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EDITORIAL NOTICE

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.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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Announcement

Beginning March 1, 1904, all American subscribers to the STREET RAILWAY JOURNAL, paying $4 per annum, will receive without additional charge the Electric Railway Directory and Buyers' Manual, published in February, August and November. The combination subscription price for the STREET RAILWAY JOURNAL, the Directory and our annual Red Book, "American Street Railway Investments," will be $6.50 per annum instead of $7.50 as heretofore. To subscribers desiring the STREET RAILWAY JOURNAL alone, the rate will hereafter be $3 per annum for the fifty-two issues. There will be no change in the present subscription rates to foreign subscribers.

With 1904 the STREET RAILWAY JOURNAL completes the twentieth year of its existence. During these years the paper has constantly increased in number of subscribers, influence and prestige, so that it is now regarded throughout the world as the unquestioned authority on all matters relating to street railways, tramways and high-speed electric traction in all its forms. The growth of the paper and the rapid development of the field whose events have been recorded in its pages have been accompanied by equal, if not greater, changes in the organization and character of the operating force required in street railway service. The large technical force which forms a necessary part of the electric railway of the present day had no counterpart in the horse railway of twenty years ago. Our patrons have often told us that a subscription to the STREET RAILWAY JOURNAL was one of the most essential factors to success in their business, and the greatest assistance to them in solving the many problems in construction and operation which are constantly arising in their work. We feel, therefore, that it is our duty to place the paper within the means of every member of the operating department who wishes to work to the best possible advantage, to advance in his chosen profession, and to give his company the most efficient service possible. Whether he is manager, superintendent, master mechanic or car-house foreman, we want him to feel that he need not be dependent on the one or more office copies taken by the company in whose employ he is, but that he can have the STREET RAILWAY JOURNAL sent individually to himself and can keep and bind his copies for future reference.

We ought to state in this connection that the change in subscription price will involve absolutely no deterioration in either the quality or character of the matter published, the typographical appearance of the paper or the number of reading pages. On the contrary, the larger clientele which the reduction in price will give and the personal pride which we believe many of our readers who have not heretofore received the paper in their own names will take in possessing copies of their own, will act as a greater stimulus to us than ever before to produce the very best technical paper possible, and one worthy in every respect of the important field which it represents.

A Hard Winter

The past winter has been one which has served to bring out all the defects and weaknesses of old motor equipments. From all over the country come reports of an unusually large number of disabled cars. In some cities this has been caused by an extra heavy fall of snow where snow has been almost unknown for several years. On two of the best managed railway systems of the Middle West a very sudden thaw resulted in so much water on the streets as to aid in disabling a large number of cars. In all parts of the country the snow-fighting equipment has been in almost constant use, and with very satisfactory results on the whole.

Two letters in our correspondence department indicate the methods followed in two widely distant sections, and will prove of great interest to those who have this difficulty to contend with. These letters are particularly interesting from the fact that Schenectady, and the Mohawk Valley in general, constitute one of the districts in the Eastern States where the fall of snow is particularly heavy during winter, while Duluth represents, perhaps, as typical a snow-fighting battle-ground in the Northwest. An essential feature of the practice of both companies, as outlined, is the use of long winged plows. The object, of course, is not directly to improve the condition of the track itself but to remove the piled up snow from the immediate neighborhood of the tracks to close to the curb line. This clears the center of the highway from hummocks, and gives an open space for sleighs and other vehicles which would otherwise tend to follow the track and obstruct the movement of the cars.

The Electric Railways in Southern California

We have already described several important electric railway installations in the vicinity of San Francisco, and have commented on the advancement that has been made in that section of late. It is now appropriate to direct attention to another field, equally interesting and important, in which one of the most comprehensive systems of trolley lines in this country has been established. We refer to the electric railway system of the Pacific Electric Railway Company, certain features of which are described this week. This article, with others which will appear in the immediately following issues, will be found especially instructive by those engaged in large transportation properties.

Electric railway development in Southern California has received a strong impetus recently through the entrance into this field of experienced steam railroad men, backed by ample and ready capital. In practically every city, improvements and extensions are being made, but the greatest work is being carried out in and around Los Angeles. The interurban roads radiating from that city reach every important town and farming community within a radius of 20 miles, and in several cases there are two or three different routes to the same point. Including the city systems there are over 540 miles of single track tributary to Los Angeles. In Santa Barbara, Ventura, Ontario, Pomona, San Bernardino, Redlands, Riverside and San Diego are local railways aggregating 109 miles in length, making the combined operating mileage of the street railways in Southern California 650 miles, by no means a small mileage when it is considered that the population of the entire section is not much over 250,000. Around Los Angeles over 200 miles of new lines are now under construction, the most extensive project being the Bakersfield & Ventura Railway, which is to be a 123-mile road, extending from Hueneme on the coast through Oxnard, Ventura, Saticoy, Santa Paulo and Sunset to Bakersfield. This road will be electrically operated from the east to Sunset (83 miles), where, for the present, connection is to be made with a branch of the Santa Fe Railroad running to Bakersfield. Including the new work now under way the mileage in Southern California figures up over 850 miles. Add to this between 200 miles and 300 miles of projected lines, many of which will probably be built this year, and it is seen that electric railways are occupying no small place in the industrial progress of that section of the State.

The central figure in the Los Angeles traction development at present is Henry E. Huntington, who, by large investments and personal supervision of the details of operation and construction of his properties, has shown that he has great faith, not only in the results of his own expenditures, but in the entire electric railway future of Southern California. Of what are known as the Huntington railways, the Pacific Electric Railway Company's system has been brought to a high state of development, when it is considered that this company has been in operating existence less than two years, and that all but two of its seven lines have been built within that period. In order to operate at high speeds the track and overhead construction have been built according to the latest and most approved standards, and the best of rolling stock and equipment is used. The extensions of the system have created a heavy demand for power, necessitating recent additions to the central power house and the building of new sub-stations, to say nothing of a large water-power development, which will soon be available. The repair shops have been erected on the same broad lines that mark the other constructions, and are equipped for making all classes of repairs, and, if desired, for building complete cars. It is of some of these features of the Pacific Electric Railway system that the series of articles, begun on another page of this issue, will treat, leaving interesting points of the other Los Angeles railway system for future description.

Maintenance of Equipment

The maintenance of a street railway property is a difficult problem at best, and an additional element of a perplexing nature is introduced in the determination of the question as to how far economies may be practiced to swell the profits without impairing the value of the equipment and the reliability of its operation. The question that should be uppermost at all times in the mind of the manager or superintendent, is whether these practices are true economies or of the "penny wise and pound foolish" order. Anything that will affect the reliability and efficiency of the system adversely is detrimental to the value and development of the property, and should be avoided. But it would seem that the importance of this subject is not fully appreciated by all managers, as many of those who have enjoyed wide experience continue to be governed in making the selection of their material and supplies principally, if not entirely, by low initial cost. This is particularly true of those articles which are used continuously in the operation of the road, including babbitt metal, grease, oil and trolley wheels. A low price is often obtained where a large order is placed, and a high quality secured at the same time, but often the buyer loses sight of the fact that an inferior article is dear at any price, and he is governed solely by the figures quoted. This is done, too, in spite of the fact that material thus purchased often fails to perform properly the functions for which it is intended, and that the same service cannot be gotten out of cheap articles as those produced by more experienced houses which command higher prices. This policy results in frequent break-downs, interruption of service and a derangement of the schedule at a price vastly exceeding the saving effected by the lower cost of the article which was the cause of the trouble.

A scored axle, due to poor grease, a broken-down commutator, due to poor brushes, the breaking of the trolley wire and the wearing out of trolley wheels are all vexatious enough, and they cause delays and congestion of traffic, but even these results, annoying as they are, are really not as far-reaching in their influence and effect as the secondary troubles resulting therefrom, which are even more expensive, and which, if considered in their true light, ought to impress the management with the absurdity of continuing such a policy.

One of the best means of correcting this evil is the adoption of a system of keeping records of the troubles on equipments and plant, which is gradually being introduced in electric railways throughout the country. Where reports of this kind are intelligently made and systematically compiled the manager can almost immediately put his finger on that part of the equipment which requires an abnormal expense to maintain, and by a little investigation he can ascertain the reasons for the troubles. Sometimes a change in the character of the supplies or material employed is found to be the cause; at other times negligence on the part of the inspector, and very frequently imperfect workmanship in the repair department. A combination of these elements is very apt to be found where it has not been the practice to keep systematic records, as one fault very naturally leads to the other, and soon laxity is found in all departments. By keeping the records of repair work done on each car separately, and noting the character and extent of each repair, the cause of the trouble can be very readily ascer-

tained, consequently, it is very important, indeed, that a thorough system of repair reports should be established, and that they should be sufficiently comprehensive to indicate clearly the condition of every equipment which passes through the shop.

A brief trial of this kind would open the eyes of many managers to the actual records made by the apparatus on their roads, and would point the way to real economies and improvement of service at the same time.

The Railway Company and the Daily Papers

The popularity or unpopularity of a street railway company in the city in which it operates depends to a large extent upon the relations which exist between the company and the daily papers of that same city. It is true that the local press in any community does not entirely mould public opinion. Its representatives probably could not, if they would, make any important issue or measure popular which for some reason had incurred the hostility of the public, nor can they successfully incite serious opposition to a railway which is furnishing a perfectly satisfactory service. But no railway company can please everybody, especially those who, with no appreciation of practical conditions, expect the impossible, and it is very easy for a local newspaper to acquire cheap applause by championing the cause of the public as against "the grinding monopoly" of the local street railway company.

There is, perhaps, no subject which at times has given many managers more concern than the proper attitude to take toward the newspapers. Those who have affected to disregard the influence of the papers entirely have been able to maintain this attitude for a longer or shorter time, but in the end have usually been obliged to surrender and make a change of policy.

Now, it is not our intention to justify any or all of the press attacks on public service corporations, the policies followed by the daily papers in many cities or the motives which lie behind them. Nevertheless, we believe that in a great many cases where street railway companies have been assailed the condition might have been alleviated, and in some instances entirely obviated by the adoption of diplomacy and certain simple rules of policy on the part of the defendant concern. Some companies believe that newspaper support can be secured only by a liberal and regular distribution of passes, accompanied by occasional favors in the way of advertising contracts. With this we do not agree. There are cases, of course, where this course of argument is more potent than any other, but, as a rule, in justice to our newspaper brethren, be it said, a different course is quite as effective, as well as very much cheaper in the long run.

Many managers who complain that they have not been treated fairly by the daily press do not know how many times reporters from the very papers of whose actions they complain, have waited in vain in the company's outer offices for an interview on some subject and to learn the company' side of the story. The manager may have had a good excuse for not seeing them, but no other person has been authorized to give out any information, and the newspaper man, after waiting a reasonable time, has gone off disgusted. Even where some other official has been ready to give the information sought, the reporter, being refused an interview with the chief executive officer, and not knowing to whom to apply, does not make further effort to learn what the company has to say. Now this may be all wrong, but the blame is not fully chargeable to the paper if the facts become twisted, or if a little venom is injected into the story in the editorial sanctum. Seeing and hearing both sides of the story, we could cite numerous instances where, by a little diplomacy on the part of railway officials, coupled with a simple explanation of certain railroad principles, well known to them but not to the general public, the attitude of the papers as regards certain criticisms would have been entirely changed. On the other hand, we know of at least one city where the relations between the company and the press are exceedingly amicable, in spite of the fact that no newspaper man receives a pass.

If the newspapers know that a request for information as to any event of public interest in connection with the railway will be honored promptly and intelligently and as fully as the policy of the company will permit, they will soon acquire the habit of taking advantage of this opportunity. To do this properly it is not necessary for the president himself to be interviewed on all occasions. Let some official be regularly designated for the purpose, one who will be recognized as speaking with authority, and who will have the confidence of the press that they are securing all the facts available so far as the company is concerned. In some cases the chief executive officer can be brought into the interview to add weight to it. In most instances, however, it is more desirable, as stated, especially on a large road, for some other person, either by name or impersonally as a "prominent official," to make the statement as coming from "the company." Then, if through any unfortunate slip which sometimes occur, it is found that a mistake has been made, the president can explain that the official quoted had been misinformed, but that the correct facts are as given by him.

To be successful, such a plan would have to be conducted in a way that would insure the absolute confidence of the papers. The official designated as the medium for presenting the company's side of any story should be accessible at all hours of the day or night, either in person or by telephone. He should be conversant with newspaper methods as well as railway practice, and should be able to explain intelligently to the untechnical readers of the papers and to their representatives, the newspaper men, any of the simple points in railway operation which may make one line of policy or another advisable. He should be fully conversant with the policy of the company and promptly informed as to all events of public interest which occur on the road and should know definitely just how much of this information should be given out. Above all he should be perfectly impartial and frank in his dealings with the papers, and should be absolutely accurate in any facts which he may give out.

Such an official could also be of great service in other ways than in defending the company against the publication of erroneous statements. He could often bring to the attention of the papers facts creditable to the company in its relations with the public or its employees, but which otherwise might escape notice, and thus create a sentiment that the corporation has the interests of the community as well as its own at heart.

The plan outlined above, of appointing a special official for this service, may seem to many companies unnecessary, and where the managing officer of a corporation has the time to devote to the subject this is undoubtedly so. But the method laid down of the proper relations between the press and the company is absolutely correct, and on large roads a multitude of other affairs demand the attention of the president or manager, and often prevent him from caring properly for the outside press, and it is here that the intelligence bureau can accomplish the most good.

THE PACIFIC ELECTRIC RAILWAY COMPANY'S SYSTEM—I

The electric railway systems in and about Los Angeles are considered by outsiders as somewhat complicated, confusion having been caused, possibly, by the rapidity which has marked the traction development of the city. A few years ago the Los

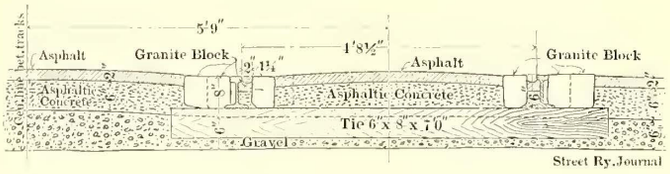


FIG. 2.—STANDARD TRACK CONSTRUCTION ON PAVED STREETS

Angeles railways were practically unknown outside of the vicinity of operation. To-day they have placed Los Angeles first among cities of its size in respect to the excellence of local transportation facilities.

Prominent names in the short but comprehensive history of the Los Angeles railway systems are those of Messrs. Clark, Sherman and Hook, but much of the recent development has been due to the Huntington-Hellman syndicate, which entered the city field in 1898 and the interurban field in November, 1901.

At the present time three of the five operating companies having headquarters in Los Angeles are controlled by this syndicate. They are the Los Angeles Railway Company, the Pacific

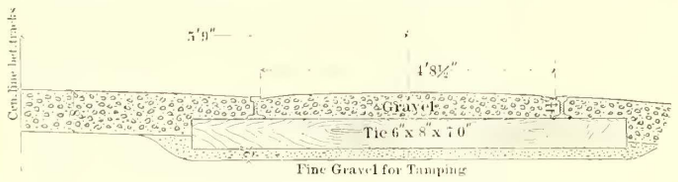


FIG. 3.—STANDARD TRACK CONSTRUCTION ON GRAVELED STREETS

Electric Railway Company, and the Los Angeles Interurban Railway Company. The first mentioned company operates entirely within the city and has fifteen lines, with 115 miles of track, and 8 miles under construction. To the Pacific Electric Railway Company has been given the work of developing interurban railways, and on Jan. 1, 1904, it was operating seven lines, extending north, east and south to Pasadena, Mt. Lowe, Monrovia, San Gabriel, Whittier and Long Beach, in addition to five city lines, its trackage at that time amounting to 190 miles. Since then the Los Angeles Interurban Railway Company, which was incorporated by Huntington interests last June to carry on the interurban development when the capital of the Pacific Electric Railway Company was exhausted, has come

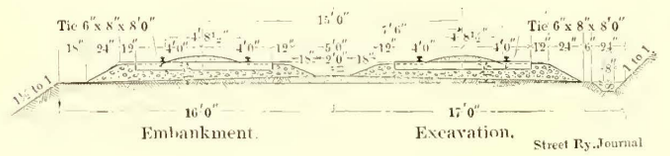


FIG. 4.—STANDARD INTERURBAN "TRACK CONSTRUCTION" OF PACIFIC ELECTRIC RAILWAY

into operating existence. It has taken over 27 miles of city lines of the Los Angeles Traction Company, the 24-mile single-track road to San Pedro of the California Pacific Railway Company, the Whittier line of the Pacific Electric Railway Company, and of lines under construction an 11-mile double-track road to Glendale on the north, a 10.27-mile branch to San Pedro from Dominguez on the Long Beach line, a 20.40-mile branch from the Long Beach line to Newport Beach, and several shorter branches. To the interurban company will fall practically all of the many extensions that are proposed. The Los Angeles Railway Company and the Pacific Electric Railway Company are distinct operating companies, and for that reason will be treated separately, as far as possible, in this and succeeding descriptive articles of the Los Angeles traction systems. The Los Angeles Interurban Railway Company is a separate corporation from the other two, but as it is closely allied with the Pacific Electric and is virtually carrying on the construction

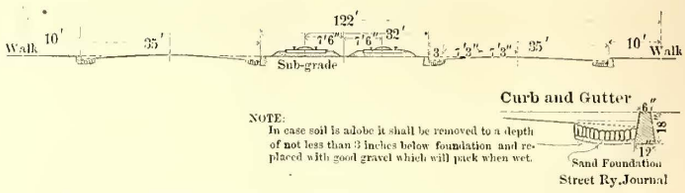


FIG. 6.—CROSS SECTION OF TRACK ON BOULEVARD, SAN MARENO AND LAMANDA PARK EXTENSIONS

work begun by that company with the same engineering staff, it will be treated together with it.

Besides the three Huntington corporations mentioned, there are two independent companies. The Los Angeles-Pacific Railroad Company operates upon 140 miles of track a network of interurban lines from Los Angeles west to the ocean resorts, of Santa Monica, Ocean Park, Playa del Rey, Manhattan, Hermosa and Redondo; and the Los Angeles & Redondo Railway Company has recently converted a steam line, between Los

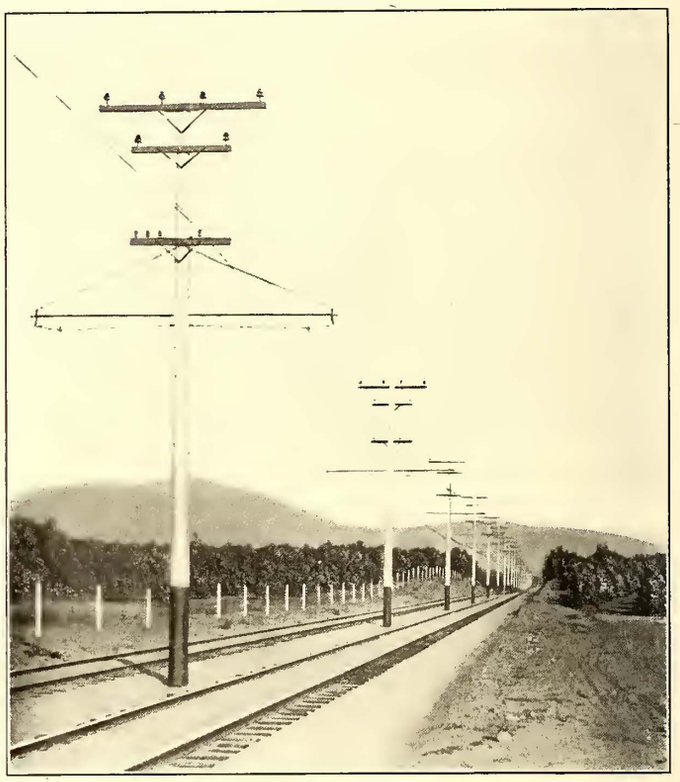


FIG. 5.—BALLASTED TRACKS AND OVERHEAD CONSTRUCTION ON MONROVIA LINE

Angeles and Redondo, into an electric system with 42 miles of track.

The routes of all of these roads, excepting the Los Angeles Railway, are indicated on the accompanying map, Fig. 1. This map covers the valley of Southern California from the ocean to the San Bernardino Mountains, and from the San Gabriel Mountains south to the ocean, and includes most of Los Angeles County and parts of San Bernardino, Riverside and Orange Counties. The Pacific Electric Railway Company's completed and proposed lines are indicated, as are also the roads of the Los Angeles Interurban Railway Company, the Los Angeles-Pacific Railway Company, and the Los Angeles & Redondo Railway Company. The tracks of the interurban company, which are indicated by short dashes, are really only tentative, since, although they are covered by the company's charter, their construction may be considered at present as only a possibility,

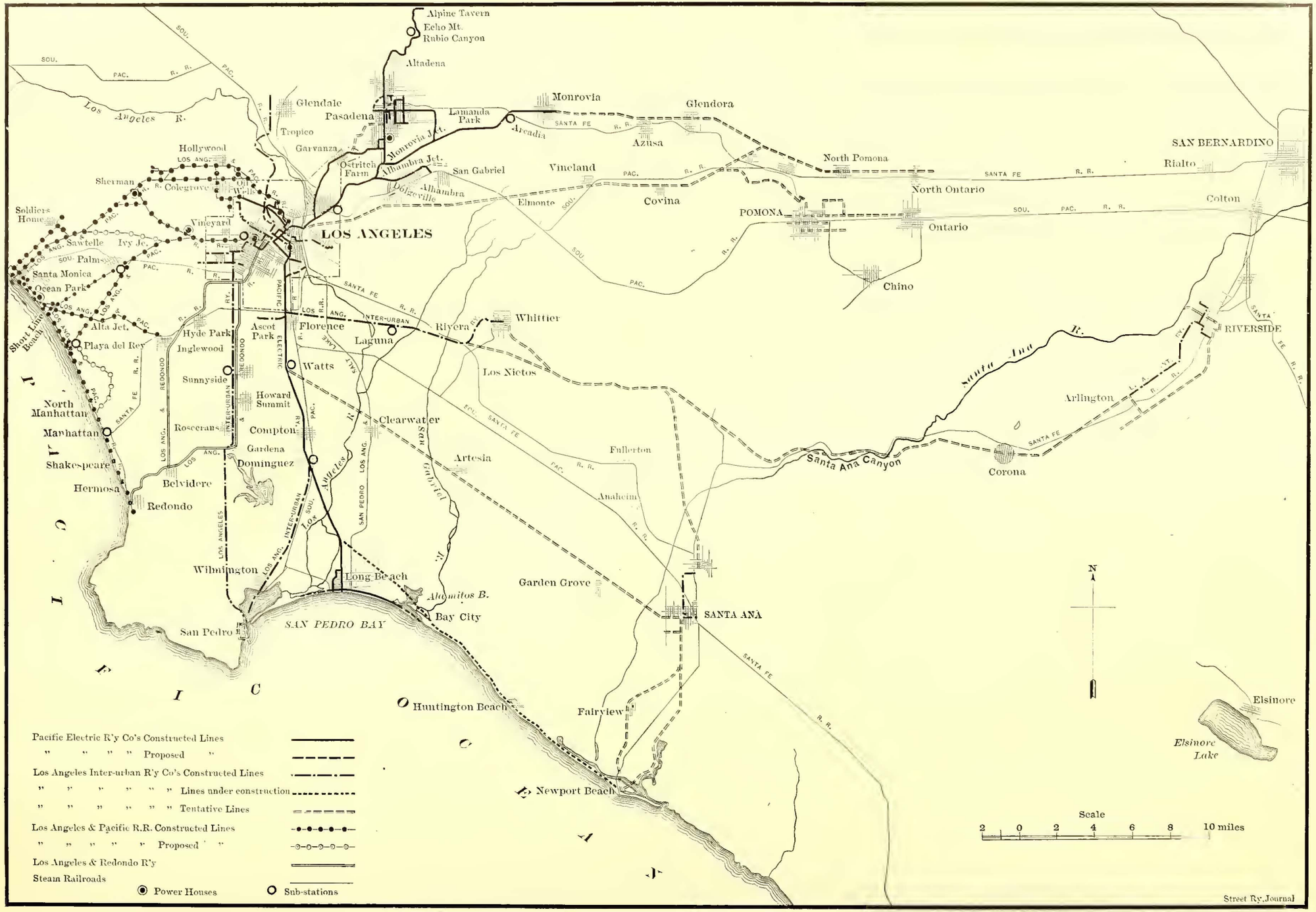


FIG. 1.—MAP OF INTERURBAN ELECTRIC LINES IN THE NEIGHBORHOOD OF LOS ANGELES

no definite plans for their building having been made. By reference to the map it is seen that these lines extend to Pomona and Ontario by two routes, to Santa Ana by two routes, with extensions to connect at Newport Beach with the coast line now building from near Long Beach, and an extension to Riverside, where connection would be made with the lines of the Riverside & Arlington Railway Company, already controlled by Mr. Huntington. Between Orange and Santa Ana there is at present a 4-mile steam-motor road, owned by the Pacific Electric Railway Company. Steam power stations and sub-stations that are already built are also indicated on the map.

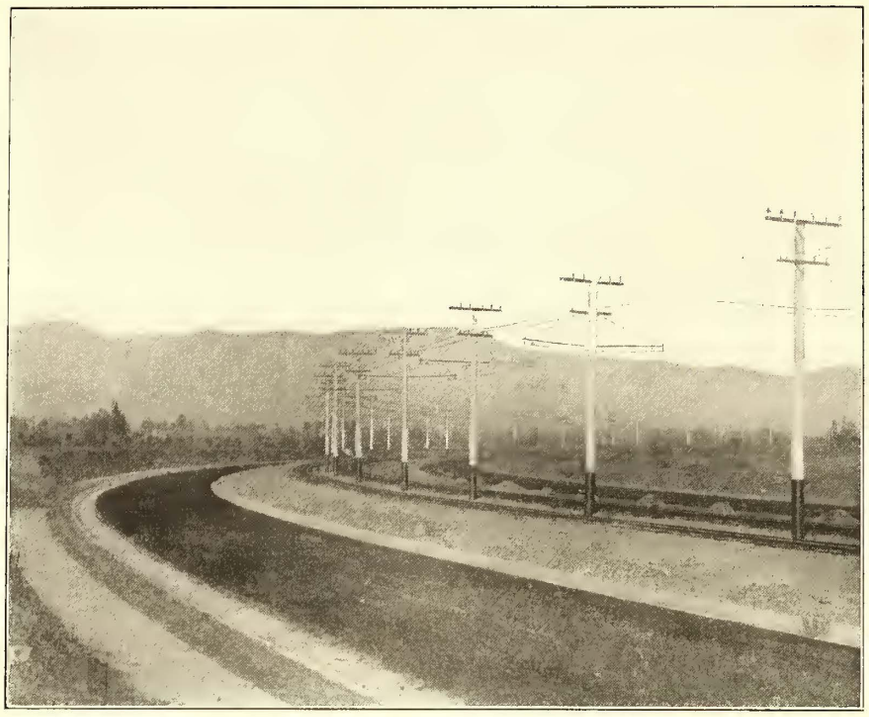


FIG. 7.—VIEW OF BOULEVARD—HUNTINGTON DRIVE

Of the three railway companies controlled by the Huntington interests, the Pacific Electric Railway Company, as already mentioned, is the principal one which at present operates interurban lines. H. E. Huntington's personal supervision has been given to the construction of this company's new lines, and the operation and maintenance of those already built, and it is of some of the distinctive points of the physical features and operation of this road, as they have been worked out under his management, that the present article will treat.

STANDARD TRACK CONSTRUCTION

One of the most noteworthy features of the Pacific Electric Railway system, considering that its official age is less than two years, is the standardization of its track and overhead construction. But in these standards and the methods of construction and maintenance may be seen the results of the years of practical experience in steam railroad operation which the chief officials of the company have had.

The standard tie construction in use on paved streets is shown diagrammatically in Fig. 2. The rails are of the 6-in. shanghai T-section, weighing 60 lbs. to the yard, and coming in 60-ft. lengths. They are laid on 6-in. x 8-in. x 7-ft. redwood ties. The pavement construction consists of 6 ins. of gravel and 6 ins. of asphaltic concrete topped with 2 ins. of asphalt. The gravel bed extends 2 ins. below the ties, and is thoroughly tamped. On both sides of the rails are laid 6-in. granite blocks, the outer ones close to the head of the rail and the inner ones 2 ins. from the rail, leaving a groove 1½ ins. deep for the wheel flange. The space between rail and block is filled in with asphaltic concrete and asphalt. There are about 9 miles of broad-gage double track of this standard in the streets of Los Angeles and Pasadena. The tracks are laid on 11-ft. 6-in. centers, and the company is required to keep the pavement in repair to a distance of 2 ft. outside of the rails.

On gravelled streets the standard tie construction is that illustrated in Fig. 3. The rails are of the 60-lb. 4¼-in. A. S. C. E. section, and they are laid on 6-in. x 8-in. x 7-ft. ties. Between ties is placed 8 ins. of ballasting gravel, while 2 ins. of fine gravel is used for tamping under the ties.

The construction adopted for the standard roadbed of the interurban lines of the Pacific Electric Railway Company, where the company has its own private right of way, has the good points of the best steam practice adapted to suit the conditions of electric service. Fig. 4 shows a section of this standard roadbed with tracks laid on 15-ft. centers. Very recently the standard has been changed to 15 ft. 6 ins. between centers, but in other respects the drawing illustrates the construction used. The rails are of the 4¼-in. T-section, of such proportions and composition necessary to meet the A. S. C. E. inspection standard. They are laid in 60-ft. lengths, on 6-in. x 8-in. x 8-ft. hewn redwood ties, spaced 2 ft. centers on roadbed and 16 ins. on bridges.

I. & C. tie plates are used. The gravel ballast is rounded to 4¼ ins. above the ties in the center, and from the rail is carried 1 in. below the ties to a point 12 ins. beyond their ends, where an 18-in. slope is given to the toe of the ballast. The tops of the ties are placed 15 ins. above sub-grade, which, in case of embankment, is 32 ft. wide, and in case of excavation is 34 ft. wide, including 24-in. gutters. A 4-in. elevation in the center of the roadbed, with even slope to the sides, provides for drainage. All embankments are given grades of 1½ to 1, and excavations 1 to 1. All grading is done by contract, but the company does its own track work and construction. The ties

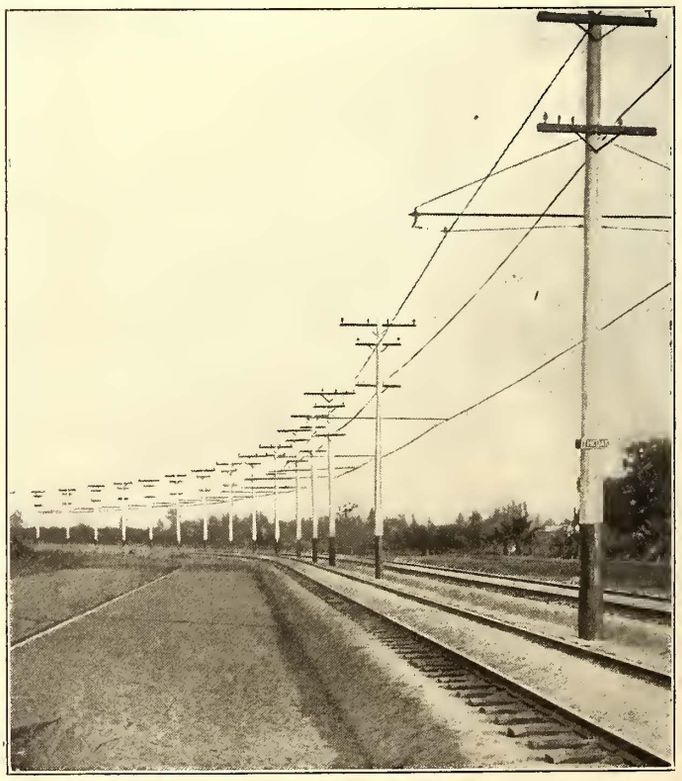


FIG. 8.—VIEW OF BOULEVARD, WITH CURVE, SHOWING BALLASTED TRACK

are all bar tamped, and every precaution is taken to settle the roadbed and insure a permanent good-wearing track. For the construction of each line the engineers were given the speeds and operating conditions of the prospective service, and the roadbed was laid out to meet these conditions, the actual construction following the theoretical design very closely.

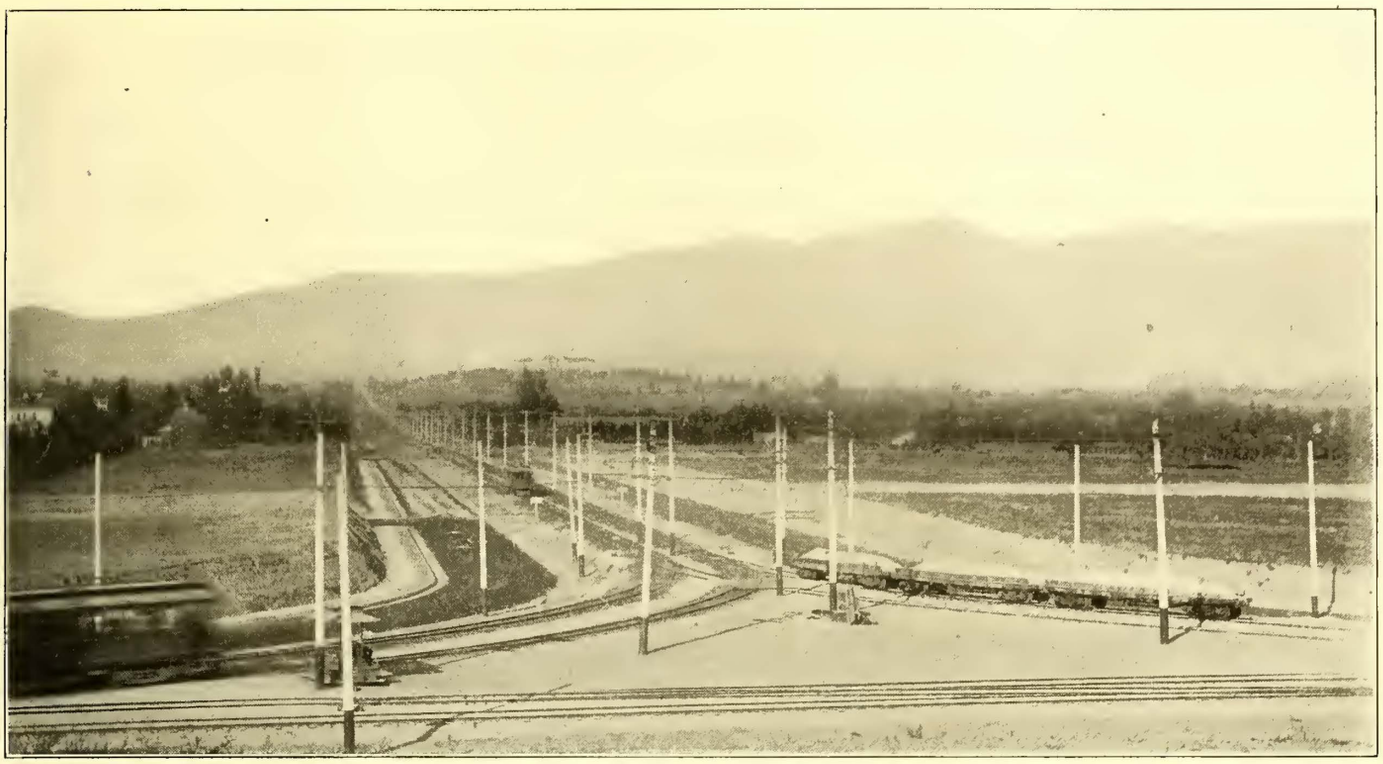


FIG. 9.—VIEW OF MONROVIA JUNCTION, WITH THREE-PART "Y"

The company has over 30 miles of this standard double-track ballasted section, including the Pasadena Short Line and the Monrovia and San Gabriel lines. Fig. 5 is a view on the Monrovia line, showing the ballasted section together with a short cut. On each side are seen orange groves, while some of the private right-of-way wire fencing is also shown. This road, known as the Orange Grove Route, was literally cut through large orange groves, and, near the Monrovia end, it passes through the famous 54,000-acre ranch of "Lucky" Baldwin.

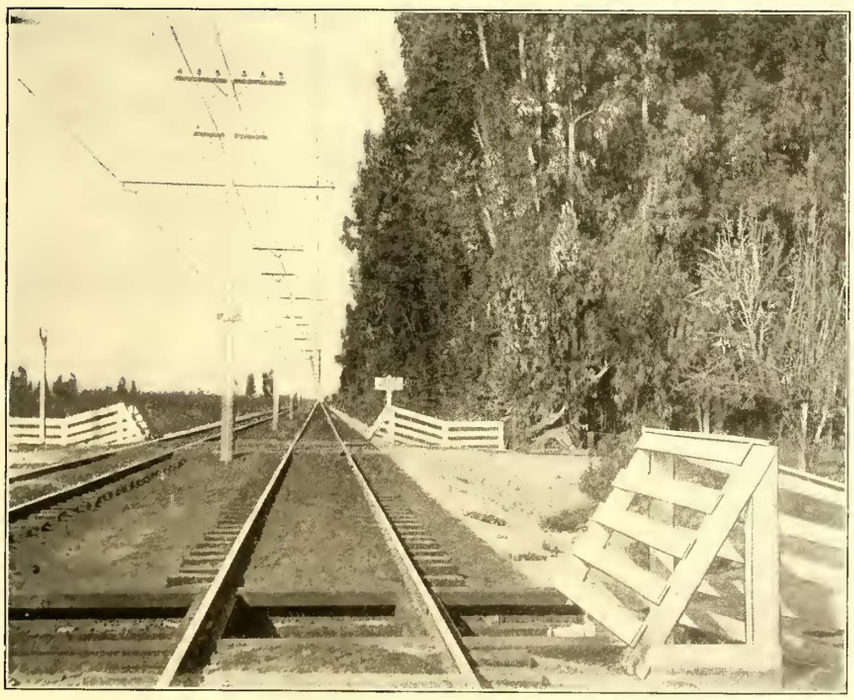


FIG. 10.—VIEW ON LONG BEACH LINE, SHOWING ROAD CROSSING

BOULEVARD SECTION

In the vicinity of Monrovia Junction, where the Monrovia line branches off from the Pasadena Short Line, the land department of the company has platted and put on the market a large residence tract, known as Oneonta Park. A similar tract, San Mareno Park, has been laid out a little further east. One of the substantial improvements made upon these tracts is a system of excellent boulevards. On portions of the Pasadena Short Line, the Monrovia line and the San Mareno and Lamanda Park extensions within the tracts, these boulevards have been laid out with a private right of way for the railway in the center. The total width of such a street is 122 ft., and this includes a 32-ft. railway roadbed in the center, with a 35-ft. road and 10-ft. walk on each side, the section being as shown in Fig. 6. The roadbed is ballasted in the standard manner, with tracks spaced 15-ft. centers, and the sub-grade raised to the level of the roadway on each side. Each roadway is held in place by concrete curbs, which flank garroted gutters. The curbs are 18 ins. high, 12 ins. wide at the bottom, and 6 ins. at the top, while the gutters are 3 ft. wide, and are laid with 6 ins stone and sand foundation. Where the soil is of an adobe nature it has been removed to a depth of not less than 3 ins. below the foundation and replaced with good gravel, which will pack when wet. Spaced at frequent intervals in the roadbed are cross drains which empty into the gutters. The roads are especially prepared by working crude oil and water into the natural soil and then rolling it. When completed there is an excellent surface, nearly equal to an asphalt pavement.

About 7 miles of this boulevard is being built along the railway right of way. One portion of it, known as Huntington Drive, has a total width of 140 ft., divided into a 60-ft. railway roadbed, two 30-ft. roads, and two 10-ft. walks. A portion of this is illustrated in Fig. 7, while Fig. 8 shows a view of the

122-ft. boulevard, with the railway ballasting completed. Both views show typical curves, and in the foreground of Fig. 8 may be noted a wooden box cross drain to the gutter. Fig. 9 is a view of Monrovia Junction, showing the three-part Y with the middle track leading toward Pasadena. In all three views the boulevards shown are not entirely completed.

FIG. 11.—VIEW ON LONG BEACH LINE AT SOUTHERN PACIFIC CROSSING

FOUR-TRACK ROADBED PROPOSED

Over that portion of the Pasadena Short Line, between East Lake Park, Los Angeles and Monrovia Junction, a distance of about 5 miles, the Pacific Electric Railway Company has planned to build a four-track roadbed, an undertaking decidedly novel for an interurban railway, and one not at all common with steam roads. On this portion of the Pacific Electric system, however, the four tracks have become a necessity. With a regular 10-minute service, increased sometimes to a 7-minute service, to Pasadena, and frequent cars going to and from Monrovia and San Gabriel, the cars are often required to run but 2 minutes or 3 minutes apart over this section. In order to provide safe and efficient transportation with operating speeds as high as 50 m. p. h., or even 60 m. p. h., it is thought the present service has about reached the limit. With the neighboring country rapidly being platted and settled, and the prospect of early extension of one or both of the eastern lines, the four tracks seem to be essential. Plans have all been drawn, and it is possible that the improvement will soon be made.

Two tracks will probably be reserved for the through Pasadena service and two for the other lines. The standard roadbed for four tracks will be 58 ft. wide on embankments and 60 ft. on excavations, the inside tracks being spaced 15-ft. 6-in. centers, and the outside ones 13 ft. from them. On that portion of Huntington Drive south of Monrovia Junction, such as that illustrated in Fig. 7, the 60-ft. roadbed has been reserved so as to provide for the four tracks. Elsewhere a 100-ft. right of way will adequately provide for the four tracks.

UNBALLASTED TRACK

An example of unballasted roadbed of the Pacific Electric system is the Long Beach line, which has come to be recognized for the high speeds at which the cars are operated. It is 21 miles in length, and is the longest single line of the system. It was built completely and put in operation inside of four months, and with the exception of two coatings of oil is in practically the same condition as when first opened, on July 4, 1902. Cars in regular service attain speeds of 60 m. p. h., while on tests, speeds of about 70 m. p. h. have been reached, these, too, with overhead trolley. The cars operate over a private right of way the entire distance between the limits of the terminal cities. Most of the road consists of tangent track, the maximum grade is 1 per cent, and as there is but one town of any considerable size on the route, the conditions are favorable for high speeds. Figs. 10 and 11 are views on the private right of way of the Long Beach line, and Fig. 12 is a view on American Avenue, in Long Beach, showing the construction on a boulevard. Fig. 13 shows an unballasted track on the Monrovia line, taken during construction. Fig. 14 is a view showing the construction of roadbed on this line without borrow pits, practically doubling the cost of the roadbed.

CURVES AND GRADES

In laying out track work the engineers of the company use a compensating clearance on curves by increasing the track center in proportion to the degree of curvature and by then giving the superelevation necessary. This is done by leaving the outside curve in the same relative position to the outer line, as on tangent track, then running a parallel offset curve for the pole line and throwing the inside track toward the radial point

FIG. 12.—VIEW ON AMERICAN AVENUE IN LONG BEACH

the same amount. The maximum curvature used on trunk line work is 3 degs., but on close interurban work through subdivided country, maximum curves of 7 degs. are allowed. On all the regular interurban lines the maximum grade allowed is 1 per cent. On the Rubio line, toward Mt. Lowe, an 8 per cent grade is necessary.

JOINTS, BONDS AND SPECIAL WORK

All rail-joints in the city track are cast-welded, the Falk process being employed. On interurban lines six-pole angle-joints are used, with holes drilled for 7/8-in. bolts. Even joints are laid in the city and broken joints in the country. The Brown-Edison oooo copper bond is the standard adopted, and it is applied in the usual method, the Brown grinding machine being used to polish the rails. For cross bonding between tracks ooo copper is employed, and the rails are connected to the negative leads at the sub-stations with cables of calculated sizes.

All track is laid with tight joints, and none but extreme temperatures are taken into consideration for contraction and expansion, since variations in temperature in Southern California are not great at any time of the year. No trouble from electrolysis has been experienced, but it is guarded against in the conduit districts of the cities by laying brick or other non-conducting material around the base of the rail.

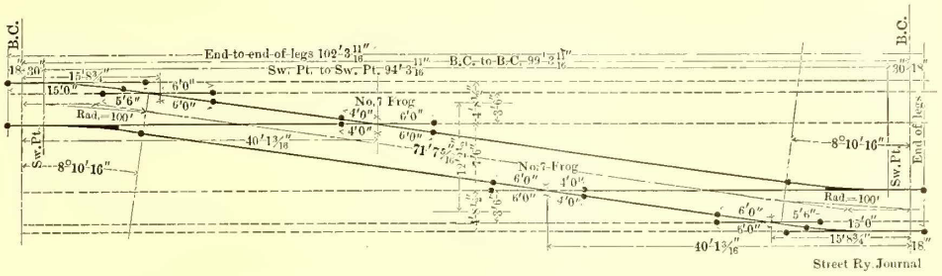


FIG. 15.—RIGHT-HAND CROSSOVER WITH TWO GAGES

Except those on bridges the ties used throughout the system are of California redwood, and their life is estimated at from ten to fifteen years. In the seashore cities, where the streets are sprinkled with salt-water from the ocean, both rails and ties have a life of only about six years.

The company builds all its own special work, except the cast joints, in its own shops, where ample facilities are provided for this class of work. Since the city systems have the narrow gage of 3 ft. 6 ins., and all the interurban lines have the stand-

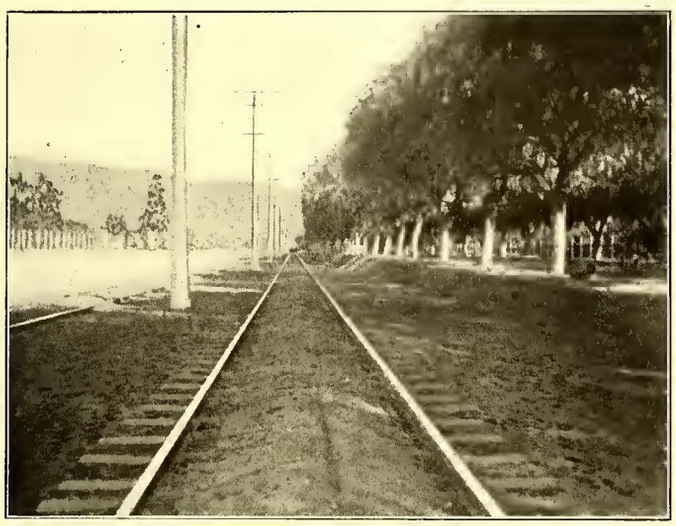


FIG. 13.—UNBALLASTED TRACK ON MONROVIA LINE

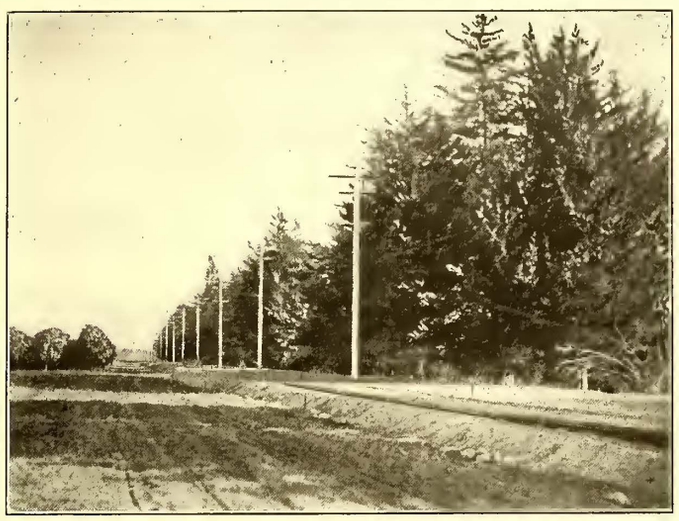


FIG. 14.—ROADBED WITHOUT BORROWPITS

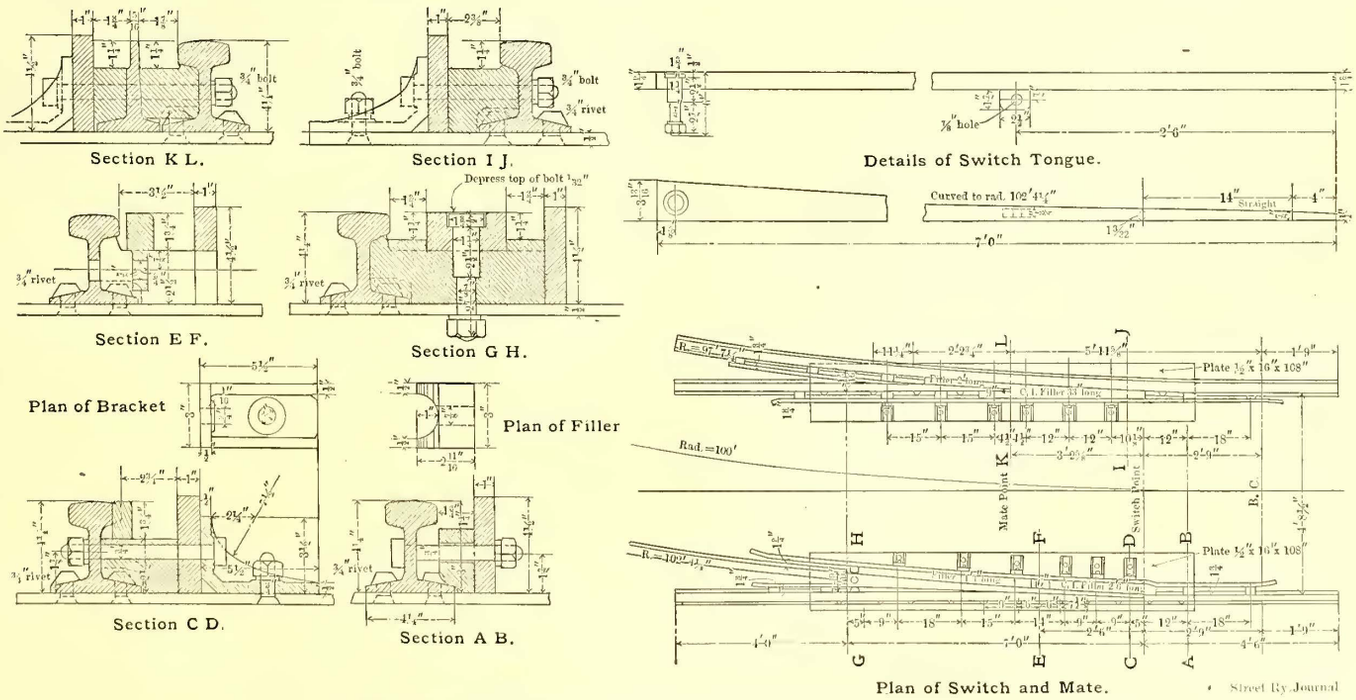


FIG. 16.—STANDARD SWITCH AND MATE USED BY THE PACIFIC RAILWAY COMPANY

ard gage, the special work necessary is quite extensive. Fig. 15 illustrates the special work used in a standard right-hand cross-over for combination gage, 6-in. 62-lb. T-rail being used.

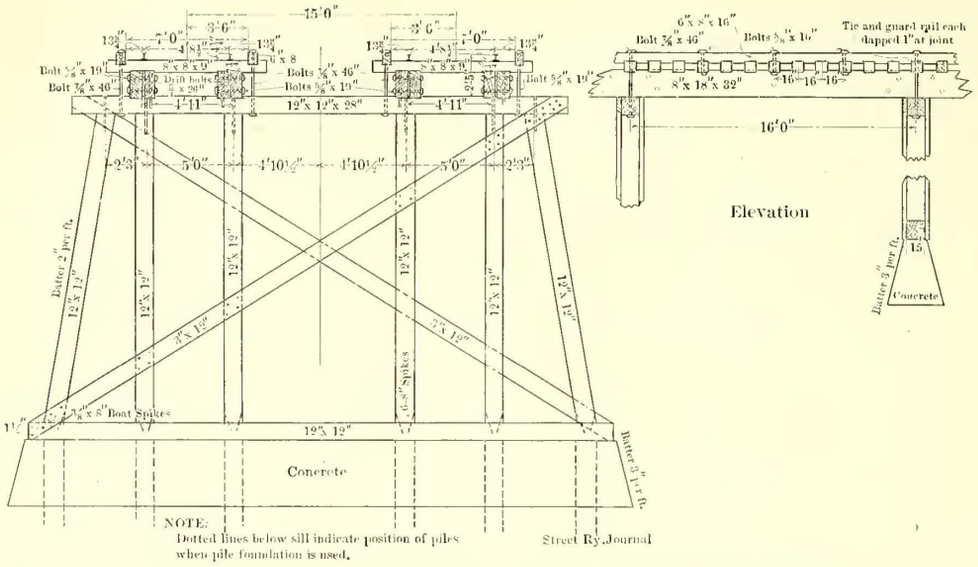


FIG. 17.—CONSTRUCTION AND DETAILS OF STANDARD TRESTLE

In Fig. 16 is shown a standard switch and mate, used with 60-lb. A. S. C. E. rail. All joints are planed to close fits, and great care is exercised in having all parts properly proportioned.

New Century switch stands, manufactured by the Pennsylvania Steel Company, are used for all interurban switches.

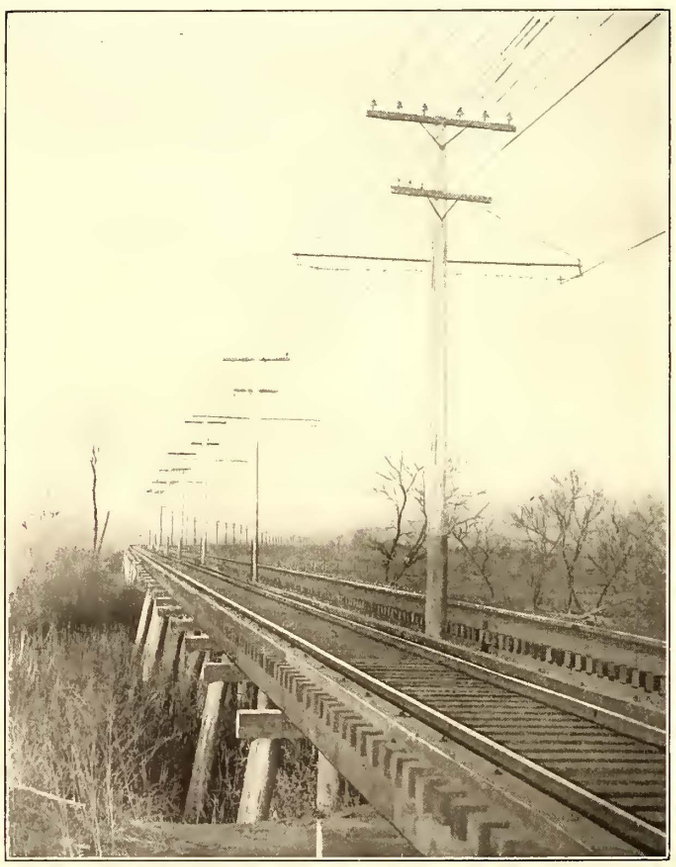


FIG. 18.—PILE BRIDGE 1000 FT. LONG ON LONG BEACH LINE

For street work a spring switch, operated by chain and handle that drops flush with pavement, is used.

TRESTLES, CULVERTS AND CATTLE GUARDS

For all trestles on the lines, standard framed vents, with 16-ft. spans, have been adopted. The rails are laid on 8-in. x 8-in. x 9-ft. ties, spaced on 16-in. centers, which are supported by double 8-in. x 18-in. x 32-ft. girders, bolted together. The caps are 12 ins. x 12 ins. x 28 ft., and are fastened by ⅞-in. x 24-in. drift bolts to the 12-in. x 12-in. posts. The construction is shown in Fig. 17, which illustrates the standard trestle with concrete foundations. The dotted lines below the 12-in. x 12-in. sill indicate the position of the piles where pile foundations are used.

Across the bed of the San Gabriel River, on the Whittier branch, a 1320-ft. pile bridge of this standard construction has been built. The bed of this stream is dry the greater portion of the year, but as it is apt to carry heavy floods in the springtime, the company has taken especial precautions to protect the bridge and the farming country in the vicinity, by clearing the channel of all brush and driftwood and building up the banks, so that the river will not be diverted from its course.

For most of the other bridges on the interurban lines similar pre-

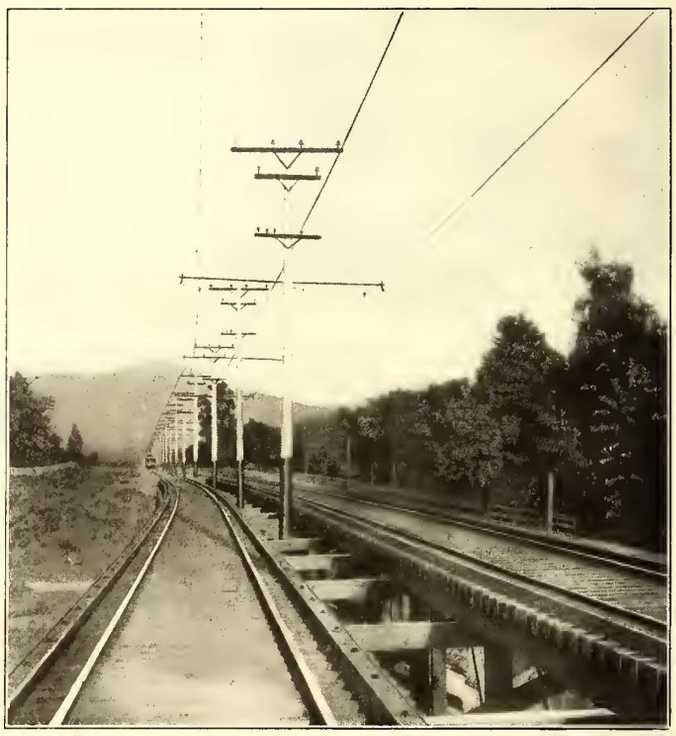


FIG. 19.—BRIDGE ON MONROVIA LINE—FLOOR VIEW

cautions have been taken to keep the spring floods within the beds of the rivers. The usual method is to dig a trench along the bank and build in it a barb-wire fence, with wires about 4 ins. apart. Cactus plants, as they are chopped or dug out of the roadway, are then filled in around the fence, and packed and covered with sand to form a sort of dyke. The idea of using cactus was obtained from the custom of the Mexicans and Indians who inhabited the country about a century ago. Many of their old irrigating ditches are still to be found, and where cactus was used in the banks they are very well preserved. The cactus is ever present in that part of the country, and as it grows equally well in dry and wet weather it serves to hold the banks together better than willow or anything of a similar nature.

In Fig. 18 a pile bridge, 1000 ft. long, across the Los Angeles River, on the Long Beach line, is illustrated. A typical concrete

pier bridge is illustrated in Figs. 19 and 20. This structure is on the Monrovia line. Concrete abutments are employed, and it will be noted that they are stepped at the ends, so that in case the company desires to widen the bridge for four tracks, there will be a good foundation for the necessary additions to the abutments. Fig. 21 is a detail view taken during construction of a concrete abutment, showing the method of stepping the end. Fig. 22 shows a standard post trestle without floor. In some cases concrete piers are used for bridges without posts, the floor resting on sills which are bolted to the piers. A sample of this construction, showing the concrete piers ready for the sills, is given in Fig. 23.

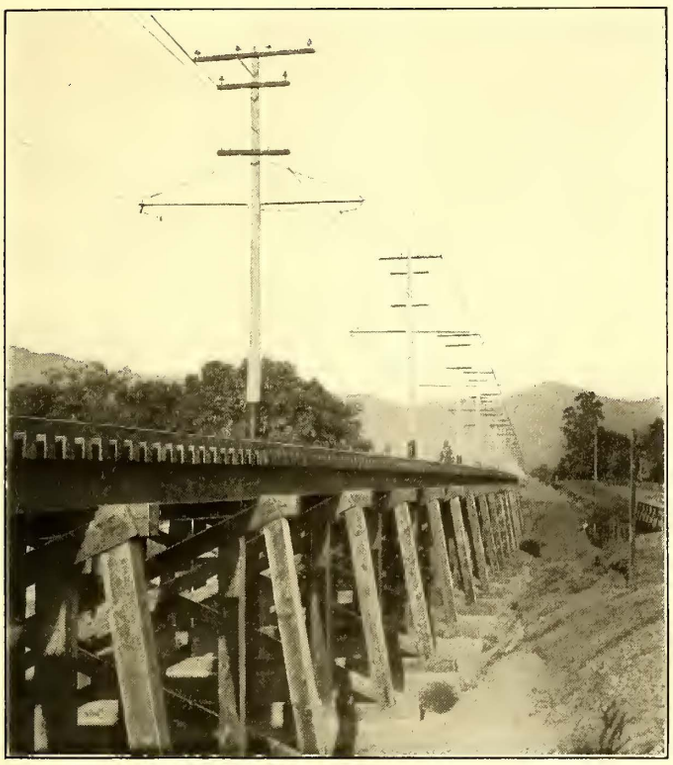


FIG. 20.—BRIDGE ON MONROVIA LINE—SIDE VIEW

FIG. 22.—STANDARD POST TRESTLE WITHOUT FLOOR

When conditions are favorable, concrete steel culverts are built, a typical one on the Monrovia line taking the form illustrated in the drawing in Fig. 24. The railway crosses the culvert at an angle, with a roadbed 32 ft. wide. The culvert is 200 ft. long, and has an arched section 20 ft. wide, with 4-ft. foundation walls. Inside it is 7 ft. 6 ins. high. The culvert arch is 12 ins. thick under the railway, and 8 ins. at the ends. Round bars, 5/8 in. and 3/8 in. in diameter, are used for the framework, as indicated in the drawing.

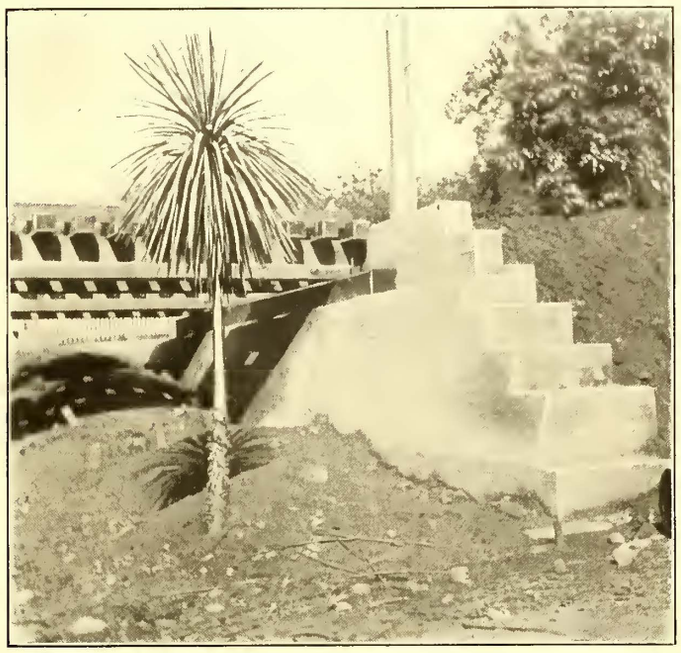


FIG. 21.—DETAIL, SHOWING STEPPED ABUTMENT OF CONCRETE PIER BRIDGE

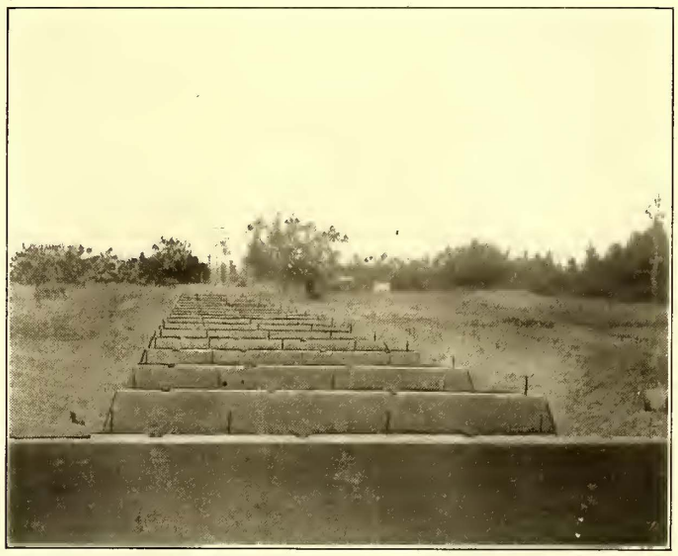


FIG. 23.—CONCRETE PIER CONSTRUCTION WITHOUT POSTS

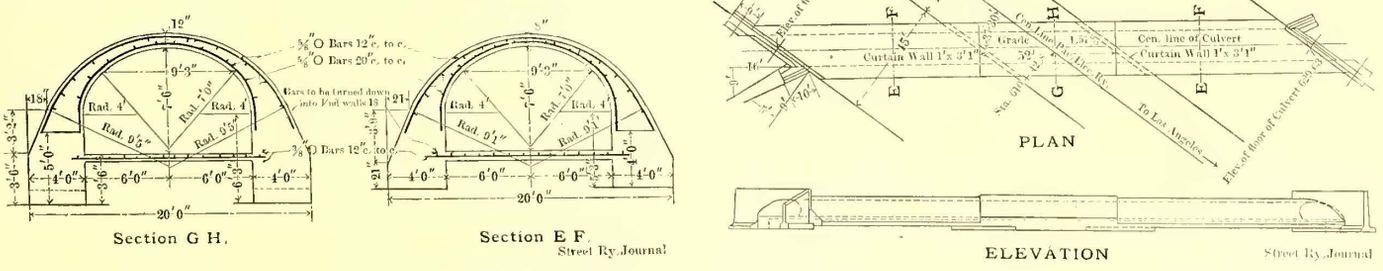


FIG. 24.—CONCRETE CULVERT ON MONROVIA LINE

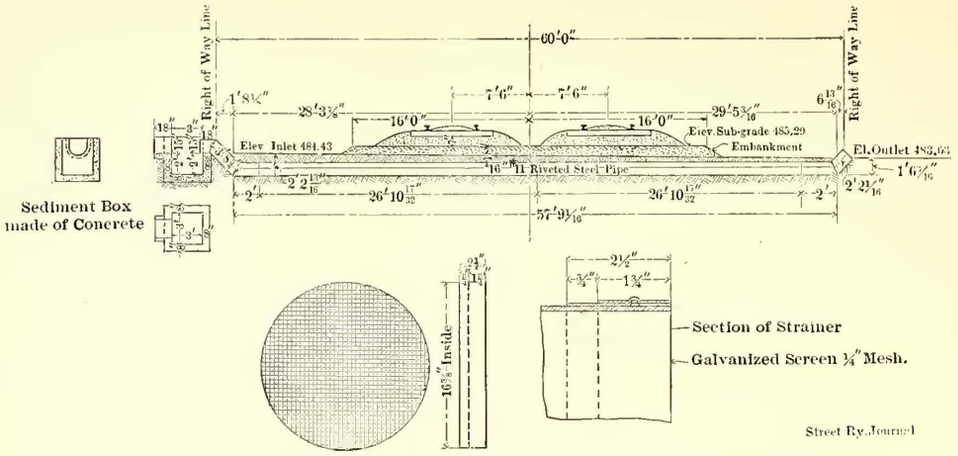


FIG. 25.—SPECIAL INVERTED SIPHON FOR IRRIGATING WATER

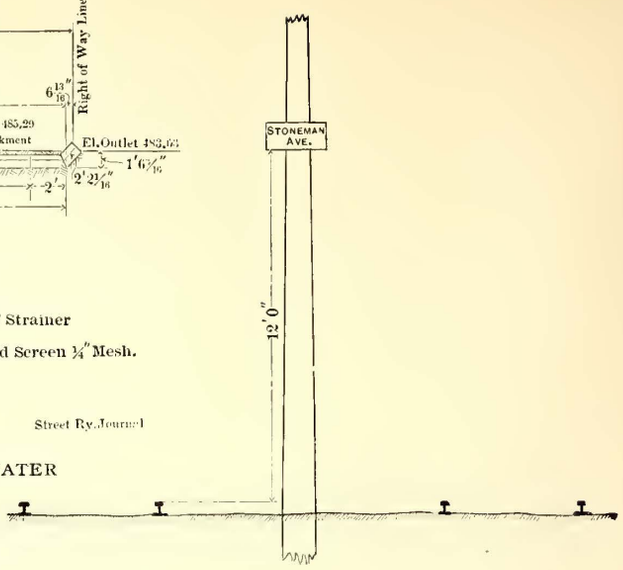


FIG. 29.—STANDARD STREET SIGN FOR CENTER POLE

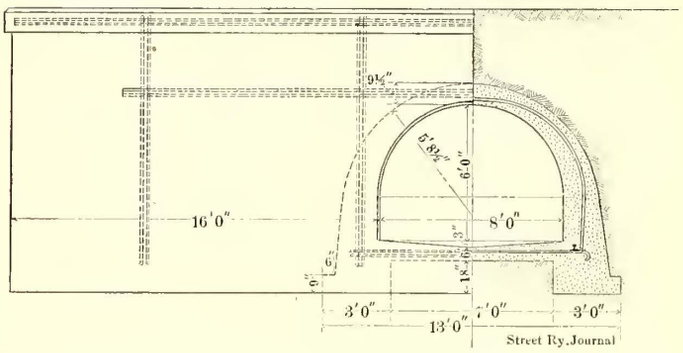


FIG. 26.—CONCRETE CULVERT FOR IRRIGATING WATER

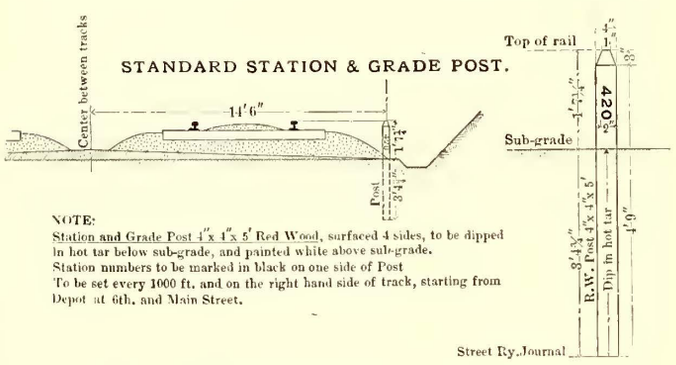


FIG. 30.—STANDARD STATION AND GRADE POST

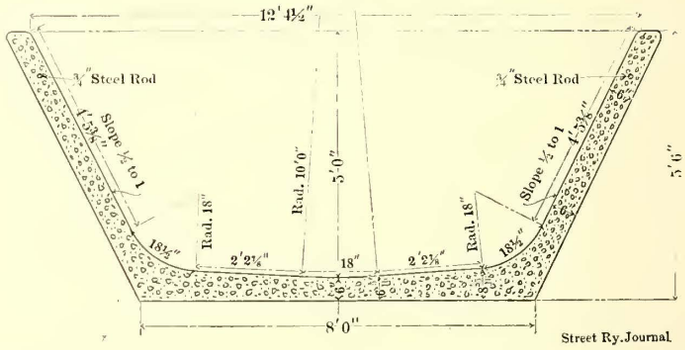
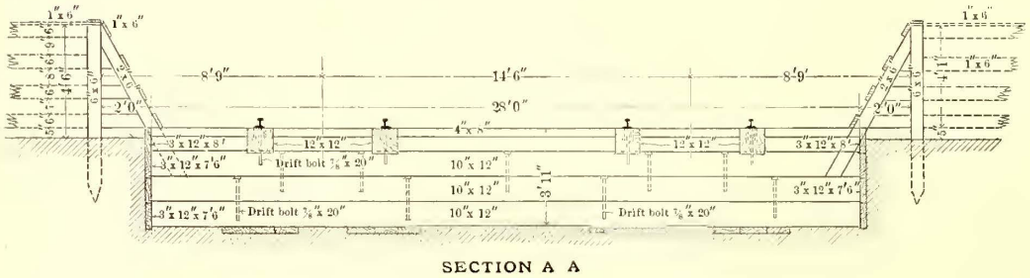
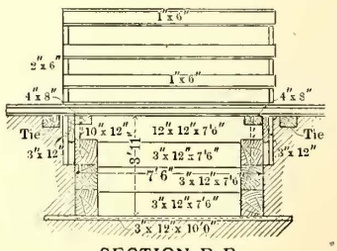


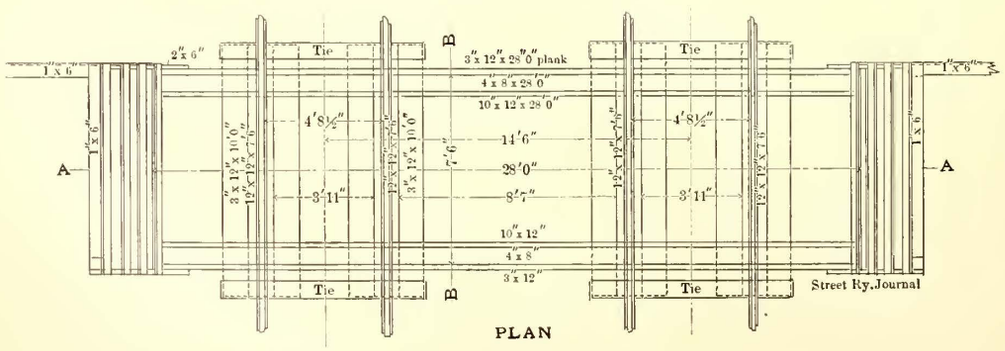
FIG. 27.—CONCRETE DITCH CONNECTING WITH CULVERT



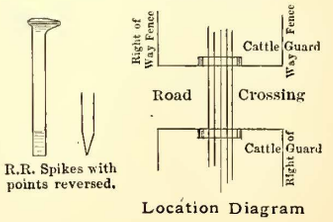
SECTION A A



SECTION B B



PLAN



Location Diagram

FIG. 28.—OPEN-PIT CATTLE-GUARD

Another type of concrete culvert is illustrated in Fig. 26. This is used on the Monrovia branch to carry the waters of a large irrigating ditch under the tracks. It is 140 ft. long, and has a width at the foundation of 13 ft. The culvert has an arched section with interior dimensions of 8-ft. x 6-ft. 3-in. Wing walls, the height of the culvert, extend 16 ft. on each side of the opening at each end. For strengthening these wing walls old railroad rails are used.

Rails are also run longitudinally in the foundation of the culvert, and to them are joined hooks of ¾-in. steel rods. For 30 ft. in the center these rods are spaced on 18-in. centers, then for 18 ft. on each side they are spaced on 2-ft. centers, and for the remaining 37 ft. at each end they are spaced on 3-ft. centers. The section of the cement ditch which connects with this culvert is given in Fig. 27. Its construction, as well as that of the culvert, are of interest, as they indicate the attention which railways have to pay to irrigating projects in California. For carrying similar ditches across the tracks the Pacific Electric Railway Company frequently employs the special inverted siphon shown in Fig. 25. The water is discharged from the open ditch made of concrete, with 8-in. walls. This box is 3 ft. square and 3 ft. 3 ins. deep, 2 ft. of the depth being provided for sedimentation. After passing through a strainer, formed of galvanized screen with ¼-in. mesh, the water is carried under the track in an inverted siphon, formed of 16-in. No. 11 riveted steel pipe.

Small openings in the roadbed, such as for drains, are carried across under the track in terra-cotta tile. Where iron pipe lines for water, oil or gas are carried across the right of way they are enclosed in redwood boxes or log water pipe, so as to guard against electrolysis or loss of return current from the rails.

On the private right of way open-pit cattle guards, of the standard type illustrated in Fig. 28, have been placed. The open pit is preferred, as cattle are not so apt to venture across them and they are large enough for animals to fall into without being injured. The pits are 28 ft. long, 7 ft. 6 ins. wide, and 3 ft. 11 ins. below the top of the ties. The sides are formed of 10-in. x 12-in. sills, and the rails are carried across on 12-in. x 12-in. stringers, both sills and stringers being fastened by ⅞-in. x 20-in. drift bolts. The bottom of the pit is floored only beneath the rails. The drawing also shows the details of the guard fence. One of these cattle pits, as used on the Long Beach line, is also shown in the earlier illustration, Fig. 10.

For fencing the right of way no great uniformity can be applied, as the fences are built to suit the owners of the adjoining property, or according to the terms agreed upon in the grant

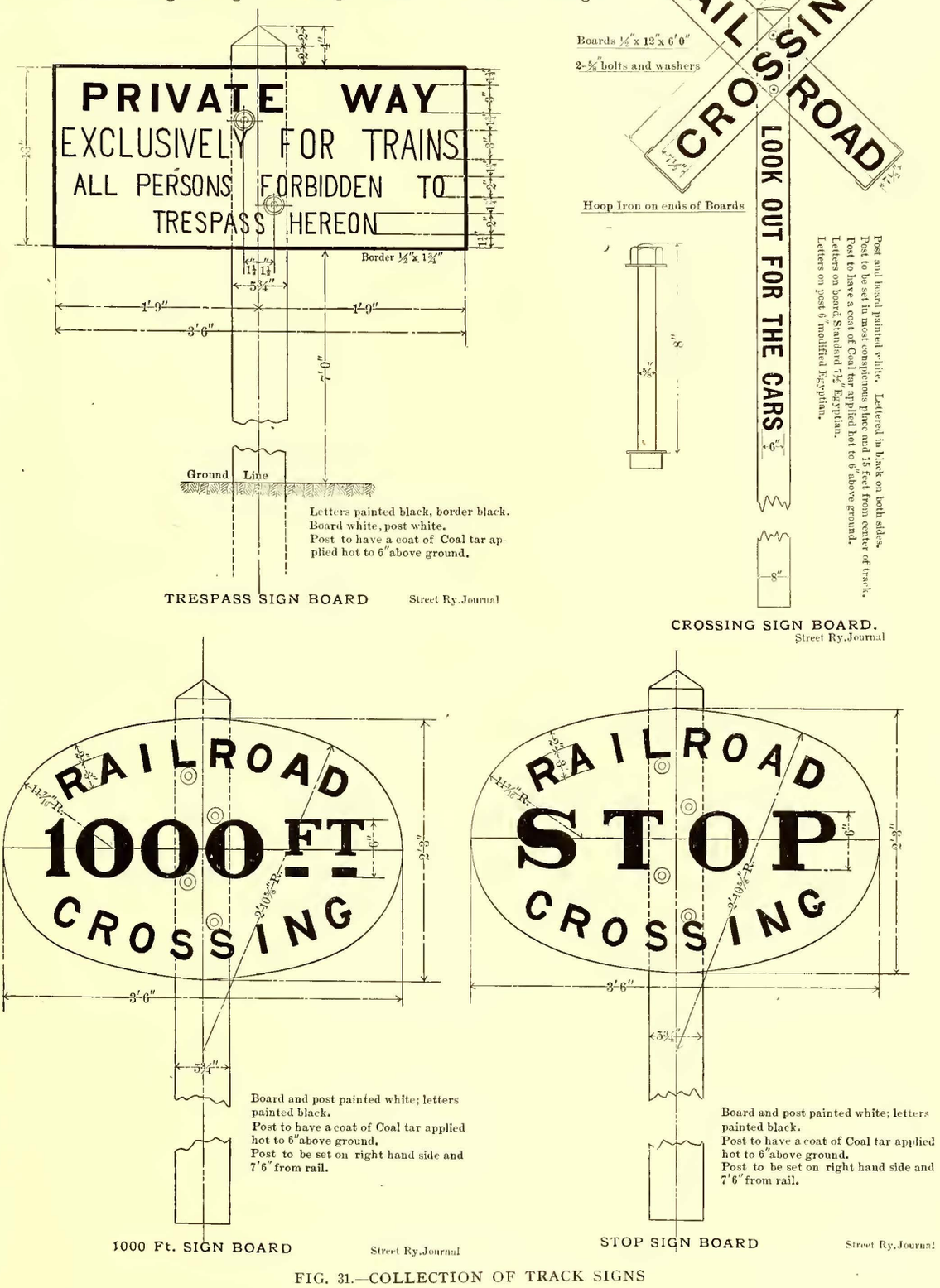


FIG. 31.—COLLECTION OF TRACK SIGNS

of the right of way. Wherever barb wire with top board is used the standard adopted is a fence 52 ins. high with four wires, and with posts spaced 12 ft. apart.

STANDARD SIGNS AND POST MARKINGS

The standardization of the track and roadway of the Pacific Electric Railway has also been made to include the public and trainsmen's signs, the stake markings, etc. In Fig. 29 is shown the standard street sign carried on the poles, and in Fig. 30 the standard station and grade posts. Fig. 31 gives a collection of these signs, the drawings being self explanatory. Those shown are the trespass signboard, stop signboard, 1000-ft. signboard and crossing signboard. Fig. 32 illustrates the standard bridge and culvert post and the standard letters and figures for stencils for stake marking. The posts for the signboards are of dressed 4 x 4's, are set 4 ft. in the ground and are dipped in hot coal tar to a point 6 ins. above the ground. The street sign, which is screwed to the center trolley pole, has white letters, on black board, but the other signs are of black letters on white boards, the posts also being white. Other interesting features of this line will be described in the next issue.

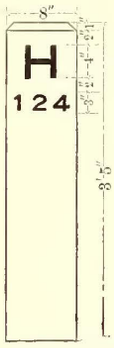


FIG. 32.—STANDARD BRIDGE AND CULVERT POST

THE ALTERNATING RAILWAY MOTOR SITUATION

BY LOUIS BELL, PH.D.

For some years past it has been obvious that an alternating-current motor, suitable for railway service, would be of enormous value in the progress of the art of electric traction. Look at the question as one may the uncompromising fact stands clearly out in the foreground that 500 volts is a pressure altogether unsuitable for the distribution of large amounts of power over considerable distances. It is a situation altogether comparable with that encountered in the early days of electric lighting, when a desperate stand was made by the low-tension contingent against the competition of alternating current. No one is disposed to deny the admirable simplicity of the direct-current distribution at short range, but even to-day, when there is scarcely a central station in the country that has not fallen back upon alternating-current auxiliaries, a plain, unvarnished statement of the losses incurred in the direct-current feeders and mains would pretty nearly raise a riot.

The development of the electric railway raises the same issues. Had it proved feasible to work railways upon the three-wire system, the situation would have been now less acute, but the exigencies of practical service have proved to be such that so far as three-wire service is concerned the game is not worth the candle.

The next step in the fight against the inevitable was the use of alternating currents for distribution, via rotary converters. This system has been developed with far more enthusiasm than wisdom, and there are to-day literally dozens of plants in which the frantic effort to develop all the energy in a single primary power house involves a daily waste of money. Even granting (which I do not) that the generation of the power in a single big plant is, under existing conditions, usually cheap enough, compared with generation in several independent stations, to offset the losses in transmission and conversion, and the upkeep and attendance on the plant required, still the rotary converter scheme fails in two essential points. First, it does not, in practice, reduce the amount of copper required in the working conductors, and, second, leaving the working voltage unchanged, it retains the serious difficulties connected with the collection of current from the working conductors.

Even the much advertised third rail, useful as it is on elevated roads and in tunnels, is not adequate for general service. When so sheltered and insulated as to be suitable for general service it must become to all intents and purposes a huge lateral trolley wire. The key to the gate that opens into the field of electric traction, *au large,* is increased voltage of the working conductors. Practically this means that the alternating current must be carried clear up to the car. It must not be understood that I am here advising the wholesale use of high-voltage alternating currents upon all trolley wires. Considerations of public safety will prohibit such a step, just as they would prohibit indiscriminate raising of the direct-current voltage, and should prohibit absolutely the use of an unshielded third rail.

Until very recently the only systems which gave promise of meeting the case were the polyphase systems with induction motors. So far as the motors are concerned they suffer from difficulties of speed regulation, being comparable in this respect to shunt direct-current motors, but are in other respects admirable. The necessity for at least two working conductors is, from the American standpoint, an almost insuperable objection, and, more than anything else, has turned American engineers toward the evolution of the single-phase motors, which have now, apparently, been brought to a very business-like condition. The somewhat tentative announcement of Mr. Lamme before the Institute set people to thinking, and the later work done abroad, fortunately, forced the hands of the American manufacturers, and served to put the commutating single-phase motor at once upon a commercial basis.

The motors already upon the stage have been already rather fully noticed in the press, so that detailed description need not be attempted here. They belong to two clearly indicated types, neither of recent invention in its main features, and both having properties akin to series-wound direct-current motors. The first type includes the Lamme and the Finzi motors, and has as its prototype the very interesting Eichemeyer motor of a decade ago. It is simply a series-wound commutator motor, with a laminated field and allied precautions against the inductive effects of alternating current. Any series-wound motor holds its direction of torque unchanged, whatever the polarity at its main terminals, and reverses only when the relative polarity of armature and field is changed. Hence, if the construction is such that the polarity reversals can rise to the frequency of a commercial alternating current without introducing collateral difficulties, one has a practical single-phase series motor with the general characteristics of the series type. To keep down reactances and parasitic currents it has been found desirable to design the motors with very powerful armatures and rather weak fields, to use high-resistance commutator leads, to keep down the currents in the coils short-circuited by the brushes, to channel the poles longitudinally, thus checking cross induction by the armature, and to make other minor structural changes. The result is a motor which is claimed to be practically sparkless in operation, and which has, to a remarkable extent, the working properties of an ordinary railway motor. The alternating machine in its present state of design is somewhat heavier than its direct current rival, and a few per cent less efficient, but it has a high power factor under conditions demanding large in-put of energy, and, thanks to the possibility of induction voltage, regulation does not make unreasonable demands upon the generators even in starting and accelerating. It requires in practice a transformer between it and the trolley wire, since it is unwise to put high voltage upon the commutator. The tests published from the Lamme motor here and the Finzi abroad, are surely most encouraging. One of the most important features of these motors is the fact that they can be made to work pretty well on a direct-current circuit, so that they can run on an ordinary trolley system by the addition of suitable regulating appliances.

This is not quite so simple as it sounds, because it has been found advisable to keep down the voltage of the alternating-current armature so that in running on a 500-volt direct-current circuit the two motors would be worked in series, or a four-motor equipment in series parallel. Still, the new motors can undoubtedly get through a direct-current route creditably well on the way to and from their regular field of action.

The second type, represented by the General Electric motor in this country, and the Eichberg-Winter motor abroad, is a derivative of Professor Elihu Thomson's repulsion motor of 1887. It is essentially a transformer motor, in which the phase relations of armature and field are definitely maintained by an artificial polar line, established by the commutator and brushes. The result is a motor which starts, as ordinary single-phase transformer motors do not, with a definite and powerful torque, and is not limited by a tendency toward a purely synchronous speed. It has, in fact, the speed-torque characteristics of a series-wound direct-current motor, so long as it is operated with its brushes, while it may be merged into a pure induction form by short-circuiting the commutator. In railway work this is not advisable, and is merely noted here as a matter of interest. The original Thomson motor and its present representative is an out and out transformer motor, but the same general scheme of operating in virtue of a polar line established by a commutator has been variously applied by Thomson himself, Wightman, Latour, Eichberg and Winter and others. Such motors all are properly derivatives of the induction motor idea, rather than foster children of the direct-current motor.

The repulsion railway motor, as described in the Institute papers by Slichter and Steinmetz, presents characteristics very similar to those of the pure series alternating type. Like them, it has rather greater weight and rather less efficiency than a standard railway motor of similar capacity, but starts and accelerates without an objectionable call for energy, and has, save at starting, a good power factor. It is radically different in the features of design from the series motors, having no salient poles, working its iron at fairly high density, and being wound, so far as its exterior connections are concerned, for relatively high voltage. As it can be readily wound for voltages up to 2000 volts or more it does not require an exterior transformer save when the trolley voltage is exceptionally high, and thus gains in weight of equipment. It can be arranged to run as a series-wound motor on direct-current lines, but probably with less ease than a pure series motor, on account of a less favorable form of magnetic circuit and radical differences in design. In spite of this it may answer sufficiently well in this function for practical purposes.

It is quite out of the question, on present data, to form a proper opinion as to the relative value of the series and the repulsion motors. The published results from the former are rather the better, but it is pretty clear that the announcements regarding the latter represent a somewhat earlier stage of development. In point of fact the characteristics of the two types differ from each other probably no more than two examples of the same type by different designers would be likely to differ. The same machine cannot be operated on both plans to obtain comparative results, for if it is a thoroughly good repulsion motor it will be a rather bad series-alternating motor, and *vice versa*.

As to general operating conditions I think we must now recognize the fact that an alternating-current railway motor, possessing thoroughly practical properties, has been produced, and must be taken into account in all future operations. Certainly within limits, and, perhaps, generally, these new machines will find an immediate place in the art. They are young yet and their design will, doubtless, be greatly improved, but even now it is probably within bounds to say that they are considerably better motors than those upon which the art of electrical traction was built up. For the present their effect will be most felt in the consideration of new roads, and it is to be hoped will prevent a repetition of some of the shockingly bad engineering not uncommonly to be found on interurban roads. One must await further experience before venturing to guess the inroads that the alternating motor can make on existing systems. Much will depend on the facility with which the alternating motors can run on direct-current networks. This feature of the case it is impossible at the present to judge. Our existing direct-current railway motors are wonderfully good machines, not to be put out of service without excellent reasons, but if they can gradually be replaced by motors able to pass out upon an interurban line with a high-voltage trolley wire, at least upon its own right of way, this replacement will assuredly take place in very many instances. At least, it may be regarded as certain that the extension of electric traction into general railroad service can take place only by the aid of high voltage-working conductors, preferably feeding alternating-current motors.

RESULTS OF THROUGH SERVICE BETWEEN CLEVELAND AND TOLEDO

Managers of all high-speed interurban railway properties are watching with great interest the possibilities of connecting up such lines and competing with the established steam roads for what may be considered as the intermediate class of the long-distance traffic. It has been demonstrated in hundreds of instances in this country that interurban lines cannot only take from the steam roads a considerable amount of traffic between points 30 miles to 50 miles apart, but actually create a large amount of new traffic under such conditions. But the possibilities of securing a similar percentage of business on lines from 75 miles to 100 miles in length are still in doubt. The whole proposition simmers down to the question of whether the frequent service and lower rates of the electric lines can be made to compensate for undeniably the higher speed of the steam lines over such distances.

In view of these existing conditions, it is with interest that this paper is enabled to present the experiences of the Lake Shore Electric Railway in its efforts to secure a portion of the through business between Cleveland and Toledo, a distance of 118 miles.

Before going into these figures, however, it is well to consider carefully a number of mitigating circumstances which have undoubtedly prevented this company from making as good a showing as it might have done, or will in the future, as well as conditions which will probably not be found with other companies similarly situated for long-distance traffic.

During eight months in the year there are daily steamers between Cleveland and Toledo which are well patronized, as it is a pleasant trip and the fare is low. For a steam competitor the company has the Lake Shore & Michigan Southern Railway, admittedly one of the greatest trunk lines in the country, giving high speed and frequent service over a route which is nearly 10 miles shorter than that of the electric road. The fastest trains make the distance in 2 hours and 35 minutes, while the ordinary trains require 3 hours and 30 minutes. The fare on the steam road is $3.25. It should also be stated that in both cities it is necessary for steam railroad passengers to take street cars to reach the business districts, which increases the time as well as the fare, as compared with the electric line, which touches the centers of both cities, and incidentally gives transfers good on the city lines. The schedule of the electric line is 6 hours for the regular cars and 4 hours and 30 minutes for the limited cars, which leave the terminals morning, noon and evening. The fare on the electric line is $1.75, and no extra charge is made on the limited.

As the result of the Everett-Moore embarrassment the Lake Shore Electric was placed in a receiver's hands just after the lines which make up the through system were physically connected. For months the power equipment and rolling stock were indifferently maintained, owing to necessary retrenchments, and the service could not be relied upon. Furthermore, it was necessary to change cars at two points. These conditions, however, have been greatly improved during the last few months, and the schedule was reduced from 7 hours to 6 hours, and was better maintained. It is only within the last three or four months that cars have been run through without change.

About the middle of October the company installed the limited cars mentioned, and a pronounced increase in through traffic was at once noticeable. In November an accident to the power station necessitated the withdrawal of the limited cars and the reduction of regular cars to 2-hourly headway. This condition extended over into December, so that in the figures presented herewith there are not a fair showing for either the limited cars or the regular through cars. It should also be borne in mind that the figures include only actual tickets sold at the Toledo and Cleveland stations. Cleveland has no electric railway station worthy of the name, and it is a safe guess that half the people who ride on the interurbans do not know of the existence of a ticket office. Many passengers board the cars at some point other than the Public Square, and pay cash fare to the conductor. Many other people, particularly traveling men, who wish to visit the intermediate towns, buy tickets from town to town and stop over a car to see customers. In this way it is possible to cover six good towns and only spend a day on the trip from Cleveland to Toledo. It is safe to figure that if an accurate record of these various classes could be obtained they would more than double the so-called through traffic:

	Tickets Sold, Toledo to Cleveland			Tickets Sold, Cleveland to Toledo		
1903	Single	Excursion	Total Single Trips	Single	Exc'sn	T'l Single Trips
January	439	51	541	364	67	498
March	465	88	641	432	75	582
April	487	83	653	360	69	498
May	493	69	631	368	82	532
June	532	55	642	421	67	555
July	586	58	702	492	85	662
August	779	101	981	570	117	804
September	752	117	984	578	115	808
October	870	124	1,113	752	161	1,074
November	674	124	822	641	112	865
December	730	198	1,126	781	200	1,181

The officials of the company figure that the new limited cars are a most profitable feature of the service. They cost no more to operate—possibly a trifle less than the regular cars in view of the less frequent stops—and they are earning a trifle over 40 cents per car mile as compared with an average for all cars, including the limits, of 22 cents per car mile.

MANGANESE STEEL RAILS IN THE BOSTON SUBWAY

The Boston Elevated Railway Company has been making some interesting experiments with solid manganese steel frogs and curve rails in its subway, where the conditions of wear are very severe. It has now three solid manganese steel frogs, and is installing a fourth. The manganese steel rails are laid in 20-ft. lengths, and the experience with them, so far as wear is concerned, has been very satisfactory. The company has laid four curves, one of 90 ft. radius, with this rail, and has a total of 685 ft. of this rail in service. The Boston Elevated Railway Company is also conducting some experiments with nickel steel rails for curves where the wear is very severe.

SHOP KINKS

A STATIONARY LAMP BANK

It is safe to say that all who have done motor repair work in a car house remember, with many misgivings, the portable lamp bank that was nearly always out of order. This bank, used for testing and detecting grounds, as frequently constructed, consisted of five 16-cp lamps attached to a board by means of wall sockets. When needed some of the lamps are usually found to be broken, or, if this is not the case, the leads have become tangled, or possibly a car has run over the leads, and has put them completely out of business.

Fig. 1 shows a diagram of a testing outfit that has many advantages over the portable lamp bank. Its chief drawback is that it can be used in a limited space only.

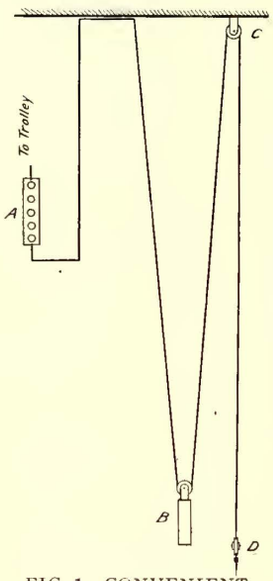


FIG. 1.—CONVENIENT LAMP BANK

The heavy line represents a No. 14 flexible insulated wire. After tapping off the trolley it passes through a bank of five lamps, placed on the wall at A, and then ascends to some high point of the building, where it is cleated firmly. From there it passes down under the movable pulley with weight attached at B, and then over the fixed pulley at C. It again descends, and, after passing through pulley D, which is screwed into the wall, it terminates in a suitable test point. Just behind the test point a knot should be tied in the wire to prevent it passing through pulley D. To use the apparatus it is simply necessary to pull the test point out to the place required, letting the weight, B, ascend. When released the test point is returned to the pulley, D, by the weight B. The apparatus is not costly, and very little time is required to rig it up. Should a greater range of usefulness be desired the wire can be made to pass through a second movable pulley after running through C, and then ascend to another fixed pulley above.

A PORTABLE LAMP BANK

A lamp bank which is quite an improvement over the five-lamp instrument, as usually constructed, is shown in Fig. 2. This consists of two 300-volt lamps, arranged in a framework as shown. These 300-volt lamps are readily obtainable, as they are used on many electric railways for switch lights. Where lamp breakages occur every few days with the old bank, it has been the experience of the writer that not an accident of this kind happened to the newly-constructed one in which the 300-volt lamps were used in a period of six months. If desired the bulbs could be further protected by tacking a wire screen over the opening on each side.

A CIRCUIT-BREAKER TESTER

Automatic circuit breakers, like all other electrical apparatus, are liable to get out of order. When they do so extensive damage may result to the motor before the condition is discovered, unless some systematic method of testing is practiced.

Fig. 3 shows a diagram of connections for apparatus by means of which the circuit breaker may be quickly tested.

After leaving the trolley the current is passed through a barrel rheostat. This consists of an ordinary 50-gal. or 60-gal. barrel filled with salt-water. One of the leads entering terminates in an iron plate resting on the bottom of the barrel, and

from the other is suspended a second plate, which may be raised or lowered to regulate the amount of current.

A circuit breaker to be used in case of emergency is put in the circuit at C, and millivoltmeter, A, is connected around the shunt B; D being a false trolley wire running parallel to the main trolley wire, and 2 ft. or 3 ft. away from it.

The car whose breaker is to be tested is run on the track under the false trolley wire, and the pole is shifted over this wire. The brakes of the car are set tightly and the motors thrown in multiple. The circuit breaker, C, is closed, and the current, which is read at the millivoltmeter A, is regulated by lowering the movable plate in the water rheostat. By repeated testing and adjusting, the circuit breaker in the car may be set at any value desired.

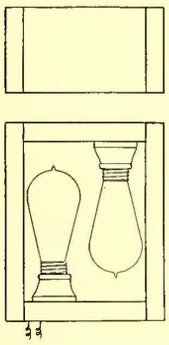


FIG. 2.—LAMP BANK

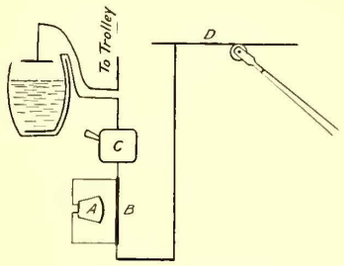


FIG. 3.—APPARATUS FOR TESTING CIRCUIT BREAKER

As the current used in testing is abnormal, the motors are thrown in multiple, so that each motor will get but one-half the total current flowing. If the brakes will not hold the car, or if putting current through the motors is deemed inadvisable, the motors may be shunted.

On a K-10 controller, or one of similar type, this may be readily done by soldering to the ends of a wire of suitable length two flat plates. One plate is slipped between the top finger and top segment of the controller cylinder, while the other is placed under the bottom finger. This gives a direct connection from trolley to ground, and very little current will pass through the motors.

As extreme accuracy in the measurement of the current provided is not required, the carefully calibrated shunt accompanying the millivoltmeter need not be used. One that can be left in the circuit permanently may be made of a piece of copper wire of suitable size, and calibrated by means of the standard shunt. The small leads from the shunt may be lead to suitable binding posts, so that to insert the millivoltmeter it is only necessary to connect its terminals to these binding posts. This obviates the extra trouble of inserting the shunt in the circuit every time the apparatus is used.

Many managers who have implicit faith in their automatic circuit breakers would certainly have to modify their ideas considerably were they to construct such a testing apparatus and use it. In the writer's experience some of the breakers tested absolutely refused to open. In several instances the power-house breaker was blown while the car breaker stood firm.

AN ELECTRIC GLUE HEATER

The shop in which the writer was employed was provided with a four-pot hot-water glue heater. When, in summer, the shop heaters were turned off, there was no means of supplying heat to the glue heater, and its use was discontinued. A kerosene stove was obtained; but, besides consuming about 15 cents worth of kerosene per day, this stove was an endless source of trouble to the cabinet-maker in charge. Caring for it consumed from one-half hour to 1 hour per day of his time.

The writer hit upon the idea of providing the old heater with electric heat. Two of the glue pots were removed, and through one of the openings a bank of three lamps was inserted, so that half the lamp bulb was immersed in the water. In the other opening was placed in the same manner the two other lamps of the five in series. At first 16-cp lamps were used, but these did not provide sufficient heat, and 32-cp lamps were substituted. These provided plenty of heat, and aside from an occasional burning out of a lamp no trouble at all was experienced thereafter. As a great deal of the water evaporated, it was necessary to add considerable water each morning, but the cabinet-maker, remembering his previous troubles with the oil stove, did this willingly.

This simple idea affected a saving of at least 30 cents per day, while the cost of constructing, considering cost of lamps, sockets and time, was about $2.50.

RAIL JOINTS AND THEIR RELATION TO PAVEMENTS*

BY C. R. VAN BUSKIRK

Ever since railroads were first introduced in the country there were, of necessity, rail-joints, but these joints were made with only two objects in view. One, of securing the rails in such manner as to prevent any longitudinal motion, except for the allowance of expansion and contraction, and the other to secure the ends in such a manner as to prevent any lateral or vertical motions.

It is the latter movements which we are to discuss principally, as their actions cause the main, and, I might say, the only troubles which harass the municipal engineer in his dealings with streets, and the rail-joints in their relation to pavements.

Rails are put together and kept from moving apart by two pieces of metal, called fish-plates, one on either side and bolted, and the result of this particular part of track laying is what causes in a great measure the disturbance so disastrous to pavements, and while it is more noticeable in some than in others, still the trouble can be discerned in all kinds of pavements, and more particularly in the asphalt pavement of the present day. Concerning the first object, we have very little to discuss or enter into, for in the putting together of the rails they are bolted together in order to prevent any motion longitudinally except that allowed for expansion and contraction, caused by changes in temperature, which in this vicinity amount to an average of 110 degs., according to the official reports of the weather bureau of New York City; to admit of this the holes in the plates are punched elliptical in shape, which allow the rails to expand or contract without cutting the bolts joining the fish-plates and rails together, this applies to exposed rails as on steam roads or on streets without any pavement, or with old cobble pavement; the change in the length of the rails, due to expansion and contraction for 110 degs. variation in temperature, are three-sixteenth of an inch for a 30-ft. rail and three-eighths of an inch for a 60-ft. rail, the latter being the only rail now laid in the Borough of Brooklyn. On account of the friction of pavement and rail it is conceeded by the best authorities that where the pavement is laid on a concrete foundation or even granite blocks on a sand foundation, provided the blocks are close together, there is no longitudinal movement of the rails, for although there is a tendency to do so, yet the strain is taken up by the rail itself.

The old Nassau Railroad Company, which became a part of the Brooklyn Rapid Transit Company's system in 1893, probably furnished the only case where the longitudinal movement of the rails caused any trouble in the pavement in this city. The case quoted was the result of the company's desire to give an easy riding road by making a track without any joints, theoretically, and the process of welding was instituted which made the various rails one long rail.

The processes of welding were of two kinds, electrically

*Read before the Brooklyn Engineers' Club, Feb. 11, 1904.

welded and cast welded, the latter being known as the Falk patent. The method of electrical welding consisted of joining the rails together and applying an electric current, which caused the two rails to fuse together. This was found by the Johnson Company, which built the Nassau system, to be very expensive, and, therefore, was temporarily abandoned, and the cast-welded joint was substituted in its place over the greater portion of the entire system.

In the cast-weld, a mould was placed around the ends of the abutting rails, the ends having been first cleaned by a sand blast, in order to remove all scale and rust, leaving the surface clean and bright and in perfect condition for amalgamation, and molten iron was taken from a portable cupola and run from this into ladles and poured into the mould by the workmen; in both of these no electric bonds were needed.

Whether the question of temperature never entered in their calculations or not is hard to tell, but this fact remains, that as the work was done in cool weather, as soon as the summer came the rails buckled in such a manner as to displace the pavement and bring the first point in our discussion into prominence. When the winter came and the rails once more came back in their place there were holes, caused by the buckling of these rails. This occurred only in the cobble-paved streets and on streets where there was no pavement. On the granite-paved streets it had no effect, proving the statement made previously.

In the movements now before us for discussion we have the joint exclusively to deal with, and it brings us to the second point in our discussion, and the main one in which we are interested; this joint and its relation to pavements, totally regardless of the length of the rail, its size, depth or any other dimension, it is the the joint only which we are interested in and which has given the city engineer all the trouble.

When the first rails were laid in our city little thought was given to the joint other than to its usefulness in holding the rails together and to prevent the motion previously cited. There was no pavement which was ruined by the joint, nor which would cause the engineer on municipal work any uneasiness, for in most cases, and I might say all, there was either cobble-stone for the pavement or the earth itself, neither of which had any impression made upon it by a loose joint or one where one rail was lower than the other, causing a pounding which eventually loosened the joint. None of these different faults, however, caused any uneasiness to the city engineer, but only to the railroad companies themselves, until the new and improved pavements began to come more and more into use on streets where car tracks were laid, and with it came the question to the railroad companies as well as to the city engineer, what fish-plate is there which will reduce, if not prevent, the lateral and vertical motions of the rail and the pounding at the joint, and by so doing preventing the wear of the pavement.

We find the trouble making itself manifest principally in the asphalt pavements, although it occurs as well in other pavements but not so disastrously. The Brooklyn Rapid Transit Company has tried many methods to obviate this trouble, but have had failures with all, more or less, until the Weber joint came upon the market. The construction of the Weber joint admits of the even distribution of all shock and movement at the joint, and, being a base support joint, prevents low or dipped rail ends, and thus does away with the pounding at the joints, which ultimately destroy the pavement around the ends of the rails, more especially the asphalt pavements. This joint is designed with sufficient strength but does not produce excessive stiffness or rigidity, and is not only as strong as is the normal rail at the center and quarter but is also as elastic. Otherwise it would wear the rail and make a hollow at the joint, for this defective quality causes a joint to become a hard spot, or it might be likened to an anvil, where constant pounding will flatten the rail, and causes excessive wear of the rolling stock and a poor riding track.

In the Weber rail-joint there is an angle called a shoe-plate, on which the two rails rest to give the rail an even bearing, and in the comparison of the angle-bar with the Weber joint we do not find it strange that as angle-bars have but about one-third the strength of the rail 30 per cent to 50 per cent of the track labor is concentrated at the joint where the angle-bars are used in the endeavor to maintain surface and line and secure to the rail a uniform wear. Between the angle-iron and the joint-plate is placed a piece of yellow pine wood, full of resin, which serves as a filler. Naturally the moisture from the earth and atmosphere soon begin to get in the wood filler, and it commences to expand so that the plate and bolts are under a constant strain, and as the wood filler, which does not decay, being under constant compression and practically enclosed in steel, preserves a tension in the bolts which prevents any movement in the parts. It can be readily seen that this expansion of the wood prevents any looseness in or around the plate and forms a joint which is absolutely tight, which prevents any sag at the joint ends, prevents any lateral or vertical motions, and, above all, makes a joint against which asphalt pavement can be safely laid.

Since the Nassau Railroad Company introduced into this city the process of welding a great many improvements have been made by the Lorain Steel Company in electrical welding. The present method of electrically welding rail joints, as applied by the track welding department of the Lorain Steel Company, comprises three distinct operations. The first is that of sand blasting, by means of which all dirt, rust and foreign matter is removed from the rails at the points where the welds are to be made and from the bars used in making the joints. The apparatus for this work consists of a 10-hp motor driving an air compressor, a tank for the storage of air and a bin for holding a supply of sand. By means of a hose and nozzle the operator directs the blast of air carrying the sand to the rail until all foreign matter has been removed. The bars are similarly treated, and the joint is ready for the actual operation of welding.

The apparatus for welding is carried in two cars, coupled together by a special form of slip coupling, which permits of sufficient range of movement for the car carrying the welder proper to be moved from one weld to another of the three welds necessary in making a joint without the necessity of moving the second car. The welder itself is hung from a bail on a crane extending out beyond the end of the car. This crane permits of lowering and raising, so that the jaws of the welder itself are hung from a bail on a crane extending out beyond the end of the car. This crane permits of lowering and raising so that the jaws of the welder can engage the side of the rail, and also the shifting of the welder from one side to the other to engage both rails of the track. The crane is operated by friction clutches from a shaft in the car, which is kept running continuously by a 5-hp motor. This motor also drives a small rotary pump for circulating water through the welding transformer and the faces of the contacts to keep them cool. After the water has passed through the welder it goes to a cooling tank on top of the car, which has a false bottom, and air, from a blower in the car, is forced under the false bottom and upward through numerous holes into the water, thus forming a most efficient method of cooling. The welder itself is an alternating-current transformer, on each side of which and supporting it, but insulated therefrom, are two large levers, hinged together at about two-thirds the distance from the top, for transmitting the necessary pressure to the weld. These levers are connected at the top by an hydraulic jack. A hand pump for forcing water into the jack is bolted to one of the levers. A pressure of 4100 lbs. per square inch is obtained on a 3⅞-in. diameter ram of the jack, the leverage on the arm increasing this so that about 37 tons pressure is developed at the weld.

In making a joint, flat rolled steel bars are used, having at each end a boss or projection on one side, which form the contact points between the bars and the web of the rail and confine the weld area to these sections. A flat strip of steel, ⅛ in. thick by in. wide, is placed across the middle of the bars on the same side with the bosses. The bars are supported on small blocks and placed across the joints so that the middle strip engages the web of both rails. The middle weld is a vertical one, and made the full width of the bar, the end weld a horizontal one.

The welding train of two cars is moved up to a joint, and the welder is thrown into place and the jaws made to press against the bars at each side of the rail. The current is then turned on and flows from contact to contact through the bars and the rail web. By altering the pressure on the jaws the resistance of the junctures is increased and the whole is soon brought up to a welding heat. As soon as this point is reached the current is cut off, and simultaneously the pressure is brought up to the full amount. The pressure is then loosened, and the welder car moved back to bring the jaws opposite the extremity of the bars. The same process is again followed here, except that when the final pressure has been applied it is held there and the weld permitted to cool under pressure until the metal has cooled sufficiently not to show any glow. The welder is then moved forward to the other end of the bar and the process repeated, after which the welder is raised and moved to the other side of the car to engage the opposite joint.

By holding the pressure after the weld is made a remarkably tough weld is secured. It will be noted that only the end welds are thus treated, as the center weld is not subjected to any strain it is not essential to have toughness there. It has been found desirable to weld the ends of the bars while the bars are in an expanding state. By making the center weld first and not stopping to cool it under pressure the greatest elongation of the bars is secured. After the ends are welded and the bars cool off they shrink and exert a powerful pull to bring the abuting rail ends together, thus closing the slightest opening and leaving practically no joint at all. This is an important point in the manufacture of a continuous rail, for if the abutting rail ends are not brought firmly together the metal in the head of the rail will have a chance to flow into the opening between the rails, and this in time will cause a low spot in the head of the rail. As the bars are always in a state of tension it follows that the rail itself, enclosed between the bars, is in a state of compression. Any construction of the rail itself between the joints will be transmitted to the end welds, and it is, therefore, necessary to have these welds exceedingly tough to withstand the strain. The object of the center weld is simply for vertical stiffness and to prevent any movement of the rail ends.

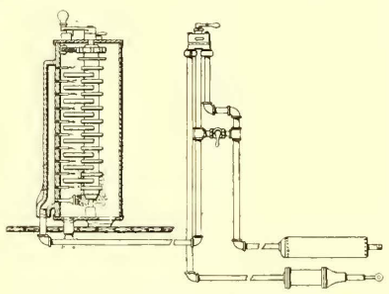
In the car coupled to the welder is carried a rotary converter for changing the direct current from the trolley to an alternating current. The third and last operation in the process consists in grinding the head of the rail to a true surface. In welding new rail there is little need for this tool, but in old track, where the rail ends have been battered, the receiving rail is purposely welded higher than the other. The grinder is then used to grind out the inequalities in the rail head and bring it back to a true surface. The grinder consists of an emery wheel mounted on a carriage having two rollers, which are about 4 ft. apart. This carriage is let down on the rail so that the rollers pass along the head of the rail, the emery wheel being over the uneven portion at the joint. The carriage is connected with a motor on a car by a swing frame, thus enabling the operator to move the emery wheel back and forth over the joint while the car remains stationary. By means of a hand wheel the emery wheel is gradually fed down, and as it is moved forward and back it grinds off the high places until the whole joint is brought to a true surface. The principle is very much the same as a carpenter's plane. With this final operation the joint is left complete.

Carried on as a continuous process, it takes from 12 minutes to 15 minutes to complete a joint. About eighty joints can be made on an average in 24 hours, or a mile of single track of 30-ft. rails could be welded in about 4½ days, at a cost ranging between $2,000 and $2,500, or in the welding of the 60-ft. rails now in use the work could be done in about 2¼ days, and at a cost of $1,000 to $1,250. The bars used are 1 in. x 3½ ins. and 1⅛ ins. x 3 ins., the length varying with the form of joint previously used. On new rail, where the ends are left without any drilled holes, especially for welding, the length of 18 ins., while on old rail the bars must be long enough to reach back of the old bolt holes, and in some cases requiring bars as long as 48 ins.

This method of joining the rails together is to be instituted during the coming season by the Brooklyn Rapid Transit Company, and as the rails are made one long rail there can be no sag at the joint, and hence no wear of the pavement, and the cause of trouble to the municipal engineer will be lessened, if not removed entirely, by the use of either the Weber joint or welding by the method just described.

AIR BLAST FOR CONTROLLERS

H. P. Wellman, superintendent of motive power of the Camden Interstate Railway Company, the electric railway connecting Huntington, W. Va., Cattlettsburg, Ky., and Ironton, Ohio, has devised an ingenious method of keeping the controller contacts clean from dirt and copper dust and thus preventing burn-outs by tapping the air brake exhaust into the controller casing, as shown in the illustration. No changes are required in the controller except the addition on the outside of the casing of a vertical duct or channel, which can either be made integral with the casing or bolted on. The air brake exhaust pipe is tapped into the lower part of this duct and the nozzles connected with it are directed against the controller cylinder, a large bell-mouth nozzle being located close to the regular blow-out magnetic coil at the bottom. These nozzles are made of an insulating material, such as mica, fibre or wood, and the diameters of their bores vary in size, the smaller openings being near the bottom, thus allowing an even play of air into the controller from all nozzles. The air exhaust from the controller is at the bottom of the casing and discharges through a pipe in the platform.



AIR BLAST FOR CONTROLLERS

Mr. Wellman has taken out a patent on his device, and claims that it not only keeps the controller clean but that it also muffles the noise of the exhaust and so prevents the annoyance heretofore experienced by passengers and pedestrians on account of noise and avoids the danger of frightening horses.

That the Shreveport Traction Company is wideawake is shown by a perusal of the pamphlet which it issues for public distribution. The company supplies current for many manufacturing purposes, and the publication contains letters from users evincing their satisfaction with its service. The booklet also includes some sensible suggestions to passengers, and, in general, serves as a medium between company and public.

METHOD OF MAKING COMPETITIVE TESTS OF CAPACITY, POWER CONSUMPTION AND EFFICIENCY OF MOTOR-DRIVEN COMPRESSORS FOR BRAKE SERVICE

BY EDWARD H. DEWSON

The proper basis for the determination of the size of compressor to be supplied for a given brake service is that when the equipment is new, the required amount of air can be supplied with the compressor operating one-fourth of the time. This gives a safe margin to cover the decrease in efficiency due to natural wear, also the temporary derangements of the system calling for an increased supply until repairs can be made, or excessive demands due also to temporary causes. Thus, during the life of a compressor, the time it was running would average somewhat less than one-third of the total time the car was on the road.

A test to determine the relative efficiency of the various makes of compressors designed for car braking should, therefore, be based not upon what the compressors might do when operated continuously, but rather under conditions which pertain in actual service, when the compressor is rarely in operation more than a minute at a time. That is, the basis of comparison should be the electrical energy required by the different compressors to deliver a given number of cubic feet of free air compressed to a given pressure every 3 minutes, the quantity and pressure to be such that the compressor will be in operation not to exceed one-third of the time, the tests to continue until the temperature of the various parts of the compressors has remained constant for at least 1 hour.

INSTALLATION

With the compressor on the car and in operating condition, that is to say, with the box in place, if one is used, etc., connect the discharge outlet by means of a proper hose to a reservoir of not less than 3 cu. ft. capacity, the air to enter, preferably, at the side of the reservoir. From one end of the reservoir make connection with a second reservoir, of a capacity, preferably, not more than one-fourth the rated capacity in cubic feet of free air per minute of the pump being tested. It is not essential that the capacity of the first reservoir be known, but that of the second reservoir should be determined by taking the weight of the reservoir, when empty, and that when filled with water, and divide the difference between the two weights by 62.3, which will give a very close approximation to the volume of the reservoir in cubic feet. In the pipe connecting the two reservoirs, and quite close to the second reservoir, should be placed a three-way cock, of which the branch should be open to the atmosphere. Between the three-way cock and first reservoir should be placed a needle valve for regulating the flow from the first reservoir, to which is attached a standard single pointer gage, reading to 180 lbs. The second reservoir should be provided with a single pointer gage, graduated in atmospheres up to 10. In addition to the above the first reservoir may be provided with a drain cock for the purpose of bleeding the air from the same without passing it through the needle valve. In the pump circuit there should be a wattmeter, also an ammeter, if convenient. A voltmeter should be so connected that it will measure the drop across the entire motor. A revolution counter should be provided, and means for driving same from the end of the pump shaft. The com-

Test of motor-driven compressor for brake service.

Co.

File No.....Sheet No. 1.

Place of test..... Date.....190...

Make of compressor..... Actual volume of measuring reservoir V = ...cu. ft.

Form.....Rated horse-power..... Atmospheric pressure attained in measuring reservoir on each run. At = ...

No. of Motor.....No. of pump.....

Diameter of cylinder.....in. Stroke.....in. Volume of free air compressed per run V × At =.....cu. ft.

Piston displacement per revolution C =.....cu. ft. Time between starting each run.....min.

No. of teeth in pinion.....and gear..... Record certified by

Temperature of atmosphere.....°C. .....Co.

Constant pressure reservoir.....Diameter.....Long. .....Co.

Measuring reservoir.....Diameter.....Long.

Run No.	Counter Readings	Revolutions of Pump = R	Seconds Pump is in Operation = T	R. P. M. of Pump vs 90 Lbs. $= \frac{R \times 60}{T}$	Volts Average = E	Amperes Average = A	Wattmeter Readings	Watt Hours = Wh	Temperature of Valve Cap °C.	Theoretical Capacity $C \times RPM$ Cu. Ft. per Minute	Cu. Ft. of Free Air Delivered per M $\frac{V \times At \times 60}{T}$	% Cylinder Efficiency $= \frac{\text{No. 12}}{\text{No. 11}}$ or $\frac{V \times At}{C \times R}$	Electrical Horse Power $EHP = \frac{E \times A}{746}$	HP to Compress to 90 Lbs. 1 Cu. Ft. Free Air $\frac{EHP \times T}{V \times At \times 60}$ per Min.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

FORM OF TEST RECORD RECOMMENDED

pressors should also be provided with a valve cap drilled for the reception of the bulb of a thermometer.

TEST READINGS

When the above has been accomplished the test proper should be made as follows:

One man should be stationed at the needle valve with the duty of maintaining a uniform pressure of 90 lbs. per square inch in the first reservoir; just previous to the starting of the test fill this reservoir, the needle valve being closed and three-way valve thrown to pass air into the measuring reservoir.

At a given signal the pump should be started, the needle valve opened sufficiently to hold the pressure in the first reservoir at 90 lbs., and a stop watch started, wattmeter and revolution counter readings having been taken just previous to starting.

When the predetermined amount of free air has been delivered into the measuring reservoir, as determined by its gage, stop the pump and watch, at the same time close the needle valve and take the wattmeter and revolution counter readings. During this time the readings of the ammeter and voltmeter should have been taken, the average reading of each, as well as the temperature of the valve cap and of the surrounding atmosphere being recorded.

Let the air in the measuring tank escape, and when 3 minutes from the time of starting the pump have elapsed, repeat the test as above outlined, continuing until the readings of the thermometer in the valve cap have remained constant for an hour. If desired the temperature of the motors may be obtained by inserting the bulb of a thermometer in a cavity drilled for the purpose in one of the screws by which the poles are secured to the frame. Note that the pressure of 90 lbs. is to be retained in the first reservoir throughout the entire test, the air in the measuring reservoir only being permitted to escape after each run.

The following sizes of measuring reservoirs and corresponding pressures at which pumps are to be stopped are recommended:

Horse-power	Reservoir	Pressure	Approximate Amount Free Air
2.5	12 ins. x 33 ins.	4.5 atmos.	8 cu. ft.
5.	16 ins. x 42 ins.	4.5 "	16 "
7.5	16 ins. x 48 ins.	5.5 "	26 "

Bear in mind, however, that the actual capacity of the measuring reservoir must be determined for each test in the manner above described.

In making competitive tests it is important that the voltage is the same for both, and is maintained at a constant pressure through the tests.

CALCULATIONS

The data called for in columns 2, 4, 6, 7, 8 and 10 will be recorded exactly as read from the various instruments. In column 3 will be entered the difference between the figures on the same line in column 2 and those of the succeeding line of the same column. That is to say, the entries in No. 2, and also No. 8, will be the readings of these instruments just previous to the run in question, consequently, there must be one more observation in each case than the number of runs made.

By multiplying the number of revolutions as figured in No. 3 by sixty, and dividing the product by the number of seconds the pump is in operation, the average speed in revolutions per minute is obtained, which is to be entered in column 5.

Unless a special wattmeter is obtained, readings from same will not be sufficiently close to warrant taking them every run, particularly with the smaller sized pumps. A record, therefore, made after every tenth run (recorded on lines of runs 1, 11, 21, etc., until the test is closed, when the final reading must be entered) will suffice in most cases. When taking the readings be sure to enter the cipher, if one appears printed on the dial just to the right of the moving figures in the little rectangles, as this indicates that the right-hand movable figure is in the ten's place instead of units, as might be supposed. To obtain the watt-hours the differences obtained from column 8 must be multiplied by the "constant," as indicated on the dial, these products to be entered in column 9.

The theoretical capacity in cubic feet of free air per minute, column 11, is obtained by multiplying the piston displacement per revolution, C, by revolutions per minute of column 5.

As the pressure obtained in the measuring reservoir is read in atmospheres, the volume of free air which has been compressed to 90 lbs. per run is readily obtained by multiplying the capacity, in cubic feet, of this reservoir by the number of atmospheres of pressure, i. e., $V \times At$, which will be the same for all the runs.

The rate per minute at which compressed air is actually delivered, in terms of cubic feet of free air, is obtained by multiplying the product, $V \times At$ by 60, and dividing the result by the duration of the run in seconds. See column 12.

The cylinder efficiency, column 13, is obtained by dividing the number of cubic feet of free air actually delivered per minute (column 12), by the theoretical capacity expressed in cubic feet per minute (column 11).

The rate of expenditure of electrical energy in doing this work, expressed in electric horse-powers, is obtained by multiplying the average volts by the average amperes and dividing the product by 746—column 14.

In a test to determine the relative efficiency of two types of compressors, the true basis of comparison is the amount of electrical energy consumed in performing a given amount of work.

A convenient basis is the horse-power required to compress to 90 lbs. per square inch 1 cu. ft. of free air per minute. From the data already obtained this may be calculated by multiplying the electrical horse-power (14) by the duration of the runs in seconds (4), and dividing this product by the volume of free air compressed per run ($V \times At$), multiplied by 60.

NEW THIRD-RAIL SLEET BRUSH ON THE BOSTON ELEVATED

The Boston Elevated Railway Company has been obtaining very satisfactory results from a sleet brush which has been used on all the cars this winter, in connection with the third-rail shoe described in the issue of Feb. 6. Each brush is made up of about 670 flat steel wires, ⅛ in. wide and 1-32 in. thick, carried on the shoe hanger attached to the journal box. Pressure is secured by a spiral spring. When not in use the brush is kept raised from the rail by a pawl, which can be automatically tripped by a lever as the cars pass a certain point. Tripping levers are located at three points on the line, viz., at each end of the subway and at Rose wharf, so that if instructions are sent out by the superintendent of the elevated division to drop the brushes all will be in operation in 10 minutes. A pressure of about 30 lbs. is used on the brushes. For emergency sleet cutting service a hanger, rigged with seven of these brushes can be attached to any motor car or to a work car and run over the line.

The wires in the sleet brush are set at an angle instead of being set to bear directly across the rail. It is considered that a flat brush will pile up sleet in front of itself, but that if the wires are set at an angle the sleet will be brushed to one side. The angle is such that the sleet is brushed from the third rail away from the track rail.

The Columbus, London & Springfield Railway and the Dayton, Springfield & Urbana Railway have instituted through night freight service between Columbus, Springfield and Dayton. This branch of the business is increasing rapidly.

THE INSPECTION OF EMPLOYEES

BY H. N. BROWN

In a recent article in this paper the writer discussed the inspection of conductors by secret service agents to detect the appropriation of cash fares. Although the receipts all pass through the conductors, motormen can exert a greater influence upon the rectitude of a conductor than many realize. For instance, when a new conductor commences work he relies on the motorman to a great extent for information in regard to rules, regulations, etc. Should the motorman be inclined to be dishonest he can readily lead this man astray. First he will usually feel his way by asking the new man whether he is scrupulous about turning over all fares that he collects to the company, and if he finds his man on the fence he suggests ways of defrauding the company, which, if acted upon, soon brings the conductor into his clutches. Should he find the conductor firm in trying to do right, he will use different tactics in order to get around him. For example, he can run his car on fast time, thereby causing the conductor much annoyance by being called into the superintendent's office for running ahead of time. Again, he will run slow and have his conductor 5 minutes or 6 minutes behind his schedule time, which also means a reprimand from the superintendent or despatcher. After receiving one or two of these reprimands the conductor will usually feel that the company is not treating him exactly right, and will confide in his motorman to this effect. The motorman sees his opportunity and replies that if the conductor will knock down a few fares during the day and divide with him, he will see that the car is run on schedule time and there will be no further trouble. The conductor readily accepts this proposition, as he is well aware of the strict rules of the company in regard to reprimands, and knows if his attention is called to this matter too many times it means a dismissal from the company's service. He falls, therefore, into the trap that has been laid for him, and every time he runs with this particular motorman he knows that the latter expects to receive his share of the money taken, and on his part will endeavor to carry as many passengers as possible, in order that the conductor can knock down as much as he can and still compare favorably in his receipts with other cars on the line. Very frequently a motorman of this class will lay back on another car's time through the crowded sections of the city, and pick up all the passengers he can get, and after leaving this section run his car very fast to catch up to his schedule time before reaching the car house or the despatcher.

The only way the management can obtain information in regard to dishonest motormen is by placing inspectors on the rear end of the cars as conductors. Being the last on the list they are extra men, and are compelled to take the place of regulars on the lines when they are off duty. In this manner an inspector acting as a conductor can run with a number of the motormen during the inspection, and give a great deal of information to a railway company.

IRREGULARITIES OF THE CASHIER'S DEPARTMENT

Another opportunity for irregularity is in the cashier's department. It frequently happens on all street railway companies that when the cashier counts the money turned in by the conductors for a previous day's work he finds that some of them have made a mistake in their count and are either short or over. If a conductor is short, naturally, the company notifies him to that effect, and the conductor is compelled to make good the shortage. While all conductors are liable to mistakes in counting their money and placing it in their envelopes to be turned over to the company, the fact should not be overlooked that the clerks in the cashier's department, should there be one among them dishonest, could cause quite a contention among the conductors. In other words, if this clerk was inclined to be dishonest he could readily report four or five conductors as being short on the previous day's receipts from 15 cents to 25 cents or more, and by submitting this report to the cashier of the company, could compel them to pay this money without any redress.

Naturally, the conductor, upon notice from the cashier that he was short so much money on the previous day's receipts, is compelled to send this money at once to the cashier, and believing that he placed the proper amount of money in his envelope the previous night, will feel quite blue over receiving such a report. If he makes up his mind that he does not propose to lose the amount of the shortage charged up against him, on his next day's run he will collect an amount of fares equal to the amount charged against him and fail to register them, and by so doing reimburse himself for the previous day's loss. Should he not hear anything from the company in regard to these fares collected and not registered, he gives way to his first temptation, and finding that it is so easy to fail to register fares, he continues to do so until discharged by the company, when, as a matter of fact, he may have been perfectly honest in every respect until this shortage was charged against him.

Should the manager of any road find considerable complaint among his men in regard to unwarranted claims of shortage, it would pay him to place an inspector on the rear end of the car to find out whether the conductor was at fault or whether irregularity existed in the cashier's department. This information can be obtained in a very short time by the inspector, who is acting as a conductor, by placing in his envelope every night a certain amount of money over his actual receipts, and seeing whether it is returned to him from the cashier's department, providing the rules of the company are to send all over money back to the conductors and compel them to pay all shortage. In all large railways the cashiers have a number of assistants, and each assistant is given a certain number of envelopes of conductors' receipts from the previous day on one division. Should the complaint of the conductors come from this particular division the manager could easily single out, through his cashier, which assistant counted this money and was dishonest.

PETITIONS FOR RAILWAY FRANCHISES IN NEW YORK

President Edward A. Maher, of the Union Railway, of New York, which is controlled by the New York City Railway Company, has forwarded to the Board of Aldermen a petition for franchises to effect thirteen new connections, including the rights to cross several bridges. Under the extensions sought to be effected by the company its lines would be taken over the Washington Bridge, the Willis Avenue Bridge, the 155th Street viaduct, over the 149th Street and new Fordham Heights Bridges, when completed, and also over two bridges crossing the New York & Putnam Railway and the New York & Harlem tracks.

The proposed system would effect connections with the New York City Railway Company's system at more than a dozen points, and the Union Company's tracks would completely interlace the Bronx territory.

The petition from the company has been referred to the committee on railroads, with instructions to hold a public hearing on the proposition on March 23. It was developed that the privileges asked by the Union Railway are largely the same as those granted by the Aldermen a year ago to the Interborough Company. The State Railroad Commission refused to approve the request of the Interborough Company for permission to construct the road, and an appeal to the courts from this decision now is pending.

CORRESPONDENCE

FIGHTING SNOW NEAR SCHENECTADY

SCHENECTADY RAILWAY COMPANY
Schenectady, N. Y., Feb. 10, 1904.

EDITORS STREET RAILWAY JOURNAL:

I have read with much interest your recent editorial on the handling of the snow problem, and I am prompted to furnish you the accompanying description and illustrations of our work and methods, in the hope that our experience may assist others who may be confronted by similar problems.

SIDE VIEW OF SNOW PLOW

We have now in use in connection with our system for the removal of snow, both in the city of Schenectady and on our interurban roads, three rotary plows, one double-truck and three single-truck plows of the shear type and one sweeper.

TRACK AND STREET CLEARED OF SNOW IN SCHENECTADY

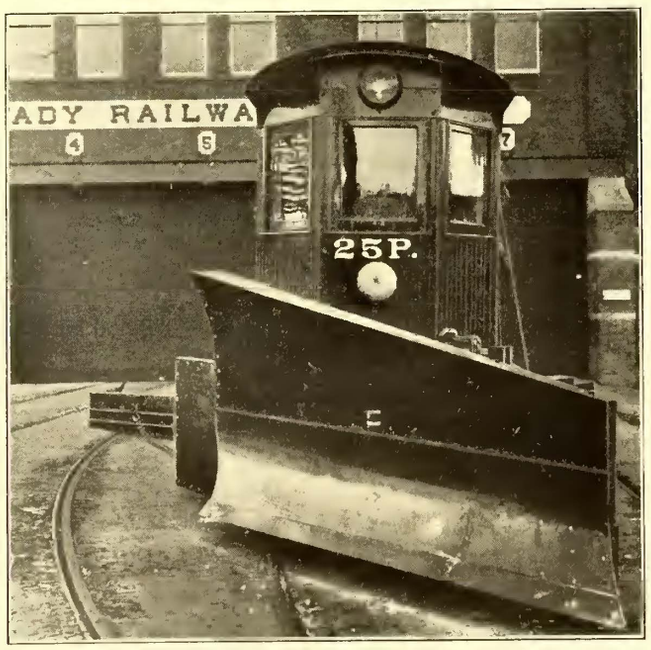
With this equipment we have been able to cope with all the severe storms of the winter, and have operated our road continuously without any interference whatever with our schedule time. The principal features of the three single and one double-truck shear plows, which we have recently added to our system, are shown in the accompanying illustrations, and there is also presented a street scene showing the condition of the track and roadway after having been cleaned by one of these plows. Following is a description of the shear plows which were built by our company during the last year:

The single-truck plows are 34 ft. over the shear, and the double-truck plow 47 ft. The single-truck plows weigh approximately 17 tons, and the double-truck plow 30 tons. The single-truck plows are equipped with two G. E. 57 motors, with a gear ratio of four and one-half to one. The double-truck plow has four G. E. 57 motors, with the same gear ratio. In order to ensure ease of operation, worm gearing was adopted in the manipulation of the "shear" and the side wings. The worm gearing is operated by hand wheels inside the cab.

All the wires and cables are housed in a wooden box, asbestos lined, and fastened inside of the plow alongside of the wall, thus making them weather and water-proof. Only where the cable is carried to the controller is it taken underneath the floor, and at this point it is well housed in a water-proof box with asbestos lining. Thus far no trouble has been experienced from short circuits.

The rheostats are all fastened on the inside walls of the plow body, and protected with an iron casing of the squirrel-cage type. This eliminates much trouble that, as a rule, is experienced with rheostats, and, moreover, furnishes some heat to the men operating the plow. The wires leading from the inside of the plow to the headlight are carried in iron pipe, ¼ in. in diameter, thus making them water-proof.

The main frame of the plow is built of heavy yellow pine



END VIEW OF SNOW PLOW

timber, well stiffened with angle-iron, giving it strength and weight. The shear, which stands at an angle of 45 degs. with the center lines of the plow, is mounted on a 12-in. channel-iron, backed up by 4-in. pine plank. The plank in turn is

fastened to two 5-in. T-rails. These T-rails slide in a cast-iron guide at top and bottom, which prevents cramping. The shear is raised by two ⅝-in. chains, fastened at either end of the 4-in. plank. The chains pass over pulleys and enter the cab, where they are wound on a 2-in. shaft, this shaft being operated by a worm and gear which enables the operator to easily raise the shear, and forming a self-locking device. The lowering of the shear is accomplished by simply loosening up the chain, the weight of the shear being sufficient to lower it. The shear is designed so that it can be raised 6 ins. above the rail. This has proved to be ample.

The side wings, one to each side of the plow, are 8 ft. long, and built of 2-in. oak planking. These wings are also manipulated by heavy chains wound on a drum, operated by worm and worm gear. The wing can be raised and lowered any desired height and angle, and made to project to a distance of 8 ft. from the side of the plow. In streets of fair width this permits of forming a driveway outside the track sufficiently wide to allow a vehicle to pass a car without getting in the way of it. If a ridge of snow be formed 2 ft. or 3 ft. from the rail, vehicles are quite sure to occupy the tracks. Underneath each end of the plow are two heavy wrought-iron diggers, which can be made to bear on the rails by the operation of a lever inside of the plow. A dog attached to the lever engages in a quadrant, permitting the diggers to be held at any desired angle and allowing any desired pressure of same upon the rails. It also permits of their being raised quickly when approaching a crossing or when backing up the plow.

There are four sand-boxes, two at each end of each plow. Each sand-box is operated independently, and the levers controlling them are within easy reach of the motorman.

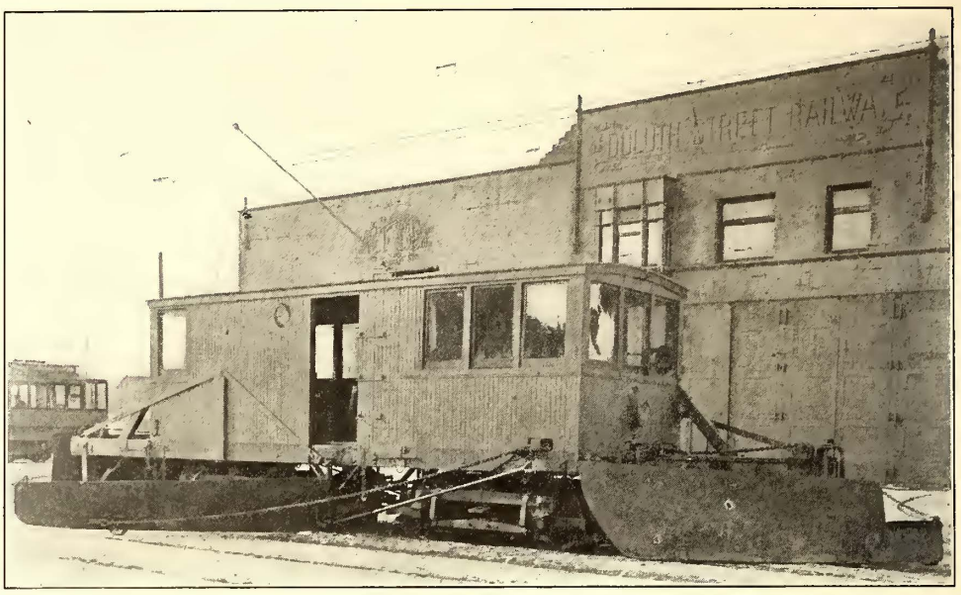
E. F. Peck, General Manager.

HANDLING SNOW IN THE NORTHWEST

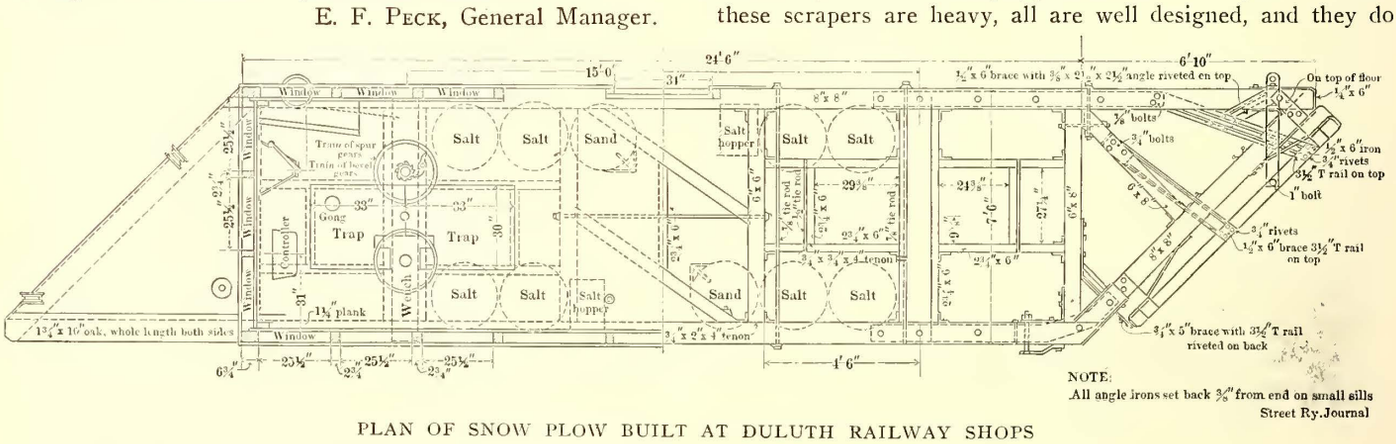
Duluth, Minn., Feb. 10, 1904.

Editors Street Railway Journal:

In your editorial on the snow problem in the Street Railway Journal of Jan. 23, you ask for the experience of street railway companies in handling snow. The Duluth Street Railway Company has almost 75 miles of track in Duluth and Superior, 50 per cent of which runs through unsettled or thinly settled districts. Part of this track is from 300 ft. to 700 ft. above the lake level, and with the heavy snow-fall, low temperature (38 degs. below zero Jan. 25 this winter) and high winds, we would be expected to have trouble with snow, but in the last seven winters we have had very little trouble with it. We have on the different lines 8 miles of snow fences. All of our ninety-six cars are equipped with track scrapers. Part of these scrapers are heavy, all are well designed, and they do good work. On double-truck cars they are hung very low on the trucks.



SNOW PLOW BUILT IN DULUTH RAILWAY SHOPS



PLAN OF SNOW PLOW BUILT AT DULUTH RAILWAY SHOPS

In 1896 we designed and built a plow, which is shown in the illustration. This plow is provided with a front wing, track scrapers and a side wing on each side. It is a double-end plow, and carries salting and sanding apparatus. The front wing can be raised 1 ft., but when this wing is in use it scrapes the rail. The bottom edge of the wing at the rail is provided with cast-steel shoes, which will ride over the guard rail, switches or anything which the wing has ever struck. This wing is 4 ft. wide and 11 ft. 5 ins. long, and is at an angle of 45 degs. with the rails. The wing is hung and shaped in such a way that any snow which can't get out at the side on account of the

PETITION TO SUSPEND ST. LOUIS LINE.

The World's Fair management has asked the City that the St. Louis Transit Company be permitted to suspend the operation of its Clayton division through the World's Fair grounds until six months after the close of the exposition. The petition adds that the arrangement is to be conditional upon the operation of the line from its western terminus to the entrance at Pennsylvania Avenue, where passengers are to be transferred to the St. Louis & Suburban Railway Company without the payment of additional fare. The exposition management is said to have perfected an agreement between the Transit and Suburban Companies which will permit this.

deep banks is thrown on roof of the cab and is blown off. Side wings are each 2 ft. 4 ins. wide and 14 ft. 6 ins. long, and the end extends under the plow inside of rail line so that any snow that falls back from the front wing is taken up by the side wing. Wings are built of ⅜-in. tank steel, reinforced with heavier steel where needed. The front wing can be raised and lowered, and the side wing can be let back or brought out into position by means of double-geared winches, so that when obstructions or teams are met the side wing can be instantly let back, and brought out into position again without delay or stopping of plow. The cab, or enclosed part of the plow, is 7 ft. 6 ins. wide, and 24 ft. 6 ins. long, and is constructed about the same as an ordinary freight car. It has a sliding door on one side and seven windows at each end. In this cab are the controllers, cables, etc., the four winches that control the wings, eight oil barrels full of salt, two salt hoppers, two barrels of sand connected to valves, and the sand pipes.

It requires four men to operate the plow, a motorman, a side-wing man, and two men to operate salt. The front wing requires no attention. The man who operates the side wing stands to the right of and just back of the motorman, and has a good view of everything on the street. The plow can be operated in any storm with windows closed so that the men are warm and dry. The outer end of the side wing is connected with winches by a ⅝-in. high grade twist link chain. The 2 tons of salt we start out with will last 5 hours if the rails are salted heavily, and in that time we generally cover 50 miles of track. We have no center poles, and when the plow has passed over both tracks it leaves a clean path 35 ft. wide and four wet rails, at a labor cost of $5 for every 50 miles of track, or about 1 cent for every 1000 surface yards of snow removed. The plow is mounted on two Brill No. 27 trucks, and it rides smoothly. The trucks never leave the rails. The plow is equipped with four G. E.-67 motors and two K-6 controllers. Trucks and motors are the same as we use under our regular cars, so that seven months in the year we have no trucks or motors tied up under the plow. Neither can the plow be disabled longer than the time required to run out the truck and run another one in.

We find that the long, heavy side wing is a great help, as it piles the snow back 10 ft. from the rail and makes a place where track scrapers can throw the snow. In a heavy, wet snow-storm and a lowering temperature we run the front wing only, and use salt, keeping the plow moving as rapidly as possible. When a storm is over we clean up with the side wing.

In 1902 we built a second plow, exactly the same as the first one, and with these two plows we have no trouble and very little expense in keeping the tracks clear of snow.

We believe that plows should be kept in perfect repair, and should be equipped with the best of trucks and motors. Motors should have sufficient power so that plows can run on schedule time, otherwise it sometimes happens that the snow-plow as well as the snow-storm causes delay. It is not a good plan to take trucks that will not stay on the track, and motors that you know will burn out, and put them under a plow just because you cannot use them anywhere else.

WILLIAM J. SMITH, Master Mechanic.

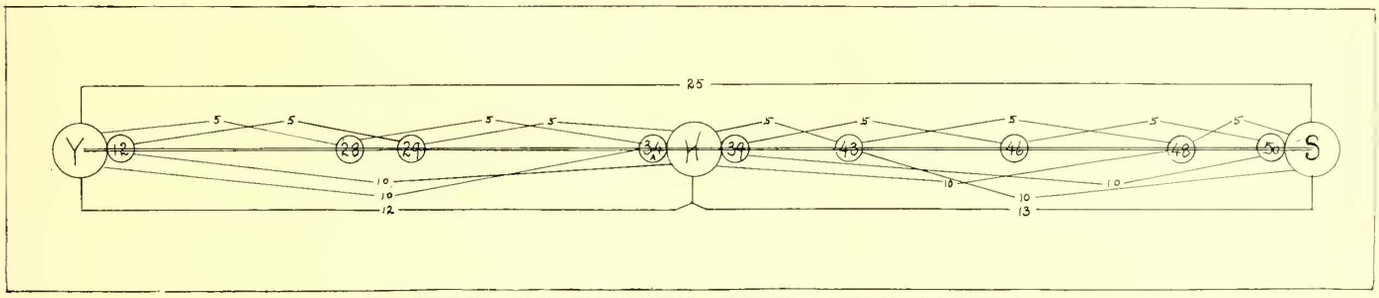
THE COLLECTION OF FARES ON THE YOUNGSTOWN & SHARON

THE YOUNGSTOWN & SHARON STREET RAILWAY COMPANY
Youngstown, Ohio, Feb. 1, 1904.

EDITORS STREET RAILWAY JOURNAL:

The collection of fares on interurban roads has been a problem for some time, as on the majority of roads fare limits are established absolutely at different points, but there are many instances where this is not practicable and would be unfair for those desiring short hauls. For instance a passenger desiring to ride perhaps a quarter of a mile, would by this system be required to pay 10 cents, whereas by adopting fare limits overlapping each other, this is avoided. The latter plan has been adopted on the Youngstown & Sharon Street Railway, but, unfortunately, much confusion resulted among the conductors as to the fare limits.

The attached schedule showing the limits diagrammatically solved the problem and may be of interest to your readers who are operating under similar conditions.



FARE LIMITS ON YOUNGSTOWN & SHARON STREET RAILWAY

The letters Y, H and S, indicate Youngstown, Hubbard and Sharon, respectively, and stop numbers are placed within the circles, the small figures indicate the fares between the points outlined.

GODFREY MORGAN, General Superintendent.

STATION MASTERS ON THE BOSTON ELEVATED STATION

Station masters are employed at all the stations of the elevated railway system in Boston, to oversee the loading of cars, direct passengers into the end doors, which are the doors used for loading during the rush hours, and instruct those leaving the trains as to the location of the exits. The station master also opens the side doors of the first car of all trains. The other side doors are opened only during the rush hours, that is, between 6:30 a. m. and 10 a. m., and between 3 p. m. and 8 p. m. This work is performed by assistant station men. As four-car trains are run between 6:30 a. m. and 9:30 a. m., and between 4 p. m. and 6:30 p. m., three extra station men are required during these hours. At all other times three-car trains are run as a rule.

The station masters are divided into two shifts. The day masters' hours are from 5:30 a. m. to 10:30 a. m., and from 1 p. m. to 5:30 p. m. The night masters work from 10:30 a. m. to 1 p. m., and from 5:30 p. m. to 12:30 a. m. As the side door attendants are on duty a maximum of only 8½ hours they work on one shift.

A new schedule has gone into effect on the Lackawanna & Wyoming Valley Electric Railway, between Scranton and Wilkesbarre. An express service of eight trains has been added, three trains running in the morning, three in the afternoon and two at night. These trains are run every 30 minutes or less.

THE WESTINGHOUSE SINGLE-PHASE SYSTEM ADOPTED BY TWO INDIANA ROADS

Two of the most important contracts for electric railway equipment that have been let in recent years have just been awarded to the Westinghouse Electric & Manufacturing Company. These contracts, while not comparatively large as regards the money involved, although of no mean proportion, are of immense importance to the future of the electric railway industry, as they involve the equipment of two long interurban railways with the Westinghouse single-phase alternating-current motor. These are the first two contracts to be let for single-phase electric motor equipment in the United States, if the ill-fated Washington, Baltimore & Annapolis plans are excepted. The first contract let was for the equipment of the Fort Wayne, Decatur & Springfield road, extending from Fort Wayne, Ind., to Springfield, Ohio. On this road the Westinghouse single-phase motor equipment with induction control was adopted, as it was not necessary to use existing direct-current trolley lines in any of the cities which are entered.

The Indianapolis & Cincinnati Traction Company, which is constructing a high-speed line between Indianapolis and Connersville, Ind., last week let a contract for the equipment of this 53 miles of road with the Westinghouse single-phase alternating-current railway system. As has been mentioned before in these columns this is to be a high-speed line, largely on private right of way, with excellent alignment, which will permit of high speed. It is the intention of the management to complete this line through to Hamilton, Ohio, and thus make it possible to give high-speed electric service between Indianapolis and Cincinnati. It is a line which has been mentioned before as being built primarily for high-speed through service rather than for local business.

The third-rail system had been practically decided upon before the advent of the Westinghouse system. The opportunites for saving in first cost and operation by the Westinghouse single-phase system have induced President C. L. Henry and Sargent & Lundy, consulting engineers for the work, to reconsider their plans for a direct-current third-rail road with rotary converter sub-stations and to adopt the Westinghouse single-phase system. Two 500-kw, three-phase, 25-cycle, 2300-volt generators were contracted for some time ago, to be used in connection with the third rail direct-current system, with polyphase distribution. The power station equipment, as regards generating machinery, will remain unchanged. The step-up transformers, which will raise the voltage to 16,500 for transmission, will be connected on the Scott system, so as to give two-phase current on the high-tension line. There will be six static transformer sub-stations, one-half of which will be connected on one phase, and the other half on the other phase. The transformers in these sub-stations will give 3300 volts on their secondary terminals, which will be the trolley line voltage. This voltage will be reduced by a transformer on each car.

As all cars must operate over the 500-volt direct-current city lines in Indianapolis, in order to gain entrance into the city, rheostatic control will be used instead of the induction control, which would be used were it not necessary to operate over direct-current trolley lines. Both methods of control might be used on a car, but the weight and complication of having two methods on a car is thought to counterbalance the small economy gained by the induction control on the alternating-current portions of the line. One of the chief advantages of the induction control is its economy in starting a car. On the interurban portion of the line, however, the stops will be few, and hence, if induction control were used it would have to be put on simply to gain economy in a comparatively small number of stops.

The first contract calls for ten cars, each equipped with four 75-hp motors, with gearing which will give a maximum speed on a level of 42 m. p. h. These cars are intended for local service.

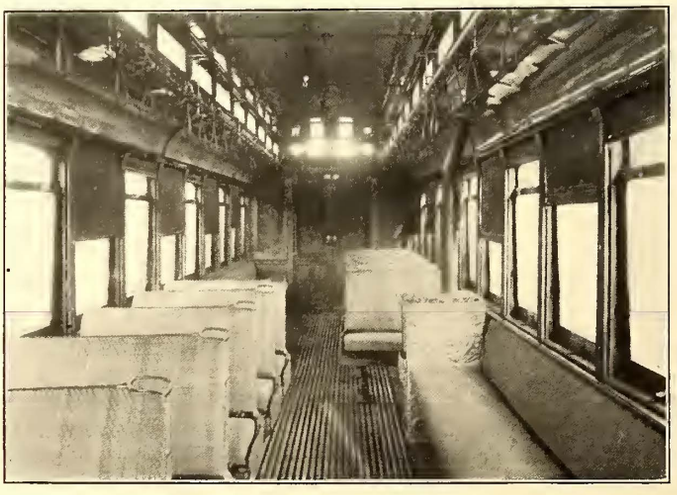
The sub-stations will be approximately 10 miles apart. The trolley wire will be No. 000 copper. There will be no feeders supplementary to the trolley wire. The sub-station transformers will supply 3300 volts direct to the trolley line.

The consulting engineers estimate that in the equipment of the entire road as proposed, 93 miles from Indianapolis to Hamilton, Ohio, a saving over the former direct-current plans of $500,000 will be effected in first cost. It is also interesting to note that the adoption of this new system involves so little apparatus which would have to be discarded in case the single-phase alternating-current system did not prove to be a success. The generators at the power station, the transmission lines and the motor equipments would all serve equally as well on a 500-volt direct-current system, with high-tension transmission, and to change to such a system with rotary converter sub-stations would necessitate only additional direct-current feeder copper and the installation of rotary converters and step-down transformers of the proper voltage at the sub-stations. Although at first sight it might seem that the three-phase generators at the power station would not be the best thing for the use of a single-phase road, it is a question whether after all they do not serve the purpose better than single-phase generators, because of the greater capacity per dollar invested, which can be obtained from a three-phase generator as compared to a single-phase, and because of the greater ease with which multiphase generators can be operated in parallel.

This road offers all the problems met on any interurban line which might adopt the single-phase system, and the ease with which it meets them shows its great flexibility.

LARGE CARS FOR ROCHESTER, NEW YORK

The car shown in the accompanying cut is one of ten lately furnished to the Rochester Railway Company, of Rochester, N. Y., by the J. G. Brill Company, for use on interurban branches of the extensive system which spreads like a network over Rochester and the surrounding country for many miles. The illustration shows the car before the motors were installed; the trucks will be equipped with four 25-hp motors per car.



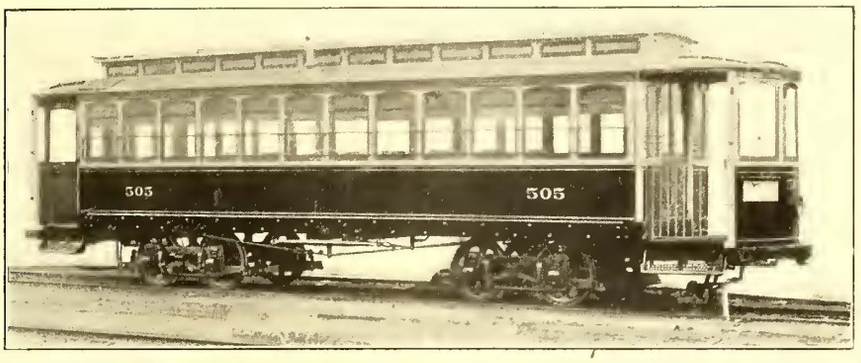
INTERIOR OF ROCHESTER CAR

An interesting feature of these cars is the seating arrangement, which is shown in the illustration of the car interior. Longitudinal seats extending half the length of the car are placed at diagonally opposite sides, with transversely placed double seats opposite. This arrangement provides a wide aisle, and at the same time balances the load. The interiors are

handsomely finished in cherry, and the ceilings are three-ply curly maple veneer. The upper window sashes are stationary, and the lower have pockets in the side sashes with the openings covered with hinged lids.

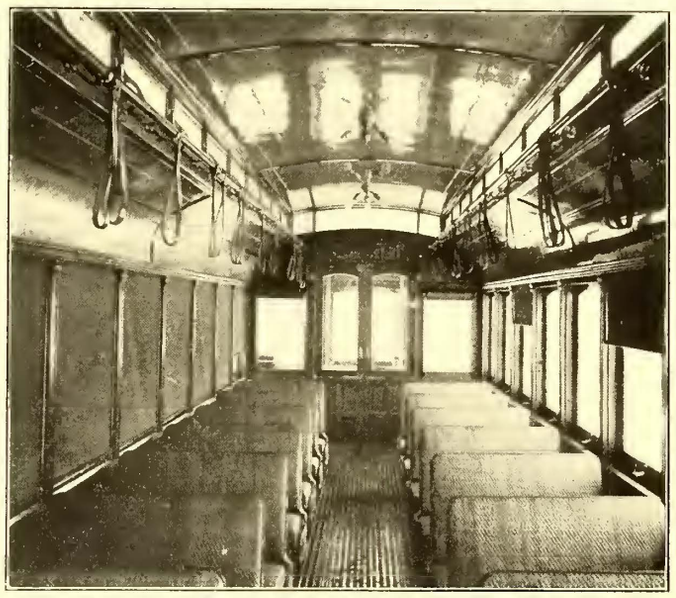
The construction is extra powerful throughout. The side sashes, of long-leaf yellow pine, are 5½ ins. x 8½ ins., plated on the outside with 8-in. x ⅝-in. steel; end sills, 4¾ ins. x 9 ins.; sub-sills, 4¾ ins. x 7¼ ins.; diagonal braces, 4 ins. x 6 ins. The inside trusses are shouldered high upon the posts, and are 2½ ins. x ⅜ in.; under truss rods are anchored at the body bolsters. The platforms are dropped 8½ ins. below the car floor, and have 2¾-in. x 8-in. center and outside knees, reinforced with angle-iron. Seven steel rafters sandwiched between wooden carlings strengthen the roof. The length of the cars over all is 41 ft. ½ in.; length over platforms, 40 ft.; inside length, 29 ft. 3¾ ins. Width over posts, 7 ft. 9 ins., and over all, 8 ft. ½ in. The roofs at the center are 7 ft. 10 ins. Track scrapers, alarm and conductor gongs and angle-iron bumpers of the builder's patented make are also furnished.

Feb. 13. The car is seated for thirty-six passengers, the seats being of the walk-over type, 34 ins. in length, leaving an aisle 22¾ ins. wide. Pockets in the side walls receive the window sashes. The interior is finished in natural cherry with decorated birch ceilings. The platforms are flush with the car floor,



EXTERIOR OF CAR FOR ROCHESTER RAILWAY COMPANY

and are fitted with draw-bars and standard steam car couplers. The latter are placed between heavy buffers, solidly backed



INTERIOR OF BISMARCK CAR

with oak. From the rail heads to the lowest platform step is 17¾ ins., and from step to step 9 ins. The length of the car over end panels is 25 ft., and over corner pieces, 34 ft. 5 ins.; width over sills, 8 ft. 4 ins. The side sills and end sills are 4½ ins. x 7 ins.; sill plates and outside of side sills, 7 ins. x ½ in.; thickness of corner posts, 3¾ ins., and side posts, 2¾ ins. Besides the radial draw-bars already mentioned it is equipped with sand-boxes, "Dedenda" gongs and Brill folding gates. The wheel base of the trucks is 6 ft. 6 ins., the diameter of the wheels 33 ins. The four-motor equipment aggregates 100 hp.

EAST BOSTON TUNNEL

The tunnel connecting East Boston with Boston is now practically completed, as far as the structure of the tunnel is concerned, and the contractors are now installing the ventilating ducts and conduits for the feed wires. The track will be laid as soon as this work is completed. It is the plan of the Boston Elevated Railway Company, which will operate this tunnel, to run through cars from East Boston through the tunnel to connect with its Boston surface and elevated system, with probably a change of cars at the Boston end.

CAR FOR BISMARCK, N. D.

The American Car Company, of St. Louis, has delivered to the Board of Capital Commissioners of Bismarck, N. D., the handsome car shown in the accompanying illustration. This car is particularly interesting on account of its being one of the shortest ever mounted on high-speed trucks. It will be used on the State line referred to in the STREET RAILWAY JOURNAL of

EXTERIOR OF CAR FOR BISMARCK, N. D.

Electric railway interests of Western Ohio are taking an active interest in the formation of a trolley baseball league. It is proposed to form clubs in Hamilton, Piqua, Wapakoneta, Findlay, Lima and Springfield. All of these towns are connected by electric railways and regular scheduled games during the season would furnish considerable additional traffic.

FINANCIAL INTELLIGENCE

Wall Street, Feb. 24, 1904.

The Money Market

After last Saturday's unexpectedly large addition to bank reserves, the immediate money position would appear to be highly favorable. The surplus of the banks stands now at $27,000,000, as compared with $9,000,000 a year ago, and $12,000,000 two years ago. This comparison, however, must be viewed with several important qualifications. In the first place the movement which brought $7,500,000 cash into the local vaults last week was due to extraordinary causes, and is, therefore, only temporary. The government call for the public money to meet the Panama Canal payments involved the transfer to New York of a large sum held by depository institutions outside of this city. At the same time, large remittances were made from the South of currency released by the drop in cotton prices. Together, these have been the entire source of gain to the local institutions during the last ten days, and it is quite improbable that any further increases in local cash supplies will occur from these quarters. The real tendency at this season is for money to flow away from this city to meet the demands of spring trade in the interior; for the next two months we must prepare to see these customary requirements pressing upon the market. Meanwhile, the situation in the foreign exchanges is turning rapidly against this country. Our commercial exports, checked by the excessive prices to which speculators have forced the leading staples, are beginning to fall off heavily. The foreign discount markets, reflecting the strain of the war, are tightening steadily. Sterling rates have advanced a full cent in the pound during the last ten days. All this raises the question somewhat acutely, whether the Panama Canal financing will not be followed by an outflow of specie to Europe. It is certainly true that our money market is the cheapest in the world, and that if credit becomes any more strained abroad foreigners will apply for assistance to our bankers. In a general outlook of the money situation, therefore, the possibility of gold exports on a considerable scale this spring is what is being considered, perhaps more seriously than anything else in high financial circles. Borrowing by corporations has, for the time-being, at least, run its course, and the tendency shown in the last few bank statements toward a loan contraction is decidedly encouraging. Nevertheless it must not be forgotten that the great preponderance of recent credits have been created on unsalable collateral. This will naturally work against any very great improvement in the loan account during the immediate future. It seems virtually assured that for the next six weeks at least surplus bank reserves will decline more or less rapidly under the prospective drain upon cash holdings. This will force up money rates, although it is not expected that the rise will equal that of a year ago. Time money still commands 4½ per cent for the district options, and 3¾ to 4 per cent for the near-by periods. Call money is quoted at 1½ to 1¾ per cent.

The Stock Market

If the average Wall Street observer were asked what the main cause was for this week's decline in securities, he would say that it was the financial disturbances growing out of the conflict in the Far East. This, however, is the superficial, and by no means a complete explanation for what has happened. The foreign markets have been through a serious crisis, owing primarily to the enormous losses incurred by French and German investors in the decline in Russian bonds. Nearly all the important government issues in the semi-panic of last Friday and Saturday reached the lowest prices in a generation. In the general collapse of foreign values, it was to be expected, of course, that our market should be indirectly involved. There has been a great deal of liquidation undoubtedly of American security holdings, especially at Paris and Berlin. But this, while a powerful factor, has by no means been the sole influence on the local Stock Exchange. As a practical demonstration, when all the other markets of the world were recovering sharply yesterday, our market reached by far the lowest prices on the present downward movement. The greater part of the list sank within a few points of the very lowest level of last summer's depression, and in not a few instances stocks went below their previous low records. It is evident, from this, if from no other indications, that other depressing influences relating purely to domestic conditions have been at work. These may be summed up as follows: The unwillingness of investors, large and small, to enter the market until the Northern Securities decision is announced, the uncertainty always felt on the eve of a presidential election, the heavy decreases now being reported almost universally in railway earnings, the falling off in general trade, resulting from the unusually severe winter, and finally, what is in our judgment the most critical of all, the accumulation of an enormous quantity of unsalable securities in the hands of the banking interests. These articles have insisted all along that the argument of "undigested securities" applies with hardly less force to the present situation than it did a year ago. There is this reservation, that money is easier now than it was, then consequently that the pressure upon the larger representatives of capital is less severe than it was twelve months ago. But it is none the less true that the heavy load which the big men of Wall Street are carrying prevents them just as effectively from extending the support which they would ordinarily to the market. This, in our estimation, is the most serious fact in Wall Street conditions to-day.

Of the local traction stocks, Brooklyn Rapid Transit has been the weakest, because it is more widely distributed than the rest in purely speculative hands. The attempt to rally this stock a week ago did not succeed, and the indications are that the pool which started to put up the price has been forced to throw over a good part of their holdings at considerable loss. Metropolitan has had a special reason for its decline, in the shape of the deficit reported by the Interurban Company for the December quarter. On the other hand, Manhattan has held remarkably well, owing to the well-known fact that the stock has been so far absorbed by investors that its market supply is very small.

Philadelphia

The Philadelphia market has been depressed this week by the same general causes which have borne down the markets elsewhere. In only two of the local traction stocks can there be said to have been any heavy liquidation. Philadelphia Electric, in which a pool has been lately operating, with no success, sold down to 5¾, or nearly 1 per cent below its recent high point. Philadelphia Company common, on selling from Pittsburg sources, dropped from 39¼ to 38. Apart from these two issues, trading has been generally light. Only a few transactions are reported in Union Traction, at 47½ and 47⅜. Philadelphia Traction lost a fraction from 97½ to 97. Rapid Transit fell from 14½ to 14, but there was little trading. Other business on the week included American Railways at 44⅞ to 44½, Consolidated Traction of New Jersey at 63½, fifty shares of Fairmount Park Transportation at 21, and an odd lot of Pittsburg Traction preferred at 49½.

Chicago

New low records have been the order of the day in this week's Chicago market. North Chicago broke to 69¾, subsequently rallied to 70, sales altogether amounting to only about 100 shares, and then broke to 67½ on the sale of 10 shares. West Chicago, on sales of only 75 shares, dropped a sheer 5 points to 40. Metropolitan Elevated preferred also touched a new low level at 47½, later rallying to 48¼. About 100 shares of the stock sold from 49 down. Northwestern Elevated common changed hands at 17¼, Lake Street receipts at 2, Union Traction common at 5 and 4¾, the preferred at 29⅝, and South Side Elevated at 93. Directors of the last-named company will meet next week to act upon the quarterly dividend, which is expected to be maintained at the usual 1 per cent. The Metropolitan has applied to the City Council for the right to bring cars of the Aurora, Elgin & Chicago line over the elevated structure. This is the first step taken in connection with the plans for handling passengers in the new downtown terminal. If given the right to use the elevated tracks, the Elgin line ought to make a splendid showing during the next year, as the arrangement will afford it the best facilities of any outside road which enters the city. Some radical change in the operation of the Union Traction system is expected under the new receivers—John C. Fetzer and H. A. Blair—who have just been appointed.

Other Traction Securities

The principal weakness among the traction group in Boston has appeared in the Massachusetts Electric issues, in which some unloading by recent speculative purchasers has occurred. The common stock sold down from 20½ to 18¼, and the preferred from 77 to 74, trading being fairly active in both cases. Boston Elevated has held remarkably steady at 138, which is a gain of a point, as

compared with a week ago. West End common has sold between 90⅛ and 91, and the preferred at 108 and 108⅛. The Baltimore Exchange reopens for business to-day. There have been no dealings in that market since the great fire. On the New York curb, Interborough Rapid Transit sold down on transactions of 1000 shares from 103¼ to 100¾, but recovered to 102½ yesterday on purchases of 200 shares. One hundred shares of New Orleans preferred sold from 30⅛ to 30½. Brooklyn Rapid Transit 4s weakened still further to 74. This was all that was done in the traction list. On the New York Stock Exchange North American and Twin City fell sharply with the rest of the market, but selling was light in both cases. The transactions on the Cleveland exchange have been very light during the past week, owing to the holidays and the death of Senator Hanna.

Security Quotations

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

	Closing Bid	
	Feb. 16	Feb. 23
American Railways	44	44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	137½	137¾
Brooklyn Rapid Transit	43⅝	38⅞
Chicago City	162	160
Chicago Union Traction (common)	4½	4¼
Chicago Union Traction (preferred)	28	29½
Cleveland Electric	71	71½
Consolidated Traction of New Jersey	63	62
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	62½	60¼
Elgin, Aurora & Southern	—	—
Interborough Rapid Transit	103	101
Lake Shore Electric (preferred)	a45	—
Lake Street Elevated	2	2
Manhattan Railway	142⅞	141
Massachusetts Electric Cos. (common)	20½	18⅝
Massachusetts Electric Cos. (preferred)	77	74½
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	48	47
Metropolitan Street	118	114⅝
Metropolitan Securities	88½	86½
New Orleans Railways (common)	8	8
New Orleans Railways (preferred)	30	29½
New Orleans Railways 4½s	79	79½
North American	85¼	82½
Northern Ohio Traction & Light	14¾	14¾
Philadelphia Company (common)	39½	38
Philadelphia Rapid Transit	14¼	14
Philadelphia Traction	97⅜	97
St. Louis Transit (common)	8	7
South Side Elevated (Chicago)	92	92
Third Avenue	120	119
Twin City, Minneapolis (common)	90	87½
Union Traction (Philadelphia)	47	47¼
United Railways, St. Louis (preferred)	52	52
West End (common)	90	90½
West End (preferred)	108	108

a Asked.

Iron and Steel

Weakness in pig iron, on the one hand, and a more active business in the finished products at unchanged prices on the other hand, present a somewhat confusing situation in the present iron market. The best authorities assert that there is no real tendency in the trade either way, meaning by this that it is not yet clear whether prices are low enough all around to attract buyers freely. The most encouraging development recently is the large orders which the railroads have put in for steel rails. Some observers think this means that the deadlock in this quarter has been finally broken. As an offset to this, pig iron prices have again been reduced in the South and West, and further declines are expected. Quotations are as follows: Bessemer pig iron $13.50, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅜ and 12½ cents, tin 28½ cents, lead 4 7-16 cents, and spelter 5 cents.

The Dayton & Troy Electric Railway has added to its service a new car known as the "Piqua Flyer," which leaves Dayton at 5.25 each evening, and arrives at Piqua at 6.25, covering the 32 miles between the stations in one hour.

NEW RECEIVERS FOR THE CHICAGO UNION TRACTION COMPANY

Judge Grosscup, on Feb. 17, appointed John C. Fetzer and Henry A. Blair receivers for the Chicago Union Traction Company to fill the vacancies caused by the withdrawal of James H. Eckels and R. R. Govin. This change, it is understood, was made to silence the dissentions between the Chicago Union Traction Company and the underlying companies. Henry A. Blair is a large stockholder in both of the underlying companies, while John C. Fetzer, a well-known Chicago man, who is a stockholder in neither company, was chosen by the court as a disinterested party of sufficient ability to handle the large interests involved. It is understood that Mr. Fetzer will give a large part of his time to the receivership. The Chicago Passenger Railway Company, which is one of the underlying companies, filed a petition for a renewal of its west side franchises with the Council immediately after the new receivers were appointed. This was referred to the Local Transportation Committee.

LIGHT ON THE SITUATION IN CHICAGO

The Chicago "Record-Herald" recently published an interview with John C. Fetzer, the newly appointed receiver of the Chicago Union Traction Company. Mr. Fetzer is manager of the real estate interests of the estate of Cyrus H. McCormick, the great harvester manufacturer, and occupies an important official position in various other large corporations in Chicago. Mr. Fetzer's interview is given to answering the question: "What does Chicago need most?" and appears in the real estate column of the paper above mentioned. As the interview throws a great deal of light on the real reason for the wearisome delay in franchise negotiations and the blocking of all matters of importance looking toward the betterment of Chicago transportation facilities, much of it is here reprinted.

Mr. Fetzer's first answer to the question: "What does Chicago need most" was: "We need a set of officials who will act," and then he continued:

"I met a man on the street not long ago, and he said to me, 'How do you get along over at the City Hall?' I told him that I got along all right, and wanted to know his object in asking. 'Well,' he replied, 'in the old days, when we had a set of boodlers in the City Hall, by paying their price one could get something done, even if by accident it did benefit the city. Now we have an honest Council, but they won't do anything at all.'

"That is the whole trouble with Chicago. We can't get anything done. It seems as though every public official is afraid to do anything for fear somebody will point the finger of scorn at him and suggest that there was something in it for him. They are so honest that they are afraid to do anything. Now, there is my good friend Mayor Harrison. No one can seriously doubt his honesty, and yet he is afraid to do things in a straight, business-like way, although he knows that they ought to be done, and done right off.

"Public utilities are constantly held up and defeated on the ground of some technicality, while many flagrant abuses of public property are allowed to continue without hindrance by the public officials. * * * * * * Let us see wherein the city is keeping back public utilities. There are the bridges, or rather the proposed bridges connecting the Union Loop with the big stores and office buildings. They cannot be built, because the city demands the payment of exorbitant rentals for them. I cannot see why at the Monadnock Building, for instance, the thousands of people who work there every day should be compelled to come down to the street level from the elevated, and then go up again, instead of entering the building at the second story, saving time and energy.

"Then, see the attitude of the city toward the Union Loop when it wanted to extend the platforms for the accommodation of the public, and so that they could handle more trains and the people would not have to wait so long. But the city officials said: 'No, you cannot build any extensions on your platforms and the public will have to be satisfied to wait for trains and to put up with being crowded.'

"Last year there was a coal famine, and our honest Council made a terrible stir over that. And yet I know that a certain railroad had hundreds of cars of coal in its yards, and could have brought still more here, but it had only the teaming facilities to unload forty cars a day. Because it was a railroad, however, the City Council would not give it the right to increase its team tracks without demanding all manner of exorbitant compensation and ridiculous conditions.

"I do not contend that public property should be used for strictly private purposes, but it should be encouraged when it benefits the public, just as much as it should be restricted when

it would be harmful. But because a private corporation makes money out of a public enterprise, it should not be condemned as long as the public is properly benefited. The trouble now is that, no matter if the members of our honest Council are convinced that certain concessions to private corporations would be of the greatest benefit to the city, when it is suggested they hold up their hands in holy horror and declare against it, when deep down in their hearts they know that the real reason is that they are afraid some one will insinuate that they have been bribed. What we need is a set of officials who can do business on business principles and still be honest."

CHICAGO CITY RAILWAY COMPANY'S ANNUAL REPORT

The stockholders of the Chicago City Railway Company held their regular annual meeting February 16, at which time President D. G. Hamilton submitted the following report:

To the Stockholders of Chicago City Railway Company:

The year 1903 has been an eventful one in the affairs of the company.

The conditions prevailing, differing materially from those of last year, as well as previous years, adversely affected the results of operation. The strike decreased the gross earnings. The abnormal increase in expenses decreased the net earnings.

EARNINGS

The gross earnings do not show the expected and normal increase, owing to the fourteen days' strike of employees in November, 1903, and also owing to the unfavorable weather conditions prevailing during the months of January and December.

The increase over 1902 was $22,383.26, of which $13,887.72 were passenger receipts.

While the passenger receipts increased less than one-fifth of 1 per cent, the transfer passengers carried increased 20 per cent, due to the enforced inauguration of the present transfer system, with its greatly extended transfer privileges.

Over fifty per cent of the fare passengers were carried on transfers.

EXPENSES

The total expenses over and above charges to reserves and depreciation in 1902, increased $311,837.41, as compared with 1902.

The increases in wages, cost of fuel, material and supplies, cleaning streets, removal of snow, insurance, taxes, and the strike expenses, caused this increase.

NET INCOME

The net income shows a decrease as compared with that of 1902 of $209,454.15, and the surplus for the year a like amount.

IMPROVEMENTS IN 1904

In addition to increased operating expenses for maintenance, replacements, and renewals in the year 1903, a large amount has been expended for additions to, and the betterment of the property. These expenditures were for underground feeder conduits, completion of the new repair shops, an addition to the new electric power plant at Twenty-First and Dearborn Streets, eighty new double-truck electric cars with electric equipments, work cars and other miscellaneous equipment.

NEEDED IMPROVEMNTS IN 1904

In order to pursue the policy of the management of this company, to best subserve the wants of the public, there should be expended, in the year 1904, further sums for additional cars and power plant apparatus, so that the present facilities for handling the traffic may be maintained to the proper degree of efficiency. In addition, a large amount of construction and reconstruction work will be required for underground feeder conduits, cement sidewalks, paving, tracks and buildings.

During the past year, negotiations were entered into, on the part of the company with the city authorities, with reference to the "franchise question," and a tentative ordinance is under consideration, by which it is hoped a fair and business-like settlement of the questions involved may be made.

Pending the settlement, the company proposes to efficiently maintain its plant and equipment, and make such improvements as will enable it to furnish the best service possible, under existing conditions.

The income account and operating statistics for the year ended December 31, 1903, are herewith presented. Respectfully submitted, by order of the board.

D. G. Hamilton, President.

Chicago, Feb. 16, 1904.

GROSS EARNINGS

Passenger receipts	(Increase $13,887.72)	$6,381,245.85
Recepts from other sources.	(Increase 8,495.54)	54,319.40
Total	(Increase $22,383.26)	$6,435,565.25

TOTAL EXPENSES

Operating expenses and taxes—(Operating expenses, taxes, and reserves for replacements, renewals and damages in 1902)	(Increase $311,837.41)	$4,648,341.61
Depreciation	(Decrease 80,000.00)	100,000.00
Total	(Increase $231,837.41)	$4,748,341.61
Net income	(Decrease 209,454.15)	1,687,223.64
Dividends	(Same amount in 1902)	1,620,000.00
Surplus for the year	(Decrease 209,454.15)	67,223.64

PERCENTAGE OF NET INCOME TO CAPITAL STOCK

On $18,000,000	(Decrease 1.17 per cent.)	9.37

TABLE OF PERCENTAGES—EXPENSES TO RECEIPTS

Percentage of operating expenses and taxes to gross earnings—(Operating expenses, taxes and reserves to gross earnings in 1902)	(Increase 4.61 per cent)	72.23
Percentage of operating expenses and taxes to passenger receipts—(Operating expenses, taxes and reserves to passenger receipts in 1902)	(Increase 4.73 per cent)	72.84
Passenger receipts per day.	(Increase $38.05)	$17.482.87

We have examined the above income account and the books and accounts of the company, and certify them to be correct,

Jones, Caesar & Company, Chartered Accountants.

MILES OF SINGLE TRACK

Electric (84.11 per cent of total)	183.96
Cable (15.89 per cent of total)	34.75
All	218.71

CAR MILES RUN

Electric (57.15 per cent of total)	18,595,440	Increase	261,578
Cable (42.62 per cent of total)	13,865,473	Decrease	378,717
Horse (.23 per cent of total)	74,210	Decrease	19,672
All	32,535,123	Decrease	136,811

PASSENGERS CARRIED

Fare passengers	128,304,445	Increase	206,646
Transfer passengers	66,883,346	Increase	11,089,784
Fare and transfer passengers	195,187,791	Increase	11,296,430
Percentage of transfer passengers to fare passengers			52.13
Percentage of transfer passengers to fare and transfer passengers			34.27

BALL OF THE BROOKLYN EMPLOYEES

The first annual reception and ball of the Employees' Mutual Benefit Association, composed of employees of the Brooklyn Rapid Transit Company, was held at the East New York clubhouse of the association on Monday evening, Feb. 22. The affair was very successful, there being at least 1000 people present. A number of the officials of the company who take an active interest in the association were there. Among them were Dow S. Smith, general superintendent of the company; W. B. Graham, superintendent of the surface lines; W. O. Wood, superintendent of the elevated lines. One of the most pleasing features of the reception was the presentation of the prizes to the winners of the bowling tournament, which ended a few days ago. The committee in charge was composed of George Wolfram, H. Phister, W. O. Wood and E. Gilchrist.

TO REGULATE THE NUMBER OF PASSENGERS IN CLEVELAND CARS

The board of health of Cleveland is considering legislation for regulating the number of passengers that may be carried in a street car. The city solicitor has given his opinion that the board of health has as much right to take action on this matter as it has the right to regulate the manner in which live stock may be loaded in a freight car. It is the general opinion that the load of a car should be limited to the seating capacity plus one-half. In other words, a car which seats fifty pasengers should not be permitted to carry more than seventy-five passengers. It also is proposed to compel the company to place an extra man on all cars during the rush hours, whose duty it would be to assist passengers on and off, give the signals to the motorman and make it compulsory on this man to limit the number of passengers. It is not recorded that the board of health favors Mayor Johnson's 3-cent fare, universal transfer scheme.

CARS ON BOB-SLEDS IN NEW YORK STATE

As a result of the unprecedented fall of snow in Central New York, the Utica & Mohawk Valley Railway Company recently furnished a novelty in railroading. The huge drifts which buried the tracks beyond resurrection, necessitated the cessation of regular service on the North Genesee Street line, which runs from Bogg's Square to Deerfield Corners, but the company was equal to the emergency. Cars were lifted off their trucks, denuded of trolley appendages and placed on bob-sleighs. The service rendered by them was tolerably good, and a source of much comment by persons who found it necessary to take a Deerfield trip. The drivers employed on the line considered the novel vehicles as more of a joke than a reality, and often drove into side streets to deliver passengers at their door.

THE INTERURBAN'S EARNINGS

Comparative statements of the earnings of the Interurban Street Railway Company, of New York, for the quarter and six months ended Dec. 31, 1903, have just been made public. The statements show:

QUARTER

	1903	1902
Gross earnings from operation	$5,565,368	$5,500,061
Operating	3,016,018	3,090,151
Net earnings from operation	$2,549,349	$2,409,910
Income from other sources	359,032	297,942
Gross income from all sources	$2,908,382	$2,707,852
Deductions from income	3,012,673	2,924,882
Deficit	$104,291	$217,029

SIX MONTHS

	1903	1902
Gross earnings from operation	$11,135,580	$10,871,752
Operating expenses	5,777,619	5,826,173
Net earnings from operation	$5,357,960	$5,045,578
Income from other sources	729,257	723,868
Gross income from all sources	$6,087,218	$5,769,447
Deductions from income	6,028,133	5,840,106
Surplus	$59,085	$70,659

These statements include all leased and controlled companies, as well as the Third Avenue system. The decrease in operating expenses supposed to be due to the change of additional lines from horses to electricity.

ONE LINE IN NEW HAMPSHIRE EARNS DIVIDEND

The annual report of the State Railroad Commissioners of New Hampshire shows that but one street railway company, the Manchester Street Railway, earned a dividend last year, although there are eighteen operating companies. The companies have 228 miles of track, $3,552,119 stock, $2,066,000 in bonds, and $1,009,003 liabilities. The gross income was $834,894; operating expenses, $796,795; taxes and interest, $103,250, and a deficit of $65,161. The Manchester road had a divisible income of $31,807.

ALLIS-CHALMERS COMPANY ENTERS NEW FIELDS

Over the signature of W. J. Chalmers, vice-president of the Allis-Chalmers Company, there has just been issued the following official statement regarding the plans of the company for entering the electrical field, etc.

We beg to notify you that our company has widened its scope of manufacture, and engaged in most important industries. We could not give you the information at an earlier date, as we have only just concluded final arrangements for all the new industries we are to engage in, which we are pleased to enumerate as below: Steam turbines, hydraulic machinery, gas engines and electrical machinery.

As regards steam turbines, we have become associated with and form part of the Steam Turbine Advisory Syndicate of England, which is composed of Yarrow Shipbuilding Company, of England; Tweedie (Vulcan) Shipbuilding Company, of England; Willans & Robinson, engineers and well-known engine builders, of England; Mr. Fullager, formerly chief engineer Parsons Steam Turbine Company, of England, now consulting engineer for Steam Turbine Advisory Syndicate, and Allis-Chalmers Company.

Our turbine is of the horizontal type, which is the type Parsons, of England, and Brown Boveri, of Switzerland, manufacture. We are convinced, after an investigation by our engineering staff in Europe and elsewhere, extending over a period of two years, that we have a steam turbine that is at least in efficiency and economy equal to the best made of Parsons or Curtis, which are the types best known. We are now prepared to enter into the building of steam turbines of the following sizes: 500, 750, 1000, 1500 and 5000 kw, and can, if required, build up to units of 10,000 kw. The largest size that has ever been built of any type of turbine is 5000 kw. Our license from the Advisory Turbine Syndicate concedes to us all of the United States, Canada and Mexico, with equal rights and privileges in South America, and rights to do business elsewhere in the Western Hemisphere.

We have concluded arrangements with Escher-Wyss & Company, of Zurich, Switzerland, whereby we become the sole licensees for the Western Hemisphere of their famous hydraulic machinery, several types of which have been installed at the Niagara Falls plant of the Cataract Construction Company, aggregating 85,000 hp. Escher, Wyss & Company have long enjoyed, and still enjoy, the reputation of being the best-known manufacturers of turbines in the world. We only mention Niagara Falls as one of the plants employing thousands of horse power installed by Escher-Wyss & Company.

We have bought the American patents, and have become sole licensees for the Western Hemisphere of the Nurnberg Machine Company, Nurnberg, Germany, for their gas engines, and are now prepared to make gas engines up to any required horse power. At the present time we are prepared to build gas engines from 250 to 1500 hp. These engines are suitable for consumer gas or taking the waste gas from blast furnaces and utilizing same with economy and efficiency. It is in the blast furnace trade that we expect the largest business to result. The engine is not an experiment, but engines of 1500 hp are now in operation in Germany, and it was after two years' investigation by our engineering staff of the various gas engines, that we selected the Nurnberg, and have engaged in its manufacture. It is a prime mover, either for blowing engines in blast furnaces, or for direct-connected dynamos in generating electricity, or for any other purpose where power is required.

We have engaged in the manufacture of generators, motors and electrical apparatus in all its branches both for stationary and railroad work, power-house installation for transportation purposes and electric lighting. We have engaged to take charge of this department of our business John F. Kelley, formerly of the Stanley Electric Company; William Stanley, of the same company, as consulting engineer, and John H. Kelman, formerly superintendent of the Stanley Company, as superintendent of this department. In addition we have engaged others of the late Stanley Company's staff whose services we can use, and have drawn a further supply from the best electrical establishments in this country and in Europe; so that we are fitted out with a complete engineering staff in every branch of the electrical business, and we believe that Messrs. Kelly and Stanley are recognized in the profession as standing equal to the best.

From the above you will observe that we have entered the field not only in the line of prime movers, embracing reciprocating engines, in which field we have always led, but also with steam turbines, gas engines and hydraulics; and with electrical apparatus combined with any one of these prime movers we are now prepared to estimate upon and accept contracts for complete plants of all description and furnish the best of their respective kinds.

CLUB ROOMS AT TACOMA

The new car house being built by the Tacoma Railway & Power Company, of Tacoma, Wash., will provide bath rooms, plunge and gymnasium for the employees, all to be equipped with all the latest appliances. They are to be located on the basement floor of the new building, and will face A Street near the corner of Thirteenth Street. At the entrance will be the rooms for the motormen and conductors. Here will be chairs and benches where the men will be able to rest while waiting for their cars. Next will come the gymnasium with its punching bags, Indian clubs and other athletic appliances. The men will have lockers so that they may keep bathing and gymnasium suits if they so desire. Then will come the bath rooms. All this was provided for the men at the expense of the company.

THE BRIDGE COMMISSIONER'S PLAN FOR RELIEVING CONGESTION AT BROOKLYN BRIDGE

Bridge Commissioner Best, of New York, has sent to the Mayor and other members of the Board of Estimate and Apportionment a tentative plan for an enlarged bridge terminal, to cost, for land and building, about $9,000,000. The new terminal will cover all the irregular shaped blocks between the present terminal northward to Worth Street. Nothing is said in the plans about a connection between the present bridge terminal and the Williamsburg Bridge, but it is understood that Chief Engineer Nichols soon will submit a plan for connecting the bridges with an elevated structure.

For the purpose of putting the new scheme through there will be required the acquisition of all the real estate not now belonging to the city in the four blocks bounded by Centre Street on the west, Tryon Row on the south, Park Row on the east, and Duane Street on the north and east; and the small block bounded by Centre Street on the west, Park Street on the south and east, and Pearl Street on the north, and the small block bounded by Park Row on the west, the property of the New York and Brooklyn Bridge on the south, and North William Street on the east, and also certain parcels of land on the south side of Duane Street between City Hall Place and Park Street, and in Centre Street between Pearl and Worth Streets.

The construction will consist of an extension of the New York and Brooklyn Bridge tracks over Tyron Row and over private property to the southerly side of Worth Street, the construction of a large terminal building covering a portion of the westerly end of the present bridge station and extending along the easterly side of Centre Street to a point at or near the northerly side of Duane Street, the building to be about 140 ft. wide.

The ground floor of the station building in Centre Street will, excepting the space devoted to public streets and places, be used for entrance to the station, and will be provided with stairways reaching to the second, or mezzanine floor, which will correspond in level with the mezzanine floor of the present station, and will provide on an extensive scale for the distribution of passengers to and from the several railway platforms.

The third, or main, station floor, will contain tracks and platforms, four in number, which will be longer and wider than those now in use on the New York and Brooklyn Bridge. The head room on this floor will be 20 ft. to 25 ft. above the platforms, and provision will also be made for the construction of fourth and fifth floors, which may be used for office purposes. This building is to be of steel skeleton construction, with stone exterior and slate roof.

From the City Hall Park an incline will lead from the surface to the mezzanine floor, and stairways will be built to the ground near the westerly curb line on Park Row.

The present bridge station will be connected with the Centre Street station building and form a southerly wing thereto. The elevated railroad platforms in the present station will be extended and brought out nearly to Park Row, and two additional side platforms will be built and roofed in over the present carriageways of the bridge, and all of these four platforms will be fitted with capacious stairways to the mezzanine floor.

THE OTTAWA & NEW YORK COMPANY TO ADOPT ELECTRICITY

The report that the Ottawa & New York Railway, operating between Ottawa, Ont., and Tupper Lake, N. Y., is to adopt electricity as motive power is confirmed by General Manager Gays, of the company. Estimates are being prepared of the probable cost of the change, and are said to favor electricity. It is proposed to get power at Ottawa, at Cornwall and at Massena Springs, N. Y. At the same time there is a water-power along the line, which can readily be developed. The company hopes to be in a position to effect the change this year.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

STREET RAILWAY PATENTS ISSUED FEB. 16, 1904

752,037. Electric Train Service; Melvin D. Compton, New York, N. Y. App. filed Dec. 2, 1901. The speed of a generator driven from the locomotive axle is varied by throwing discs of different diameters into and out of engagement by means of pneumatic pistons which are controlled automatically by the condition of the current in the various circuits of the system.

752,081. Car Signal; Geo. M. Lane, Brooklyn, N. Y. App. filed may 14, 1903. Details.

752,084. Railroad Signal; John K. Leedy, Roanoke, Va. App. filed Nov. 10, 1902. Details.

752,121. Trolley Finder; Elisha S. Stitt, Newton, Mass. App. filed Oct. 17, 1902. A guiding fork for the wheel, arranged to be held in operative position by tension on the cord.

752,127. Railway Switching and Signaling Apparatus; John D. Taylor, Buffalo, N. Y. App. filed Jan. 12, 1901. Details of a locking mechanism for the signals.

752,139. Trolley Catcher; William C. Young and Johnson McMahon, Buffalo, N. Y. App. filed June 1, 1903. A spring normally under tension is released when the trolley-wheel leaves the wire, to contract and draw the pole downward.

752,374. Automatic Check Device for Trolley Cords; Seth F. Buckland, Springfield, Mass. App. filed April 22, 1903. A spring-drum and ratchet arrangement for retracting the trolley cord.

752,437. Overhead Trolley Guide; Charles W. Burkehead, Madisonville, Ohio. App. filed Aug. 16, 1902. A guiding fork constructed to perform its function whether the wheel is running forward or backward on the wire.

752,501. Trolley Hanger; Montraville M. Wood, Schenectady, N. Y. App. filed Aug. 8, 1903. A cup-schaped nut that holds the clip in place is provided with a locking device to prevent it from turning.

PERSONAL MENTION

MR. HENRY D. THOMAS, president and promoter of the Marion, Kokomo & Western Interurban Railroad, of Marion, Ind., died very suddenly Feb. 17, from heart disease. He was taken ill while out on the lines with a surveying party.

HON. W. W. GUEST has been elected president of the Lancaster County Railway & Light Company, of Lancaster, Pa., and all subsidiary companies. He is a resident of Lancaster, and a former secretary of the Commonwealth.

MR. JOHN F. DUSMAN, chief electrician of the York County Traction Company, and the York Street Railway Company, of York, Pa., has resigned from these companies to accept a position with the United Railways & Electric Company, of Baltimore. Mr. Dusman formerly was manager of the York County Traction Company.

MR. E. C. FOLSOM has been appointed to succeed Mr. J. T. McNary as superintendent of the Logansport & Wabash Interurban Railway, and the local lines in Logansport, Ind. In addition Mr. Folsom is to have charge of the reconstruction of the local lines. Mr. McNary will retire, but still retains his interest in the Logansport-Rochester line, projected.

MR. CHARLES LANG has resigned his position with the Wheeler Condenser & Engineering Company after ten years' service with that company. During that period Mr. Lang advanced from office boy to purchasing agent, and later entered the company's engineering department. He is at present enjoying a much-needed rest before taking up new work.

MR. E. D. ARNOLD, consulting engineer for the Council Bluffs, Tabor & Southern Electric Railway, who has been in California during the winter, looking over railway construction as carried on in the West, and securing data for his road, will return to Creston, Ia., about March 1. All correspondence as to the electrical and mechanical equipment of this line should be addressed to him at Creston.

MR. JOHN B. O'HARA, associate editor of the STREET RAILWAY JOURNAL, met with a sad bereavement on Feb. 14 in the death of his wife. Mrs. O'Hara was of most attractive personality and respected and beloved by all who had the pleasure of acquaintanceship with her. She was formerly Miss Margaret Hickey, of Rochester, and, besides her husband, leaves one son. The burial occurred in Rochester on Feb. 18.

MR. ABE COOK, who was secretary and treasurer of the Laclede Car Company for fifteen years, and more recently the purchasing agent of the St. Louis Car Company, is now connected with the Central Union Brass Company, of St. Louis. Mr. Cook has a host of friends and is thoroughly familiar with all branches of street railway work, and will be a valuable addition to the force of the Central Union Brass Company.

MR. H. E. BURCHFIELD, who was in charge of the construction work of the Evansville-Princeton Traction Company's line between Evansville and Princeton, Ind., and who has been superintendent of the line since its completion, has resigned from the company to accept a position with the Walker Construction Company, of Philadelphia, which has taken the contract to build an electric railway from Parkersburgh to Lafayette, W. Va., a distance of 21 miles.