337
Operating expenses .....	5,846,051	5,460,794
Net earnings .....	\$8,341,635	\$6,747,543
Other income .....	341,504	346,859
Total .....	\$8,683,139	\$7,094,402
Fixed charges .....	2,893,412	2,820,859
Balance .....	\$5,789,726	\$4,273,544
*Dividends .....	4,564,000	3,546,000
Surplus .....	\$1,225,726	\$727,544

\*The above dividends include the guaranteed 7 per cent on the Manhattan Railway Company and the 2 per cent declared on Interborough Rapid Transit.

**THE ST. LOUIS TRANSIT COMPANY'S EARNINGS—  
PLAN TO REDUCE BOND ISSUE**

A daily increase of more than 250,000 passengers is indicated by the record-breaking statement of the St. Louis Transit Company's earnings for August. The exhibit shows gross earnings of \$1,014,076 for the month, as compared with \$659,535 for August, 1903, an increase of \$355,241, or approximately 54 per cent. For the present year up to Sept. 1, the receipts of the company have aggregated \$6,246,856, as compared with \$4,766,704 for the same period of 1903, an increase of \$1,480,153, or more than 30 per cent. The average monthly increase thus far this year has been in excess of \$126,000, while the average daily fares have increased more than \$11,500.

The total number of passengers carried each day has increased to more than 600,000, while during the past month 20,295,520 revenue passengers were hauled. Including transfers, it is estimated that more than 30,000,000 people were handled.

It is now confidently expected that the gross earnings of the company for the present calendar year will not be less than \$9,000,000. Some estimates that have been made place the figures at \$10,000,000. Net receipts also have increased at an astonishing rate during the past few months. It is anticipated that the balance for August, after all expenses, will amount to \$150,000.

A meeting of the stockholders of the company has been called for Oct. 19 to pass upon a proposition to cancel the issue of \$20,000,000 improvement and refunding bonds authorized last May, and to issue in lieu thereof bonds not to exceed \$12,500,000.

The object in authorizing the issue of \$20,000,000 bonds last May was to retire certain obligations arising from deficits and improvements which the company has incurred in the course of its existence. The bonds were to be guaranteed by the United Railways Company, of which the Transit Company is in a measure a subsidiary organization.

Notice of the purpose to restrict the issue to \$12,500,000 was

made public last month, and was noted in the STREET RAILWAY JOURNAL at that time. Since then it has been stated that arrangements have made by which the company will issue only \$10,000,000 bonds, as the cost of the proposed improvements have not been as great as estimated, and the collateral loans coming due in November for \$6,000,000 can be retired from the difference between the cost of the improvements and the total of the bonds, which, it is believed will bring a good price. Brown Brothers, of New York, have done much toward financing the company, and have disposed of some of the bonds, though arrangements with the purchasers can be made on the new basis. Another feature which it is believed will be considered is that in all probability the Transit Company will be able to wipe out its deficits with its net earnings this year.

**NORTHERN COLORADO COMPANY'S PROJECT**

The directorate of the Northern Colorado Electric Railway Company has been changed by the resignation of L. C. Moore and the election of William R. Rathvon, of Boulder, Col., as his successor. Mr. Rathvon has been for some years connected with the United Oil Company in an executive capacity, and is at present the manager of the northern fields for the above named company. The United Oil Company is the refining company for the Continental Oil Company. Mr. Moore has been elected treasurer of the company. The preliminary plans of the company as adopted by the new directorate include building from Eaton, Weld County, to Longmont, in Boulder County, including in the line the towns and cities of Windsor, Timnath, Fort Collins, Loveland, Berthoud and several in-country villages. The total distance is about 61 miles and the population per mile is 451. The proposed road will penetrate one of the richest potato, beet and wheat sections in America. Franchises have already been granted for Larimer County, Windsor, Fort Collins, Loveland and Berthoud, and applications for grants are being considered by the City Council of Longmont and Town Board of Eaton. Terminal service will be arranged over lines now ready to build from Denver to Longmont. The line will be built to conform with the latest standard interurban practice. Preparations are being made for beginning surveys at once.

**CONTRACT FOR SINGLE-PHASE LINE IN THE SOUTH**

The Atlanta Interurban Railway Company, controlled by the Georgia Railway & Electric Company, and now building a line in Atlanta and its suburbs, has awarded a contract to the Westinghouse Company for the equipment of the line with the single-phase system. This is the first company in the South to contract with the Westinghouse Company for the equipment of its lines with this system.

**REGULATION OF TRAFFIC IN NEW YORK BY THE POLICE**

During the last municipal administration in New York the continental method of regulating street traffic at congested crossings was introduced in the borough of Manhattan. Under this system the traffic on streets extending north and south is given right of way while the traffic on streets east and west is held. Then the traffic on the streets east and west is given the right of way while the traffic north and south is held. When this scheme was introduced simple instructions also were issued as to the proper way to follow the rules of the road. The police soon learned just what was expected of them, and the plan finally worked out successfully. The present police commissioner has conceived the idea that he can improve upon the system as operated under his predecessor, and has placed mounted police at a number of crossings, his contention being that a mounted officer has an advantage over a patrolman in dealing with offenders. Probably the most important task the commissioner has undertaken is that of regulating vehicle traffic over the Brooklyn Bridge between the hours of 4 o'clock and 7 o'clock p. m. Trucks coming to Brooklyn from up town are now required to pass down the west side of Park Row, until near the Post Office. Then they may cross over and come up the east side of the Row, keeping off the car tracks, and turn into the bridge roadway. Trucks from Brooklyn are compelled to turn to the right up Park Row to Chambers Street, instead of plunging directly across to Center Street. Thus, the space directly in front of the bridge is kept clear of heavy wagons, and the cars on Park Row and Center Street are permitted to make good time. In the system as worked in New York there is a lesson that could be applied in other cities that find it hard to cope with the problems in traffic presented in congested districts.



## NEW BRIDGE TRAFFIC PLANS IN NEW YORK

Bridge Commissioner Best, of New York, has sent another letter to Mayor McClellan on the question of improved facilities for handling traffic over the old and new East River Bridges. Mr. Best says that the proposed connecting railway between the two bridges now erected would afford but little relief. He says that to avoid the experience of having a bridge completed with no railway facilities, as is the case with the Williamsburg Bridge, lines to and from the Manhattan Bridge, now building, should be provided for at once. He therefore suggests to the Mayor the following improvements:

An elevated railway through Canal Street from Greenwich Street or the Hudson River to the Manhattan Bridge terminal, with a branch through Elm Street, Center Street or the Bowery to Delancey Street, thence to the terminus of the Williamsburg Bridge, the line to be built either by the Brooklyn Rapid Transit Company or the Manhattan Elevated.

Or, a trolley subway through Delancey Street, across town to Hudson Street, down Hudson Street, West Broadway and Greenwich Street, at least as far as the Jersey City ferries at Cortlandt and Liberty Streets, with a branch through Duane Street, under the present subway at Elm Street, into the basement of the projected station on Center Street, there to connect with the surface lines from Brooklyn, which could use the basement of the station as a terminal and through station.

The building of this line the Commissioner suggests leaving to the Brooklyn company or to the Jersey City companies, which will soon have a foothold in New York through tunnels. He thinks that this route could be operated as a loop or otherwise at the option of the companies. The transfer of the present loop tracks at the Brooklyn Bridge to the basement of the new terminal station Mr. Best believes to be advisable, but not imperative. He adds: "I assume that the project to carry the South Brooklyn Subway over the Manhattan Bridge may be urged quite persistently, and that if it is adopted we shall not be able to run so many cars over this bridge as has been anticipated. In this event, a trolley subway would not be necessary."

## LEVIS COUNTY RAILWAY-CANADIAN ELECTRIC LIGHT COMPANY.

The troubles hitherto existing between the above two companies are in a fair way to be promptly and amicably settled. Allusion to the fact of power contract disputes between these two companies has been previously made in these columns. We are now advised that a board of arbitration has been appointed, and an agreement signed by both companies, to settle all difficulties, and to draw up a new power contract. The gentlemen selected are: R. S. Kelsch, consulting engineering of the Montreal Light, Heat & Power Company; Henry D. Bayne, manager at Montreal of the Canadian Westinghouse Company, Limited, and L. P. Sirois, a prominent notary of Quebec.

Power has been served to the railway, and the road has been in operation since Aug. 9, through the influence of a citizens' committee, and is now continued by the arbitration agreement.

The Levis road was without power for five weeks and three days during its best season, and to provide against any recurrence the work of installing a relay steam plant is progressing.

## BUENOS AIRES HORSE LINES TO BE CONVERTED

The Buenos Aires Grand National Tramways Company, which operates upward of 50 miles of horse tramways in and around the capital of the Argentine Republic, is largely to convert its system to electric traction, and has already placed an important contract for American equipment, the General Electric Supply Company, of Buenos Aires, which represents the General Electric interests in that part of the world, having been awarded a contract for 100 40-hp. double motor equipments with controllers, trolleys, cables, complete.

The Grand National Company is composed mostly of British capital. The London offices are at 6 Eastcheapside, E. C. The president of the company is B. S. Howard. Charles Downey is managing director. The consulting engineers are Sir George Bruce & White, London. The contracts for material, equipment, etc., for Argentine Republic electric traction systems have hitherto chiefly been instituted among European manufacturers, especially German concerns. The General Electric contract is the first important one secured by American interests for some time.

## CINCINNATI, GEORGETOWN & PORTSMOUTH RAILROAD IN MARKET FOR EQUIPMENT

The Cincinnati, Georgetown & Portsmouth Railroad, of Cincinnati, Ohio, will reach Russelville on its West Union extension about Oct. 15, and expects to reach West Union early next season. The earnings for the year ended June 30, 1904, exceeded those of June, 1903, more than \$12,000. The increase for July, 1904, over the same month last year was \$1,500. For the first three weeks in August the increase over the same period last year was \$1,200. The company is in the market for rails and bridges.

## TWIN CITY COMPANY HAS PLAN TO PREVENT ELECTROLYSIS

The Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, has submitted to the Board of Water Commissioners of St. Paul a detailed plan for the prevention of damages to the city's water mains by electrolysis. The presentation of the plan was in accordance with an agreement by which the city of St. Paul was to suspend a damage suit against the company providing such a plan was devised and presented by Sept. 1, 1904. The plan which has been submitted was prepared by Sargent & Lundy, of Chicago. It provides that a cable, to be connected with the rails by wires, be laid between the double tracks, thus providing adequately for the return of the current to the source of supply. The report has been submitted to the Board's electrical expert, Prof. Dugald C. Jackson, of the University of Wisconsin, who, after making a careful examination as to the feasibility of the plan, will report back to the Board.

## REMARKABLE RECORD OF THE BOSTON & WORCESTER

The Boston & Worcester Street Railway, operating between Boston and Worcester, Mass., a distance of about 40 miles, shows an increase in earnings for the summer that can only properly be designated by the word remarkable. For the month of August car receipts averaged the record figure of \$5.25 per car hour, and for the year to end this month the gross earnings will exceed \$400,000. On Saturday, Sunday and Monday, Sept. 3, 4 and 5, the gross earnings were \$9,696. The earnings for Labor Day alone were \$4,246. The total for the three days showed an increase over last year of more than 25 per cent. It is said that earnings so far this month have shown an increase of \$500 per day over last year.

## ANNUAL CONFERENCE OF THE MUNICIPAL TRAMWAYS ASSOCIATION OF GREAT BRITAIN

The annual conference of the Municipal Tramways Association of Great Britain is to be held in Liverpool on Sept. 27, 28 and 29. The executive committee has considered the arrangements for the annual conference, and the programme will be roughly as follows:

On Sept. 27 there will be a meeting of the executive committee at 9.45 a. m., and a meeting of the manager's section at 10 a. m. Half an hour later a reception will be given to the association by the Liverpool Corporation, followed by a conference at 11 o'clock. In the evening the members will be entertained to a dinner by the Liverpool Corporation.

On the following day there will be an executive committee meeting followed by a business meeting and conference of the association. The Lambeth Road works and Pumpfields power station are to be visited in the afternoon preceding the association dinner at 7 p. m.

An excursion has been planned for Sept. 29, of which the details have not yet been announced. The following papers and reports will be submitted for discussion:

"How to Effect Economy in Current Consumption," by P. Fisher.

"Arrangement of Men's Duties," by J. B. Hamilton.

"Methods of Dealing with Mixed Systems of Traction," by A. L. C. Fell.

"Cars, Their Equipment and Maintenance," by J. Aldworth.

"Overhead Equipment, Its Construction and Maintenance," by J. M. McElroy.

Report on the standardization of tramway accounts.

Revised report on the hours of labor, etc., of tramway employees.



## CONVENTION ARRANGEMENTS OF MANUFACTURERS' COMMITTEE

The executive committee of the American Street Railway Association held a meeting at St. Louis Sept. 10, in conference with a committee of the recently formed manufacturers association, to decide upon details of the programme for convention week. The entertainment that will be provided by the supply men will be in line with the anticipated desire of those visiting the convention to see as much of the Exposition as possible.

The members of the American Street Railway Association executive committee in attendance at the conference were President W. Caryl Ely, of Buffalo; J. C. Hutchins, of Detroit; E. C. Foster, of New Orleans; Secretary T. C. Pinington, of Chicago, and Capt. Robert McCulloch and John Grant, representing St. Louis. The members of the manufacturers' committee present were Chairman Daniel M. Brady, Secretary R. W. Meade, C. C. Pierce, of Boston; W. J. Cooke, of Chicago; G. J. Kobusch, of St. Louis; Daniel Royse, representing F. S. Kenfield, of Chicago, and E. H. Baker, chairman of the finance committee.

## MUNICIPAL SHORTSIGHTEDNESS IN JERSEY CITY

The spectacle is presented in Jersey City of the City Council passing street railway ordinances and the Mayor signing the documents in the face of protests from the company in whose favor the grants were made, that the conditions embodied therein were impossible of acceptance. The ordinances granted to the Public Service Corporation the right to build extensions and make improvements to its lines in Jersey City, that, as President McCarter of the company said, were of far more importance to the public than they were to the company. Despite this, however, the city wanted to make a contract that could be upset before the expiration of the company's bonds. The company was willing to pay to the city 5 per cent of its gross receipts; it was willing to grant transfers, to pave and sprinkle the streets, to concede the principle involved in a renewal of its contract at periods of twenty-five years, but refused to do this during the life of its bonds, which were issued before this new condition was thought of.

## FRESH CAPITAL AND NEW NAME FOR STILWELL-BIERCE & SMITH-VAILE COMPANY

The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, all its manufacturing lines, goodwill, patents, drawings, etc., have been purchased by Col. J. D. Platt, president of the Barney & Smith Manufacturing Company, of Dayton, Ohio. Col. Platt has organized a company called the Platt Iron Works Company, to carry on the enterprise. The purchase price was in the neighborhood of \$750,000. The new company has a cash working capital of \$400,000. The company will take over all the unfinished contracts of the Stilwell-Bierce & Smith-Vaile Company. The personnel of the engineering and sales department will remain practically the same as heretofore. Geo. W. Neff is the Eastern manager of the company, with headquarters in New York.

## MILWAUKEE COMPANY'S OFFER TO LIGHT STREETS

A formal proposition has been made by President John I. Beggs in behalf of the Milwaukee Electric Railway & Light Company to the joint committee of the Common Council of Milwaukee on finance and lighting, for lighting the streets of the city. Mr. Beggs says the company is willing to make an agreement with the city to furnish light at the same figures that are charged in the city of Detroit, which has been frequently referred to in the discussion of the project of building a municipal light plant. Mr. Beggs proposes that expert accountants each year report to the City Council exactly what it has cost the city of Detroit to light its streets and the figures thus reported shall govern the price to be charged the city of Milwaukee. It is provided, however, that the difference in the cost of coal in Detroit and Milwaukee shall be taken into consideration, and also that any other similar questions shall be considered by the accountants. It is roughly estimated that it would cost the city \$1,000,000 to erect a municipal plant.

## STEAM RAILROAD SUBWAY FOR CINCINNATI

Plans prepared under the direction of the Union Terminal Company, of Cincinnati, for a tunnel into the city for the steam lines will, it is said, be submitted to the railroad authorities this week. The plans include a subway directly across the center of the city. Private property is to be taken by purchase and lease, giving those along the line direct switching connection with every railroad in the city. It will contain twelve standard tracks. The motive power will, of course, be electricity.

## SOUTHERN PACIFIC COMPANY'S ELECTRIC PLANS

From Sacramento comes the statement that plans are well under way for installing electricity on the Southern Pacific Company's suburban lines across the bay. Engineers are at work upon the plans, and a portion of the \$5,000,000 which Mr. Harriman recently authorized Director Kruttschnitt to spend on improvements will go toward the preliminary work. Rumor has it that it has been definitely decided to operate the Berkeley, Oakland and Alameda lines of the Southern Pacific on a third-rail system similar to the North Shore Railroad, instead of the overhead trolley wire system, by which the Santa Fe moves its Key Route trains.

## CHANGES IN CINCINNATI, DAYTON & TOLEDO TRACTION

The annual meeting of stockholders of the Cincinnati, Dayton & Toledo Traction Company on Sept. 8, resulted in sweeping changes in the directorate. Of 50,000 shares represented, only 6000 were shown to be held in Cleveland, which resulted in the practical elimination of the Mandelbaum interests that formerly controlled the property. H. B. McGraw was elected director to represent the Cleveland interests, he being the only Clevelander on the new board, which is as follows: George B. Cox, W. E. Hutton, L. A. Ireland, C. A. Richardson, W. Kelsey Schoepf, of Cincinnati; Peter Schwab, of Hamilton; H. B. McGraw, of Cleveland. These officers were chosen: W. Kesley Schoepf, G. B. Cox, C. A. Richardson, executive committee; George B. Cox, president; W. K. Schoepf, first vice-president; C. A. Richardson, second vice-president; J. B. Foraker, secretary-treasury; J. Williams, assistant secretary-treasurer; F. J. J. Sloat, general manager; W. J. Boyer, auditor.

## ELKINS HOLDINGS IN PHILADELPHIA RAPID TRANSIT GO TO A SYNDICATE

A deal has been closed by which about 35,000 shares of stock of the Philadelphia Rapid Transit Company belonging to the estate of William L. Elkins have been sold to a syndicate of inside Philadelphia and New York traction interests. Previously about 15,000 shares of the Elkins holdings were sold to members of the same syndicate. The price paid was about \$15 a share, and the stock is understood to have gone to men who were close friends and associates of Mr. Elkins. Among the purchasers are: John B. Parsons, president of the Rapid Transit; P. A. B. Widener, George D. Widener, J. J. Sullivan, William H. Shelmerdine, Michael Murphy, John M. Mack, George A. Huhn and Clarence Wolf, of Philadelphia, and Thomas F. Ryan, August Belmont, James H. Hyde and John D. Crimmins, of New York.

The capital of the company is \$30,000,000, divided into 600,000 shares of a par value of \$50. When the company was organized \$5 a share was paid in. This assessment amounted to \$3,000,000. In May, 1903, a second call for \$5 was made, and the third \$5 was paid last December, making in all \$9,000,000 called. A fourth assessment will be called next month. It will be for \$5 a share. This will bring the total paid-in capital up to \$12,000,000.

George H. Earle, Jr., president of the Finance Company of Pennsylvania, has been elected a director of the company to fill the vacancy caused by the death of William L. Elkins. Mr. Earle is interested in Indiana traction lines controlled by United Gas Improvement interests. He also has considerable interest in the United Railroad of San Francisco, and in addition is a larger owner in the Philadelphia Company, which controls the Pittsburg roads. Beside being at the head of the Investment Company of Philadelphia, Mr. Earle is president of the Tradesmen's National Bank, the Market Street National Bank, and of the Pennsylvania Warehousing & Safe Deposit Company.



## SCHENECTADY COMPANY TO ESTABLISH A BUS SERVICE

The availability of the automobile as an adjunct and feeder of the electric railway is to be tested by the Schenectady Railway Company, of Schenectady, N. Y. This company has placed an order with the General Electric Company for two passenger cars, which will be placed in service between Loudonville and Albany, a distance of 8 miles. The seating capacity of each bus will be twenty persons, and the speed with full load will be 12 m. p. h. This experiment may allay the fears of those who heretofore have looked upon the automobile only as a possible competitor of the electric railway.

## ACCIDENT FAKIRS SENTENCED IN BOSTON

On charges of conspiring to defraud the Warren, Brookfield & Spencer Street Railway by pretending that one of them was on one of the company's cars when it met with an accident, and recovering \$25 for fictitious injuries, John W. West and Elizabeth Allen were each sentenced to eight months in the House of Correction in the Municipal Court at Boston, Sept. 10. Judge Boltser, in finding the couple guilty, censured them sharply and gave them sentences that are much heavier than usually are given in offenses in which no greater amount is concerned. "While it is true that the amount involved is small," the Judge said, "all the evidence shows that it was a plan of premeditated, deliberate and continued villainy."

## STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED SEPT. 6, 1904

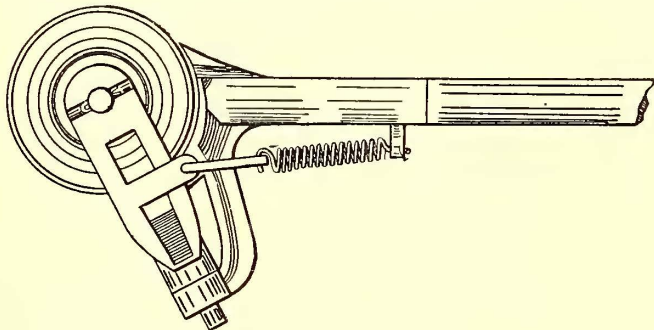
769,187. Registering Mechanism; Jacob Schinneller, Pittsburg, Pa. App. filed Feb. 9, 1903. A special auxiliary register adapted to be operated independently of the main register when the passenger is entitled to a rebate.

769,301. Summer Car; Edmund Bury, Philadelphia, Pa. App. filed Feb. 6, 1904. Mechanism whereby the side exits to the cars may be readily opened and closed from either platform.

769,398. Operating Mechanism for Car Registers; Wilfred I. Ohmer, Dayton, Ohio. App. filed Jan. 23, 1903. Comprises a shaft capable of both rotary and longitudinal motion, a vertical shaft mounted in a housing and having a geared connection with said shaft within said housing, whereby both shafts rotate in unison, an operating handle mounted on the vertical shaft, a bell crank lever mounted in the housing and engaging the shaft to move the same longitudinally, and a connection between the operating handle and the bell crank lever to actuate the lever when the handle is moved longitudinally.

769,462. Self-Adjusting Trolley for Electric Railways; Charles C. Benson, Newburyport, Mass. App. filed Nov. 19, 1902. The harp is so constructed as to permit the wheel to swing laterally.

769,513. Switch Operating Device; Cort W. Townsend, New Philadelphia, Ohio. App. filed June 28, 1904. Details of construction of a switch-throwing device mounted upon the car-axle.



PATENT NO. 769,462

769,576. Car Brake for Railroads; Edward A. Wagener, Denver, Colo. App. filed Sept. 30, 1903. Two friction rollers, located (relatively to the car wheel) diametrically opposite each other, with means for bringing the roller simultaneously into contact with the tread of the car wheel, and also independent stationary surfaces.

769,577. Railway Switch; William Wharton, Jr., Philadelphia, Pa. App. filed June 3, 1904. A recessed body portion having a rail at one side and stops at the opposite side, the surface between the stops being inclined, and a tongue with a tread portion and a guard mounted in the recess.

769,685. Electric Railway Switch; Schuyler C. Gurley, Indianapolis, Ind. App. filed Sept. 8, 1903. Details of an electro-magnet for actuating a railway switch.

## PERSONAL MENTION

MR. BENJAMIN C. FAUROT, a pioneer citizen of Lima, Ohio, died a few days ago. He established the first street railway system in that city, now known as the Lima Electric Railway & Light Company.

MR. J. A. BRETT, for the past several years general manager of the Electrical Installation Company, of Chicago, will, on Oct. 1, retire from that company to engage in other business. Mr. Brett has made no definite arrangements for the future, but has several proposals under consideration.

MR. HENRY BACON TUCKER, master mechanic of the Jacksonville Electric Company, of Jacksonville, Fla., was married Wednesday, Sept. 7, at Middletown, Conn., to Miss Winifred Langdon Allison, daughter of Mr. and Mrs. William J. Allison, of South Farms, Middletown. Mr. and Mrs. Tucker are now at home at Jacksonville to their friends.

MR. S. B. LIVERMORE, former superintendent of the Winona Railway & Light Company, has been appointed superintendent of the La Crosse City Railway Company to succeed Mr. Peter Valier, who recently resigned to accept a position with the La. Crosse & Southeastern Railway Company. Mr. Livermore had several years' experience with the Winona Company.

GEN. JOHN M. HOOD, president of the United Railways & Electric Company, of Baltimore, Md., has returned from a flying trip through England, France, Germany, Switzerland and Northern Italy. He left Baltimore on Aug. 3 and sailed for Europe from New York on the following day, arriving at Hamburg on Aug. 11. His main object in making the trip was to study European transportation methods.

MR. JOSEPH ELBLE, a division superintendent of the Cincinnati Traction Company, was quite seriously injured a few days ago in a brave effort to save the life of a child. Mr. Elble was standing on the running board of a car when a child ran onto the track. The motorman made an effort to stop, but Mr. Elble, seeing that the child was certain to be struck, jumped forward and grasped the child, pulling her to one side and saving her life. Both were knocked down, however, and Mr. Elble received serious scalp wounds and other injuries.

MR. CURTIS J. HARRINGTON, who was for several years past prominently identified with the electric railway construction and supply business, died at St. Vincent's Hospital, New York, on the morning of Sept. 10. Funeral services, with Masonic honors, were held at his New York residence, 151 East Fifty-Fourth Street, on Monday, Sept. 12, before his body was sent for interment to Scranton, Pa., where his parents live. Mr. Harrington was born April 21, 1870, and first entered the electric railway supply business in 1897 with Mr. Elmer P. Morris, New York, after having spent several years in electric railway work around Philadelphia. He left Mr. Morris to become manager of the Electric Lead Reduction Company, of Niagara Falls, N. Y., but later he returned to New York to engage in business for himself. He leaves a wife and one child. His brother, Mr. W. E. Harrington, is vice-president of the Camden & Suburban Railway Company, of Camden, N. J.

MR. JOHN C. WILLETTS, president of the John Stephenson Company, died on Aug. 31, 1904, at his home at Skaneateles, N. Y., after an illness of several months. Mr. Willetts was born in Cincinnati, Ohio, March 4, 1846; he was a son of Mr. William Jackson Willetts. In his early manhood Mr. Willetts engaged in the leather business in New York, but on account of ill health was soon obliged to give up his interests and remove to Florida, where he spent several years. In 1872 he married Miss Emma Prentice, daughter of John H. Prentice, one of the proprietors of the well-known Prentice stores of Brooklyn. For the past twenty-five years Mr. Willetts has made his home in Skaneateles, N. Y., and during this time has been prominently identified with the growth and improvement of the town. He was particularly interested in the establishment of the new public library at Skaneateles, and gave much of his time to this end, personally supervising the construction and equipment of the new library building. Besides being president of the John Stephenson Company, Mr. Willetts was at the time of his death the president of the Dexter Folder Company, vice-president of the Syracuse Chilled Plow Company, vice-president of the National Bank of Skaneateles, a director of the E. W. Bliss Company. He also was interested in several other well-known business enterprises. The funeral service was held at Skaneateles on Sept. 3. Mr. Willetts is survived by a wife and four children. Mr. H. K. S. Williams has been elected to the position held by Mr. Willetts with the Stephenson Company.